

# **CONSTRUCTION SKILLED LABOR WORKFORCE**

## **A Summary Analysis of Transportation-Related Skilled Construction Labor Supply and Demand**

**State of California  
Department of Transportation  
Division of Construction  
June 2008**



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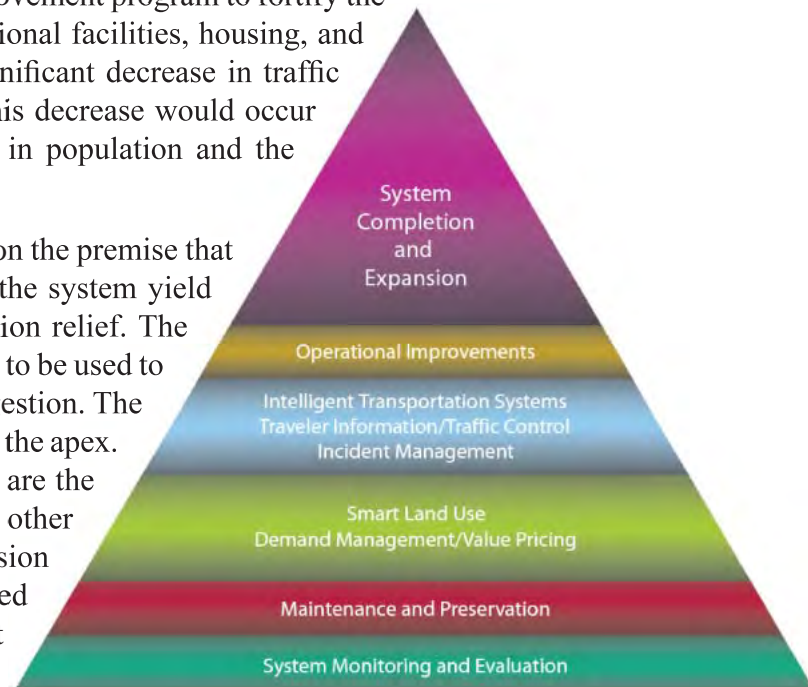
## INTRODUCTION

California's infrastructure supports the safety, health, comfort, and economic benefit of California's citizens and visitors. As a valuable asset, the infrastructure must be maintained, improved, and replaced as necessary to address the ever-changing needs and demands placed upon it. A skilled workforce, in turn, is necessary for the maintenance and improvement of that infrastructure in an economical and timely fashion. The skilled construction workforce is also a key element in the state's economy as it constitutes approximately 10 percent of the state's workers. The following report addresses a small but important part of the workforce issue—skilled workers to construct transportation-related projects.

### *The Strategic Growth Plan*

Governor Arnold Schwarzenegger's Strategic Growth Plan (SGP) calls for a \$222 billion infrastructure improvement program to fortify the state's transportation system, educational facilities, housing, and waterways. The SGP aims for a significant decrease in traffic congestion to below 2006 levels. This decrease would occur even while accommodating growth in population and the economy over the decade.

The SGP's congestion goal is based on the premise that investments in mobility throughout the system yield significant improvements in congestion relief. The pyramid above outlines the strategies to be used to achieve the outcome of reduced congestion. The base of the pyramid is as important as the apex. System monitoring and preservation are the basic foundation upon which the other strategies are built. System expansion and completion will provide the desired mobility benefits to the extent that investments in and implementation of the strategies below the apex establish a solid platform.



### *ICE—The Industry Capacity Expansion Program*

*ICE tracks more than 130 different tasks that address many areas beyond skilled labor. Further information regarding ICE can be found on the Caltrans internet site:*

<http://www.dot.ca.gov/hq/construc/GoCalifornia/>

ICE is one measure undertaken by the California Department of Transportation (Caltrans) to achieve the objectives of the SGP. The effort is intended to save capital costs and fortify the heavy highway construction industry. Increasing the number of bidders reduces the capital cost of Caltrans projects, potentially saving at least \$100 million annually that could be used to fund additional projects. The ICE effort identifies strategies and actions that enable the heavy highway construction industry to better meet future transportation needs.

Eight strategies to fortify the heavy highway construction industry and make it more able to construct SGP projects are identified in the ICE Action Plan. These strategies include technology and process improvements, communication, training, and resource needs such as aggregates, equipment, and labor.

### ***Proposition 1B***

In November 2006, California voters approved the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, also known as Proposition 1B, which provided \$19.9 billion in transportation related funding. As of March 2008, the additional funding in three Proposition 1B components, the Corridor Mobility Improvement Account, the Route 99 Corridor Account, and the State Highway Operations and Protection Program Accounts totaling \$6 billion in bond funds had been combined with State Transportation Improvement Program (STIP) funds, local measure funds, and other sources to allow for the development of 83 projects worth approximately \$10.7 billion. In addition to Proposition 1B, \$22.728 billion in bonds were approved for the development of other state infrastructure needs such as affordable housing (Proposition 1C—\$2.85 billion), education (Proposition 1D—\$10.4 billion), flood control (Proposition 1E—\$4.09 billion), and drinking water and water resources (Proposition 84—\$5.388 billion).

*Further information on Proposition 1B, including allocations and status of projects, can be found at*

*<http://www.bondaccountability.com/> and <http://www.dot.ca.gov/hq/transprog/ibond.htm>*

### ***Construction Skilled Labor Workforce Initiative***

Recognizing the role of skilled labor in fulfilling the goals of the SGP and the rapid increase in construction projects anticipated with voter approved Proposition 1 bonds, the Business Transportation and Housing Agency and Caltrans established the Construction Skilled Labor Workforce Initiative (CSLWI) in 2006. Caltrans held meetings with labor stakeholders to identify various issues affecting the supply of labor that need to be addressed. The CSLWI's importance was heightened with the passage of Proposition 1B and the infusion of more than \$19 billion in new transportation funds in the ten-year period between 2007-2016. A study of labor demand versus labor availability began. The study is one of the many actions to be examined as a part of the CSLWI.

From its inception, the CSLWI has been active in pulling together construction employers, training providers, state government agencies, and apprenticeship program officials to examine skilled construction workforce issues. Below in Part I is a summary of CSLWI efforts. Part II examines the supply-demand scope, while Part III sets out recommendations for training and recruitment based on the information gained through Part I efforts.

## **PART I: CONSTRUCTION SKILLED WORKFORCE INITIATIVE'S RESEARCH EFFORTS AND EFFORTS WITH STAKEHOLDERS**

Beginning in October 2006, Caltrans' staff assembled representatives from major employers, industry associations, training providers, apprenticeship programs, and various state agencies to address skilled construction labor issues. A list of participants in CSLWI sessions is attached as Appendix 1, which shows the breadth of stakeholder participation.

Subcommittees were appointed to examine five areas: Understanding Supply and Demand; Career Technical Education in Schools; Apprenticeship Programs; Legislation, Regulation, and Policy; and Communication and Education. Three major sessions were held in the Sacramento area between October 2006 and November 2007, to discuss subcommittee issues and findings. The sections below show some of the findings the major subcommittee presented in a November 2007 meeting.

### ***Supply and Demand***

In June 2007, Caltrans commissioned a study of the current and projected supply of construction labor in California. The study focused on the five occupations most involved in highway, street, and bridge construction in California: laborers, carpenters, operating engineers, cement masons, and ironworkers.



One product of the study is "Volume 1: Overview, Methodology and Recommendations for Ensuring a Sufficient Future Workforce," which explains the analysis process, assumptions, methodology, and general recommendations of the labor supply issue. As noted above, only five labor classifications (as defined by the North American Industry Classification System

[NACIS]) are studied but these five represent approximately 50 percent of all work on the majority of transportation construction projects. Limiting labor classifications was necessary to make the study manageable and economical, provide an overall perspective of supply, and allow identification of areas where deficiencies may occur.

The study was conducted when the state and national housing market was robust and in need of its own labor supply. The labor pool for the housing market overlapped the transportation area. The downturn in the housing market made a significant amount of labor available to the transportation construction industry, but deficiencies in certain areas are still noted. There is also an issue of ensuring that the workers in the housing market have the knowledge to transition easily into the transportation arena.

The study also produced “Volume 2: County-Level Estimates of the Skilled Workforce for Transportation Projects,” which applies the methodology from Volume 1 to counties and regions. Using this data, local agencies such as Workforce Investment Boards can focus training needs to address surplus and deficient areas.

### ***Career Technical Education in California High Schools***

Career Technical Education (CTE) has been one of the Governor’s main policy initiatives over the past few years, reflecting his view that technical education should play a greater role in secondary education. The Governor’s CTE initiative is envisioned to total \$500 million in state funds. The dropout rates in California (30 percent of California students do not graduate from high school) and the evidence that technical education can reduce this rate and direct students into productive career paths are the rationale for this effort. CSLWI efforts concentrate on compiling and distributing lists of available construction-related training resources throughout the state, identifying strategies for construction CTE programs to best compete for the new state CTE funds and developing recommendations to relax Commission on Teacher Credentialing rules for the credentialing of CTE teachers.

### ***Apprenticeship Programs***

California has a vibrant program of apprenticeships. Apprenticeship programs have been in existence in California since 1858 and have approximately 69,000 apprentices enrolled at any given time. Almost 85 percent of the apprentices, approximately 58,000, are in the building trades. The apprenticeship programs run from one to six years, with 3.1 years as the average apprenticeship period.



The California Department of Industrial Relations, Division of Apprenticeship Standards noted that California apprenticeship programs have the capacity to handle additional trainees, as additional jobs generated by the Proposition 1B and other state infrastructure bonds enacted in 2006 might justify. The CLSWI is seeking to increase the awareness of apprenticeship opportunities among high school students in California, strengthen pre-apprenticeship programs, and link these programs to the high schools.

### ***Legislation, Regulation, and Policy***

The CSLWI efforts in the area of Legislation, Regulation, and Policy arose from concerns about teacher preparation and credentialing for CTE construction classes and concerns about state financial support for CTE construction classes and apprenticeship programs, such as tax credits for industry to provide facilities, manpower, and equipment to schools. The CSLWI subcommittee

seeks to implement recommendations proposed by the other subcommittees, particularly the CTE and Apprenticeship subcommittees.

### ***Communication and Education***

The CSLWI's goal in Communication and Education is to increase participation in education and apprenticeship programs through a statewide outreach program. The outreach effort includes improving the overall image of construction careers, with recognition of construction as a acceptable-wage career.

## PART II: SUPPLY AND DEMAND

Although, estimates of total jobs created from highway construction expenditures vary, both the Caltrans model (Cal I-O) and the widely used IMPLAN model estimate the direct (or construction) jobs at about 10,000 jobs per \$1 billion in highway expenditures. Another 8,000 to 16,000 more jobs are created through induced and indirect means, such as restaurants, hotels, supplies, and discretionary items for the same investment of \$1 billion in highway expenditures.

Based on the U.S. Bureau of Labor Statistics national highway construction data, the combined five highway construction occupations of laborers, operating engineers, carpenters, cement masons, and ironworkers account for 49 percent of all jobs in the highway construction workforce. Therefore, a one-billion-dollar expenditure in highway construction would generate about 4,900 jobs in the five occupations alone. Other trades would create a like number.

A review of Caltrans's projections of highway construction capital outlay indicates that total state highway capital outlay is projected to peak in FY2008-09 at about \$7.3 billion, and then generally begins to level off thereafter. See the figure on the next page. Estimated skilled labor demand is based on the peak year and \$7.3 billion as the "worst-case" scenario, corresponding to the highest labor demand. The number of jobs, both direct and induced, corresponding to this dollar amount is 131,400 to 189,000.

### ECONOMIC IMPACT ASSESSMENT: INPUT-OUTPUT MODELING

Input-output models start with the national input-output model prepared and updated by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The BEA analyzes the interrelationships of all industries and develops industry multipliers for each industry with respect to all other industries. Multipliers are a numeric way of describing the impact of a change. For example, an employment multiplier of 1.8 would indicate that for every ten employees hired in the given industry, 18 total jobs (in all sectors including the generating one) would be added to the given economic region.

Multipliers can be broken down as follows:

- Direct effects take place only in the industry being immediately affected.
- Indirect effects concern inter-industry transactions (that is, suppliers, lodging, and so forth).
- Induced effects measure the effects of the changes in household income where the affected employees may eat out or shop more than they normally would have since they are now employed.

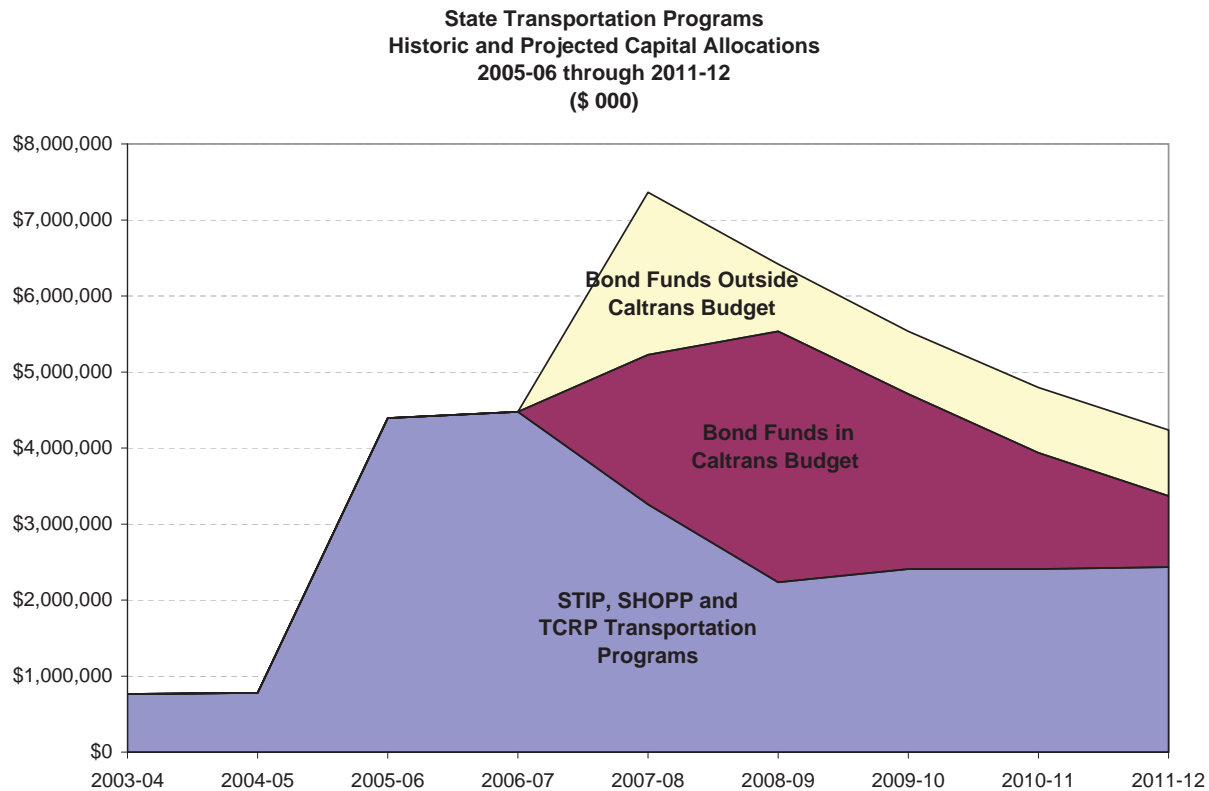
The BEA's regional (state) version of this input-output (I-O) model is known as RIMS II. Caltrans has used RIMS II multipliers for some 20 years to assess the impact of highway and transit expenditures on the economy. About five years ago, the Federal Highway Administration (FHWA) had Boston University develop an I-O model for them (JOBMOD) and started using the model to assess the impacts of highway expenditures on the national economy level.

Caltrans reassessed its model and made it comparable with the FHWA model. CAL I-O is consistent with FHWA's JOBMOD and BEA's RIMS II.

The IMPLAN (Impact analysis for PLANning) model can be used to measure the effect of a given change in economic activity on a regional or local economy. IMPLAN, a proprietary program developed by the Minnesota IMPLAN Group, Inc. (MIG, Inc.), allows the user to build economic models estimating future effects of similar changes on communities. The IMPLAN database contains county, state, and federal economic statistics and is used by over 1,000 public and private entities.

The number of jobs estimated by CAL I-O, JOBMOD, and RIMS II tend to be generally higher than the IMPLAN estimate. Caltrans does not have access to the working formulas of IMPLAN to be able to pinpoint the cause of the differences. Most likely though, the difference is because of either the nature of IMPLAN as a sub-regional (county by county) model or the number of industries that are selected as the "impacted industries."

In order to estimate county-level highway construction capital outlay, the STIP county shares reported in the 2008 STIP Fund Estimate were used to break down the \$7.3 billion in projected capital outlay. The 12 regional shares were then calculated by adding the county shares in each region.



The following table summarizes the estimated highway construction skilled labor demand for the five occupations for twelve state regions and compares them to the estimated total labor supply reported in Volumes 1 and 2. The last column indicates that for the FY2008-09, most of the regions will experience some labor shortage. Statewide, the total demand for the five occupations will be 35,211, while the total supply is estimated at slightly more than 22,000, indicating a need for about 13,000 skilled workers in the five select groups. For subsequent years, there seems to be an adequate supply of skilled labor because of the declining projected capital outlay and the estimated growth in labor supply. Note that these numbers do not take into account demands arising from housing or building construction.

**ESTIMATED REGIONAL HIGHWAY SKILLED LABOR DEMAND**

Labor Demand for \$7.3 Billion Highway Construction C/O

REGION	Regional Share (%)	Laborers 25.17%	Operating Engineers 15.04%	Carpenters 4.15%	Cement Masons 3.53%	Ironworkers 0.9%	Total Demand	2008 Estimates	
								Supply	D-S
S.F. Bay Area	17.84	3,277	1,958	540	460	117	6,353	4,517	-1,836
Northern Counties	3.71	681	407	112	96	24	1,320	265	-1,055
Sacramento Region	4.61	847	506	140	119	30	1,642	1,407	-235
Mother Lode	2.76	507	303	84	71	18	984	158	-826
Central Valley	11.99	2,204	1,317	363	309	79	4,272	1,637	-2,635
North Coast	1.84	339	202	56	47	12	656	3,657	3,001
Central Coast	4.83	888	531	146	125	32	1,721	658	-1,063
Los Angeles County	22.23	4,084	2,440	673	573	146	7,917	2,902	-5,015
Ventura County	2.20	404	241	67	57	14	782	460	-322
Orange County	6.70	1,232	736	203	173	44	2,388	1,641	-747
San Diego/Imperial	9.10	1,673	999	276	235	60	3,242	1,884	-1,358
Inland Empire	11.05	2,029	1,213	335	285	73	3,934	2,916	-1,018
<b>All Regions</b>	<b>98.86</b>	<b>18,165</b>	<b>10,854</b>	<b>2,995</b>	<b>2,548</b>	<b>650</b>	<b>35,211</b>	<b>22,102</b>	<b>-13,109</b>

## **Part III: Recommendations for Next Implementation Efforts**

Building on CSLWI's research efforts and stakeholder sessions conducted so far, the following are recommendations for future efforts:

### ***Build on Existing Statewide Training Programs***

A new training system is not needed in California since a well-functioning training system already exists in the state. The challenge will be to build on existing statewide training programs to train new workers, provide additional training for incumbent workers, and allow flexibility in meeting demand. The primary element of this training is the apprenticeship programs, particularly union-based apprenticeship programs that currently train approximately 90 percent of apprentices in most occupations. The system also includes pre-apprenticeship programs that prepare workers in literacy and math skills and in work orientation to succeed in apprenticeship training.

Apprenticeship programs indicate that many of their applicants tend to be in their mid-to-late twenties and lack some basic skills applicable to work environments (that is, punctuality, understanding of requirements and expectations, commitment, etc.). Addressing this deficiency requires outreach to high schools and pre-apprenticeship training programs. In addition to addressing the basic skills issue, such efforts would also create greater understanding of the construction trades and the opportunities provided by them.

To help facilitate the outreach efforts, teacher credentialing must be examined. The majority of teachers and counselors in high schools are generally unaware of the construction trades. This unfamiliarity limits the communication of potential benefits to students and hinders the ability to teach students the basic skills required to enter an apprenticeship program. Although there appears to be a pool of willing instructors in construction trades, many instructors do not have the educational background to meet existing credentialing requirements, which focus on the basic "A to G" requirements. Modifying credentialing requirements would increase the availability of CTE instructors, thereby expanding the candidate pool available to apprenticeship programs, which would, in turn, result in increased pass-rates from those programs.

### ***Distribute Supply and Demand Research***

For a government agency, deciding on the number of workers to train always requires a balance between meeting anticipated increases in demand and creating a surplus of workers and who will be unable to find work. State government does not want to heighten expectations among training providers and apprenticeship programs so much that an excess of training results. Yet, in the very near future, training providers and apprenticeship programs should be alerted to supply and demand estimates to ensure that additional training for new and incumbent workers is provided.

The first step is to distribute Caltrans supply and demand research to the workforce stakeholders in each county. Chief among these stakeholders are local employers and the main construction industry associations, particularly the Associated General Contractors (AGC). Employers will have the clearest vision in the state's main regions of job openings, of labor shortages that might be expected, and about the changing impacts of the residential market downturn.

The apprenticeship programs are key stakeholders. Each of the five highway construction occupations studied has strong, established apprenticeship programs with training centers throughout the state and an ability to increase numbers of apprentices as demand justifies. These training centers also have the capacity to provide targeted training for incumbent workers outside the transportation subsector who might need certain classes to make the transition into transportation projects.

Other key stakeholders are the Workforce Investment Boards (WIBs), the 50 local entities throughout the state that administer the main part of the federal Workforce Investment Act (WIA) funds that come to California each year, as well as community college districts, adult education programs, and administrators of the Governor's Career Technical Education initiative.

### ***Meet With Local Workforce Investment Boards***

Distribution of Caltrans supply and demand research should be followed by meetings with the local stakeholders to develop training goals for counties and regions. Separate training goals should be set for each of the five occupations, and perhaps additional occupations. The training goals might be set on a county- or region-wide basis. In the San Francisco East Bay, for example, the four WIBs—Alameda, Contra Costa, Richmond, and Oakland—have formed an association, “EastBay Works,” to undertake joint planning and select program administration. Discussion would involve all four WIBs to allow for coordination of efforts. The same would apply to WIBs in “regional” settings.

### ***Identify Available Funding and Develop Strategies***

The bulk of the more than \$300 million of federal WIA funds that come to California each year are administered by the local WIBs. They are uniformly looking to use training funds that offer acceptable pay and benefits for the job fields in their areas. Public sector construction jobs are high on the WIBs' lists of favored training opportunities, since they meet the pay and benefits criterion and are within the reach of Californians who do not have college degrees. Accessing WIA funds will require WIB contacts on a county-by-county or region-by-region basis.

A further funding opportunity for construction training comes from Governor Schwarzenegger's CTE initiative, and its accompanying new funding. As the California Construction Education and Research Foundation (CCERF) has demonstrated, high schools represent a promising pool of potential workers for construction jobs, especially among the sizable segment of high school students who do not go on to college. The CTE initiative provides funding for a variety of valued pre-apprenticeship skills.

Related to the pre-apprenticeship training through CTE is the pre-apprenticeship training available through the community college districts in California. Vocational education, aimed at job placements in decent-paying jobs, is one of the main mandates for these districts. Similarly, the state's adult education system provides resources for worker recruitment and pre-apprenticeship training. Accessing the community college and adult education resources will require a county-by-county effort, similar to the accessing of WIA funds.

## APPENDIX 1: List of Participants in the CSLWI Stakeholder Sessions

AGC Construction Education and Research Foundation

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AGC of California

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Sabrina Watts, Director of Workforce Development

Alameda County Apprenticeship Collaborative/Hispanic Chamber of Commerce  
of Alameda County

Jesus Vargas

American River College

Cris McCullough, Associate Vice President, Workforce Development

Scott Griffith, Dean of Engineering and Technology

Assembly Education Committee

Marisol Avina

Business, Transportation & Housing Agency

Dale Bonner, Secretary

Jim Bourgart, Deputy Secretary for Transportation and Infrastructure

California Alliance for Jobs

Jim Earp, Executive Director

Tomi Van de Brooke, Director Land Use and Water Policy,  
Government Relations, Bay Area

California Coalition for Construction in the Classroom (CCCC)

Adrienne Monroe, former Executive Director

California Community Colleges Chancellor's Office

Barry Noonan, Apprenticeship Coordinator and Specialist

California Department of Education

Dennis Guido, Manager

Rick Mejia, Professional Staff

Patrick Ainsworth, Associate Superintendent, Secondary, Postsecondary and  
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California Employment Development Department  
Bonnie Grayball, Labor Market Information  
Denise Miller, Workforce Development

California Industrial Technology Education Association (CITEA)  
Seth Bates, President  
Jim Howlett, Past President California Labor & Workforce Development Agency  
Victoria Bradshaw, Secretary

California Labor and Workforce Development Agency  
Jaime Fall, Assistant Secretary

California Laborers-Employers Cooperation and Education Trust (CA LECET)  
Joe Blodgett, Interim Director  
Chad Wright  
Ken Allen, Retired Director

California State Council of Laborers  
Jose Mejia, Director  
Patrick Henning, Legislative Department

California State University  
Emir Macari, Sacramento College of Engineering and Computer Science, Dean

California Workforce Investment Board  
Barbara Halsey, Executive Director  
Ken Quesada  
Sunshine Duffy

California-Nevada Conference of Operating Engineers  
Tim Cremins

California's EDGE Campaign  
Sharon Huntsman, Executive Director

Carpenters Training Committee Northern California  
John Bullock, Apprenticeship Training Director

Carpenters Training Committee Southern California  
Pat McGinn, Apprenticeship Training Director

Carpenters Training Committee  
Jim McNamee, Director of Training Services  
Mary Lieser, Assistant District Coordinator  
Richard Graalfs, Training Officer

Center for Employment Training  
Carlos L. Lopez, Director of Government Relations

Cosumnes River College  
Patrick Blacklock, Dean, Careers and Technolog

Engineering and Utility Contractors Association (EUCA)  
Randy Ruby, Director of Labor Relations

## Folsom Lake College

Stuart Van Horn, Dean of Careers and Technical Education

Aiden Ely, Dean of Student Division

## Home Builders Institute

Deanna Lewis, Manager for Career Services

## International Union of Operating Engineers

Tim Neep, Local Director

## Los Rios Community College District

Thelma Scott-Skillman, Chancellor

Bill Karns, Vice Chancellor, Education and Technology

## Matich Corporation

Stephen Matich

## Milken Institute

Michael Bernick National Association of State Directors of Career Technical  
Education Consortium

Kimberly A. Green, Executive Director

## Norcal Cement Masons JATC

Mark Gonzalez, Director

## North State Building Industry Association

Rick Larkey, Director, Workforce Development

## Northern California Carpenters Union

Dan Curtin

## Northern California Labor District Council

Cedric Porter, Assistant Business Manager

## Northern California Laborers

Jeff Armstrong, Director of Apprenticeship

## Operating Engineers JAC

Tammy Castillo, Director of Apprenticeship

## Plumbers and Steamfitters Local Union No. 159

Aram Hodess, Business Manager

## San Joaquin Area Apprenticeship Coordinators Association (Department of Education)

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## San Mateo Community College District

Ron Galatolo, Chancellor

## Secretary of Education

Ray Reinhard, Assistant Secretary

## Southern California Laborers

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Jeff Wright

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Doug Urbick, Division President

Unit 12, International Union of Operating Engineers

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Western Council of Construction Consumers (WCCC)

Andy Wiktorowicz, Executive Director

Glenn Singley



# SKILLED CONSTRUCTION LABOR IN CALIFORNIA

## Estimating Workforce Availability

### Volume 1—Overview, Methodology, and Recommendations for Ensuring a Sufficient Future Workforce

State of California  
Department of Transportation  
Division of Construction  
March 2008





## Contents

<b>I. Executive Summary .....</b>	<b>1</b>
Table 1 Projections of Skilled Workforce—HSB, California 2007-2016 .....	2
Table 2 Projections of Skilled Workforce—Total Construction, California 2007-2016 .....	2
<b>II. Key Dynamics of Transportation-Related Construction Employment in California ..3</b>	
Figure 1 Construction Components .....	4
<b>III. The Current Supply of Construction Workers in California .....</b>	<b>5</b>
Figure 2 Statewide Construction Employment by Industry Sector or Subsector .....	5
Table 3 Occupations Related to Transportation Projects.....	6
Figure 3 Statewide Employment by Occupation—Construction Laborers .....	6
Figure 4 Statewide Employment by Occupation—Operating Engineers .....	7
Figure 5 Statewide Employment by Occupation—Carpenters .....	7
Figure 6 Statewide Employment by Occupation—Cement Masons .....	8
Figure 7 Statewide Employment by Occupation—Ironworkers.....	8
<b>IV. Construction Employment in California and Levels of Transportation Funding .....</b>	<b>9</b>
Figure 8 Construction Employment in California .....	9
Figure 9 Heavy and Civil Engineering Construction Employment in California.....	9
Figure 10 Highway, Street, and Bridge Construction Employment California .....	10
Figure 11 Total State Highway Expenditures .....	10
Figure 12 California Construction Volume.....	11
<b>V. Movement of Construction Workers Among Subsectors .....</b>	<b>11</b>
<b>VI. Annual Exits/Entries Among Transportation-Related Construction Occupations ...</b>	<b>12</b>
Table 4 Net Replacement Rate Among Occupations .....	13
Table 5 New Apprentices in California—Total Construction .....	13
<b>VII. Estimating the Supply of Skilled Construction Workers in California .....</b>	<b>14</b>
Table 6 Projections of Skilled Workforce in California—HSB .....	14
Table 7 Projections of Skilled Workforce in California—Total Construction .....	15
<b>VIII. Consistency of Supply Estimates with Projections of Construction Employment ....</b>	<b>15</b>
Figure 13 California Construction Employment Forecast (UCLA) .....	16
Figure 14 California Construction Employment Forecast (Caltrans).....	16
<b>IX. Recommendations to Ensure an Adequate Supply of Skilled Workers .....</b>	<b>17</b>



## Skilled Construction Labor in California

### I. Executive Summary

The \$19.9 billion allotted for transportation funding contained in Proposition 1B represents the largest single influx of new transportation funding in California of the past 40 years. The California Department of Transportation (Caltrans) seeks to be proactive in determining whether the supply of skilled construction workers will be sufficient to meet the needs of the transportation projects on a timely basis and whether the transportation-related construction jobs might be employment opportunities for unemployed and underemployed Californians, in line with the Governor's goal of maximizing the employment impacts of transportation investment.

To address these issues, Caltrans and the Milken Institute prepared estimates of the supply of transportation-related construction labor projected over the ten-year period 2007–2016 and distributed over the 58 California counties. In order to provide a reasonable labor supply projection in a relatively short time frame, five specific labor occupations were examined: construction laborers, operating engineers, carpenters, cement masons, and reinforcing iron and rebar workers (ironworkers).

In this report, estimates are presented for the supply of skilled workers in each of these five occupations. These estimates build on the dynamics of construction employment in California. They start with the current skilled workforce in each of these occupations, which will form the basis for labor supply for the Proposition 1B projects, as well as other state highway projects. The estimates use a formula that takes into account the workers being trained in the apprenticeship programs throughout the state, as well as the net replacement rate for each occupation compiled by the federal Bureau of Labor Statistics and the state Employment Development Department (EDD).

Separate estimates are compiled for the Highway, Street, and Bridge (HSB) subsector, the main subsector of employment involved in transportation projects and for the overall construction sector in California. One of the main dynamics of construction employment is the considerable movement of workers and transferability of skills among subsectors. In many cases among the five occupations, workers in subsectors outside the HSB subsector can move into HSB work with no additional or a limited amount of training.

The formula for estimating the skilled workforce in the HSB subsector is set forth below:

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$$\text{Estimate of Skilled Workers in HSB} = \text{Current Employment Skilled Workers in HSB} \\ + \text{New Entering Apprentices in HSB} - \text{Net Replacements in HSB}$$

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The results for the years 2007-2016 are summarized in Table 1:

**Table 1**  
**Projections of Skilled Workforce—HSB, California 2007–2016**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers	Total
2005	7,886	5,311	2,099	1,544	672	17,512
2006	7,968	5,401	2,268	1,585	742	17,964
2007	8,284	5,482	2,165	1,602	703	18,236
2008	8,369	5,589	2,204	1,636	716	18,514
2009	8,455	5,697	2,244	1,671	728	18,795
2010	8,541	5,807	2,285	1,707	740	19,080
2011	8,629	5,920	2,326	1,744	753	19,372
2012	8,717	6,035	2,368	1,781	766	19,667
2013	8,807	6,152	2,411	1,819	779	19,968
2014	8,897	6,271	2,455	1,858	793	20,274
2015	8,988	6,393	2,500	1,898	806	20,585
2016	9,080	6,517	2,545	1,939	820	20,901

Source: Department of Industrial Relations, EDD, Milkin Institute

A similar formula is applied for projections of the total construction skilled workforce in California:

$$\text{Estimate of Skilled Workers in Construction} = \text{Current Employment Skilled Workers in Construction} + \text{New Entering Apprentices in Construction} - \text{Net Replacements in Construction}$$

**Table 2**  
**Projections of Skilled Workforce—Total Construction, California 2007–2016**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers	Total
2005	131,464	32,378	201,294	29,125	7,382	401,643
2006	132,789	32,921	206,016	29,807	7,902	409,435
2007	135,678	33,405	208,996	30,336	7,695	416,110
2008	137,035	34,052	212,994	30,991	7,828	422,900
2009	138,406	34,712	217,069	31,660	7,964	429,811
2010	139,791	35,385	221,221	32,343	8,103	436,843
2011	141,190	36,071	225,453	33,042	8,244	444,000
2012	142,604	36,770	229,766	33,755	8,387	451,282
2013	144,031	37,483	234,162	34,484	8,533	458,693
2014	145,473	38,210	238,641	35,229	8,681	466,234
2015	146,929	38,951	243,207	35,990	8,832	473,909
2016	148,401	39,706	247,860	36,767	8,985	481,719

Source: Department of Industrial Relations, EDD, Milkin Institute

These estimates are presented with several caveats. They are meant as a baseline for evaluating potential actions and do not take into account increased training and recruitment efforts that might be undertaken by the state's apprenticeship programs, the construction industry, and the public workforce system. They focus on transportation projects, not on all infrastructure projects in the state. Still, this report does recognize and discuss the increased competition for workers that will come from these other infrastructure projects approved by voters in November 2006. Most important, the estimates are not the result of complex economic modeling—time and budget do not permit. However, they do present the order-of-magnitude estimates that will enable state government, the construction industry, and training entities, along with the local workforce investment boards, to better determine levels for new construction workforce training and recruitment.

In Volume 2 (County-Level Details), the methodology developed in this volume is applied to the California counties for transportation-related projects for the years 2007 through 2016 and results in detailed labor supply estimates by county.

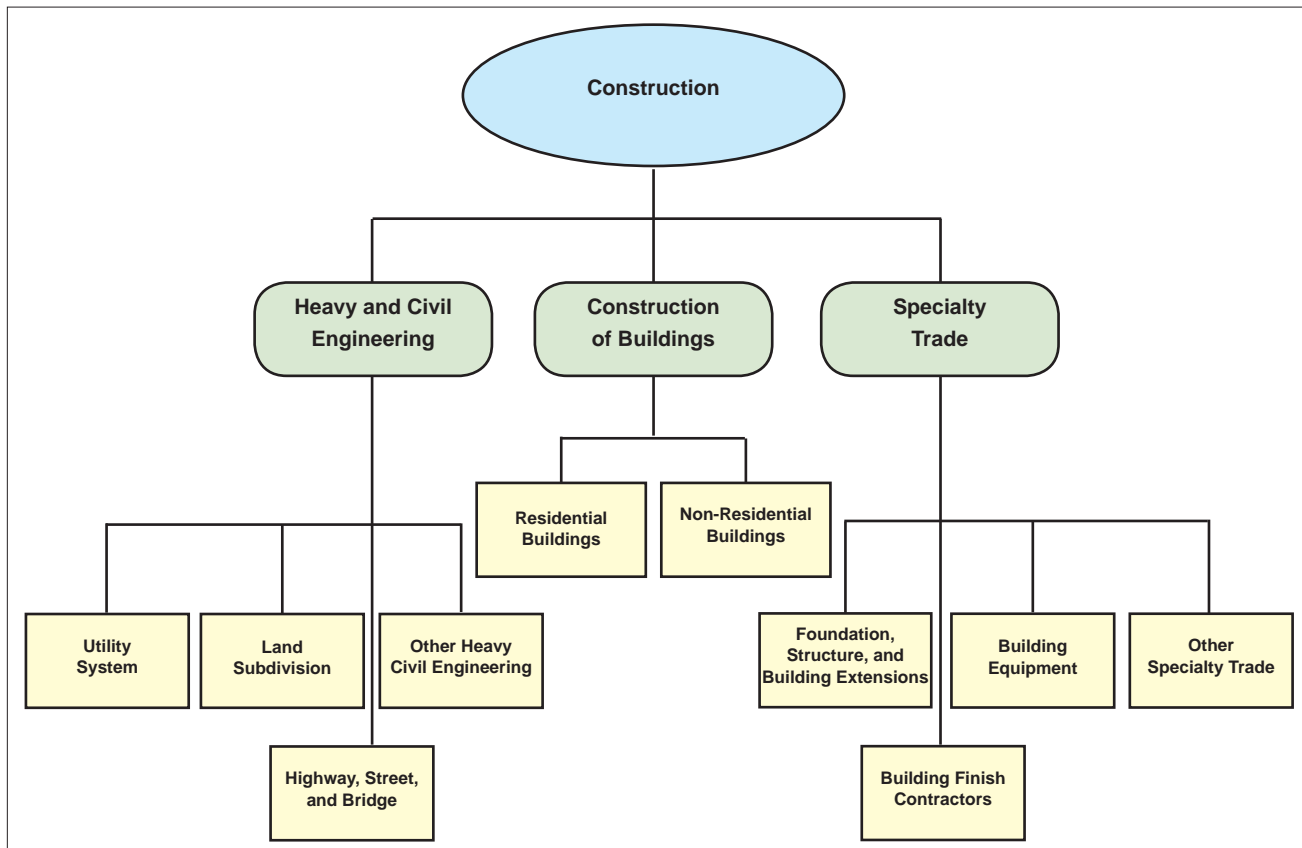
## II. Key Dynamics of Transportation-Related Construction Employment in California

Developing supply estimates is not a simple or direct process. The researcher is required to pull together several sources of data and to draw on the expertise of the parties involved in the hiring and training processes, including employers, labor organizations, and the apprenticeship and training programs. Most of all, identification of the key dynamics of transportation-related construction employment in California is necessary. The dynamics most important in estimating the skilled construction workforce available for transportation-related projects are set out below.

- A. The current labor supply will form the basis for projecting supply in the next decade. An estimate of skilled transportation-related construction labor will start with data on the current employment levels in the Highway, Street, and Bridge (HSB) subsector.
- B. The employment of construction workers in HSB projects in California currently constitutes a very small proportion of the construction employment statewide. Only 3 percent of the construction workforce was employed in HSB construction in 2004. Heavy and Civil Engineering Construction, the category that combines the four subsectors of construction employment related to infrastructure projects, employed only around 10 percent of the construction workforce. The great majority of construction workers, including in the five occupations targeted by Caltrans, are in the other major categories of construction that are combinations of subsectors: Construction of Buildings (residential and nonresidential building construction) and Specialty Trade Contractors.

Figure 1 diagrams the components of the Construction Sectors, its three categories (Heavy and Civil Engineering, Construction of Buildings, and Specialty Trade Contractors) and ten subsectors. EDD classifies workers among employment sectors, of which construction is one of the main employment sectors in California. EDD also classifies workers in the construction sector into ten separate subsectors, of which HSB is one of the subsectors.

**Figure 1**  
**Construction Components**



- C. In a similar vein, construction employment in California has increased steadily since 1993, from fewer than 500,000 workers in 1993 to over 900,000 workers in 2006. This employment has been impacted little by the ups and downs of HSB spending during these 14 years.
- D. Although transportation and infrastructure employment make up a small percentage of construction employment, there is considerable movement of workers and transferability of skills among subsectors. In most cases among the five occupations, workers in other subsectors can move into transportation projects with a limited amount of or no training. Each of the labor organizations associated with the targeted occupations has multiple training centers throughout the state that can increase enrollees or undertake targeted training for incumbent workers if demand justifies.
- E. Employment in transportation-related construction is not static. Workers are exiting the five occupations regularly because of retirements or changes of occupation. Using survey data from the federal Bureau of Labor Statistics, EDD has compiled estimates of annual “net replacement” rates for each of the five occupations.
- F. Workers are also entering the five occupations on a regular basis, particularly through the apprenticeship programs. These programs play a main role in training workers for construction employment in California.

Each of these dynamics is discussed in the following section in greater detail.

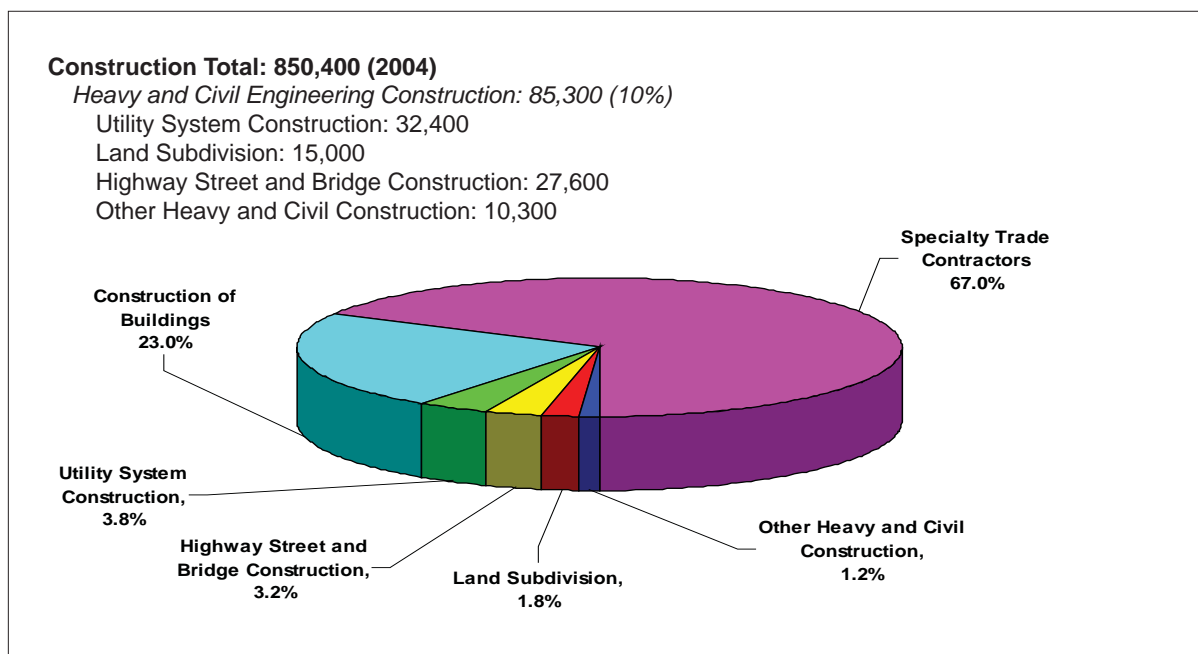
### III. The Current Supply of Construction Workers in California

#### *Total, Subsector, and Major Transportation-Related Occupations*

Understanding the future supply of construction workers available for the transportation-related projects starts with an overview of the total current supply of construction workers in California followed by a review of subsectors and major transportation-related crafts.

According to data from EDD, there were 850,400 construction workers in California in 2004. As shown in Figure 2, only 3.2 percent of these construction workers, a total of 27,600 were employed in HSB work. Further, only a slightly higher percentage, approximately 7 percent of construction workers were employed in the rest of the Heavy and Civil Engineering category, made up of the subsectors of construction related to infrastructure projects: Utility System Construction (32,400 workers), Land Subdivision (15,000 workers), and Other Heavy and Civil Construction (10,300), along with HSB.

**Figure 2**  
**Statewide Construction Employment by Industry Sector or Subsector**



The largest percentage of construction workers were employed in Specialty Trade Contracting (569,600), distributed among Building Equipment Contracting (184,100); Building Finishing Contracting (173,800); Other Specialty Trade Contracting (66,600); and Foundation, Structure and Building Exterior Contracting (145,100). The remaining 195,700 construction workers were employed in Construction of Buildings, distributed among Residential Building Construction (130,300) and Nonresidential Building Construction (65,400).

EDD not only divides construction employment into separate industry subsectors using North American Industry Classification Codes, but also divides construction employment into occupations using Standard Occupational Classification (SOC) System Codes. Caltrans is focusing initially on the five occupations related to transportation projects shown in Table 3.

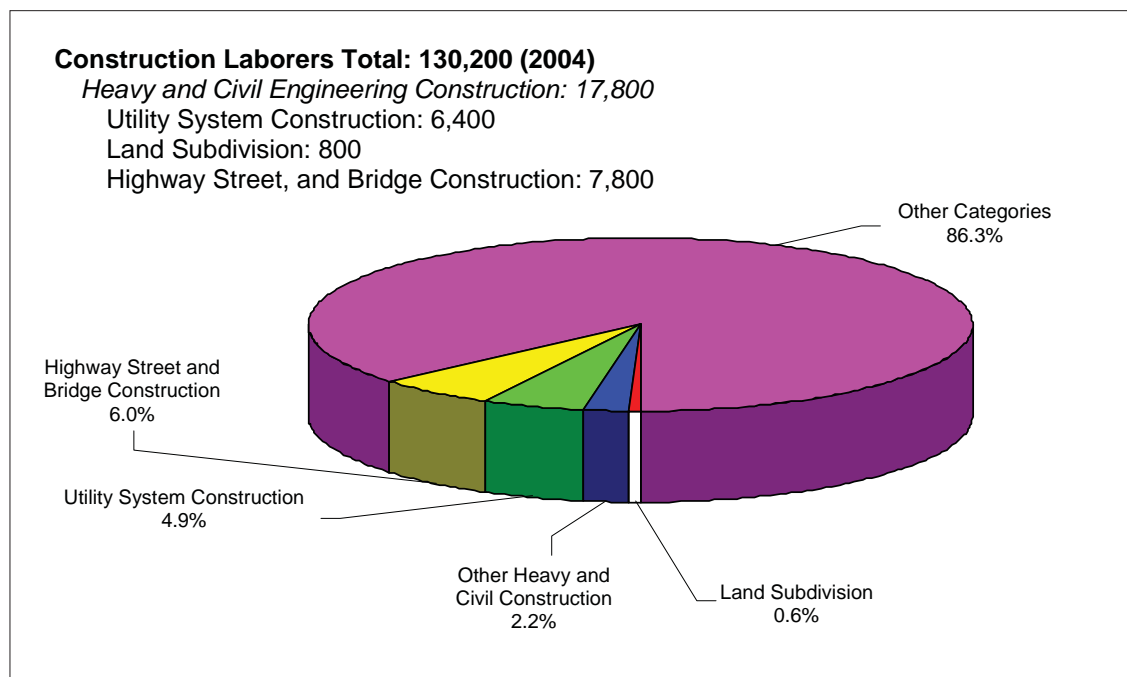
**Table 3**  
**Occupations Related to Transportation Projects**

<b>Occupation .....</b>	<b>SOC Code</b>
Construction Laborers .....	47-2061
Operating Engineers .....	47-2073
Carpenters .....	47-2031
Cement Masons .....	47-2051
Ironworkers.....	47-2171

Figures 3, 4, 5, 6, and 7 show the employment of these five transportation-related occupations by total employment statewide and by industry subsector. What is true of construction employment in total is true of each of the five transportation-related occupations. Although the occupations differ in their percentages among subsectors, the great majority of workers in each of the five occupations work outside HSB and outside the four combined Heavy and Civil Engineering subsectors. The Operating Engineers have the highest percentage of its workforce in Heavy and Civil Construction at over 30 percent, while the Carpenters have the lowest, at approximately 2 percent.

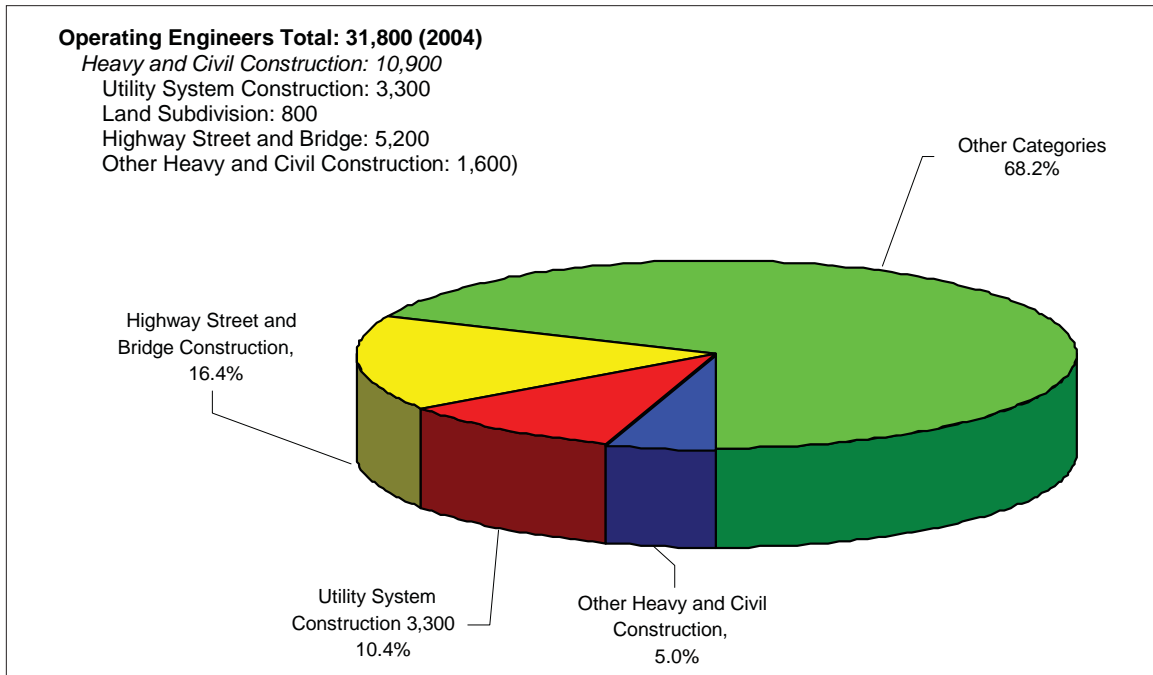
Construction Laborers: As shown in Figure 3, there were 130,200 construction laborers in California in 2004, 17,800 of whom worked in the four infrastructure subsectors of Heavy and Civil Engineering Construction. HSB construction employed 7,800 construction laborers, the largest number of the subsectors.

**Figure 3**  
**Statewide Employment by Occupation—Construction Laborers**



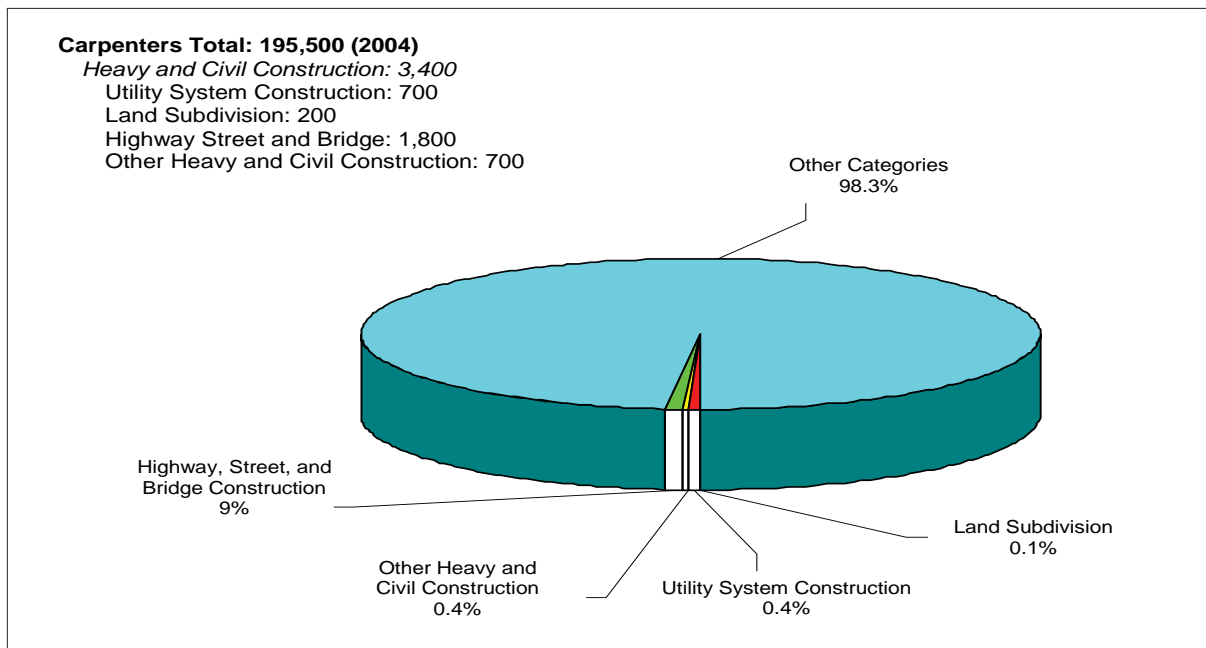
Operating Engineers: As shown in Figure 4, California had 31,800 operating engineers in 2004. Roughly one-third worked in the four infrastructure subsectors of Heavy and Civil Engineering Construction. HSB construction employed 5,200 operating engineers, the largest number among the subsectors.

**Figure 4**  
**Statewide Employment by Occupation—Operating Engineers**



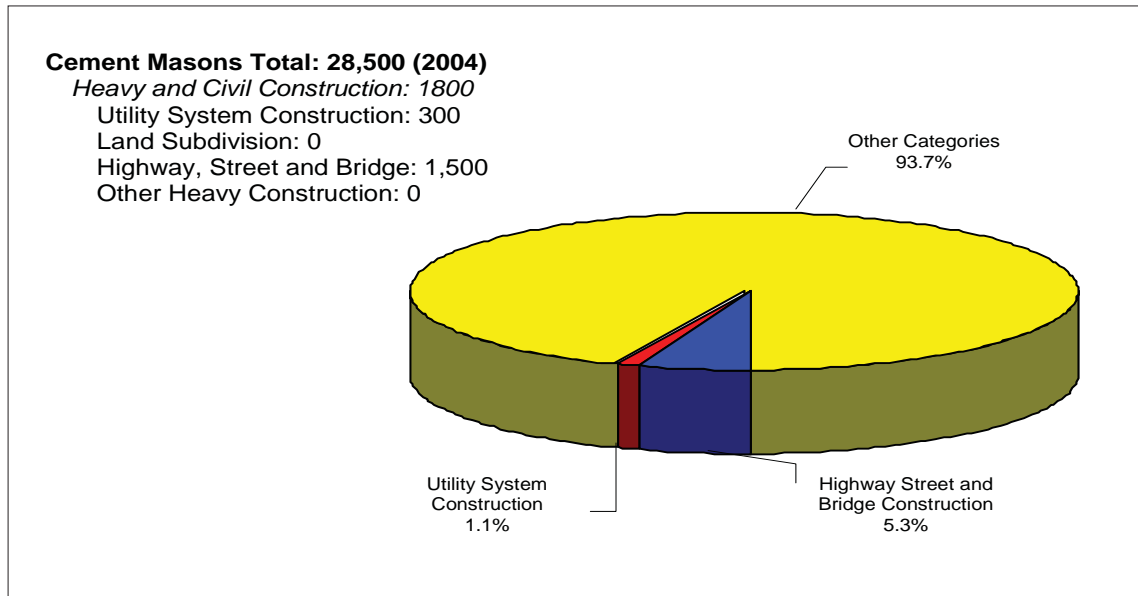
Carpenters: As shown in Figure 5, California had 195,500 carpenters in 2004, of whom only about 2 percent worked in the four infrastructure subsectors comprising the Heavy and Civil Engineering category. Only 1,800 carpenters statewide were employed in the HSB construction subsector.

**Figure 5**  
**Statewide Employment by Occupation—Carpenters**



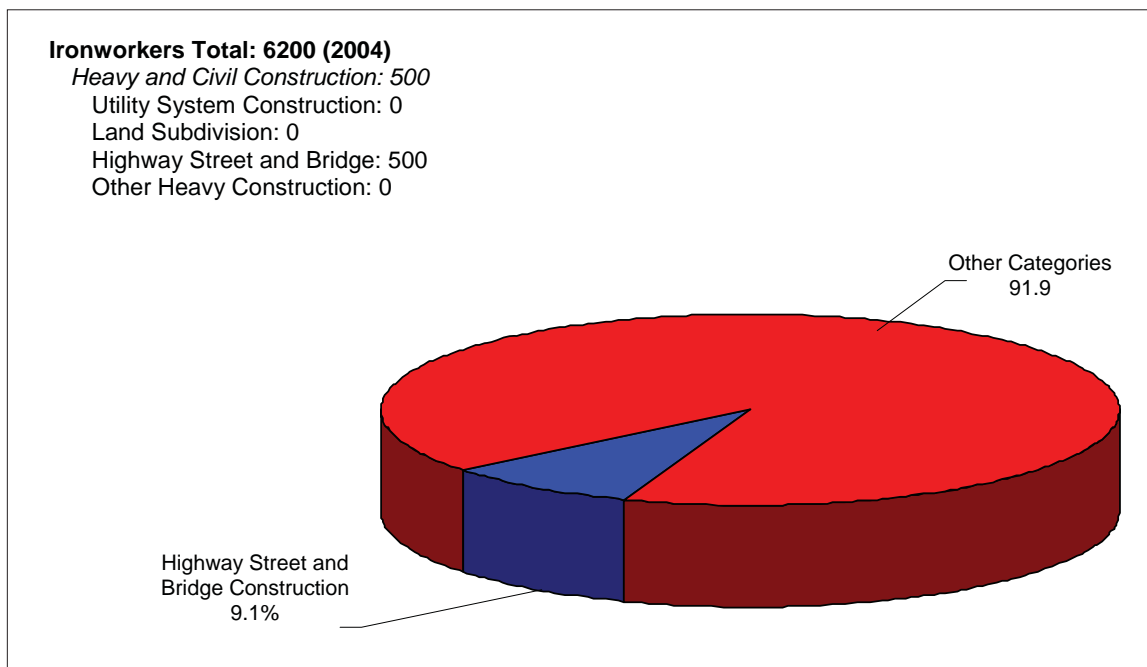
Cement Masons: As shown in Figure 6, California had 28,500 cement masons and concrete finishers in 2004. HSB employed 1,500 cement masons statewide.

**Figure 6**  
**Statewide Employment by Occupation—Cement Masons**



Ironworkers: As shown in Figure 7, California had 6,200 ironworkers in 2004. The HSB subsector employed 500 ironworkers.

**Figure 7**  
**Statewide Employment by Occupation—Ironworkers**

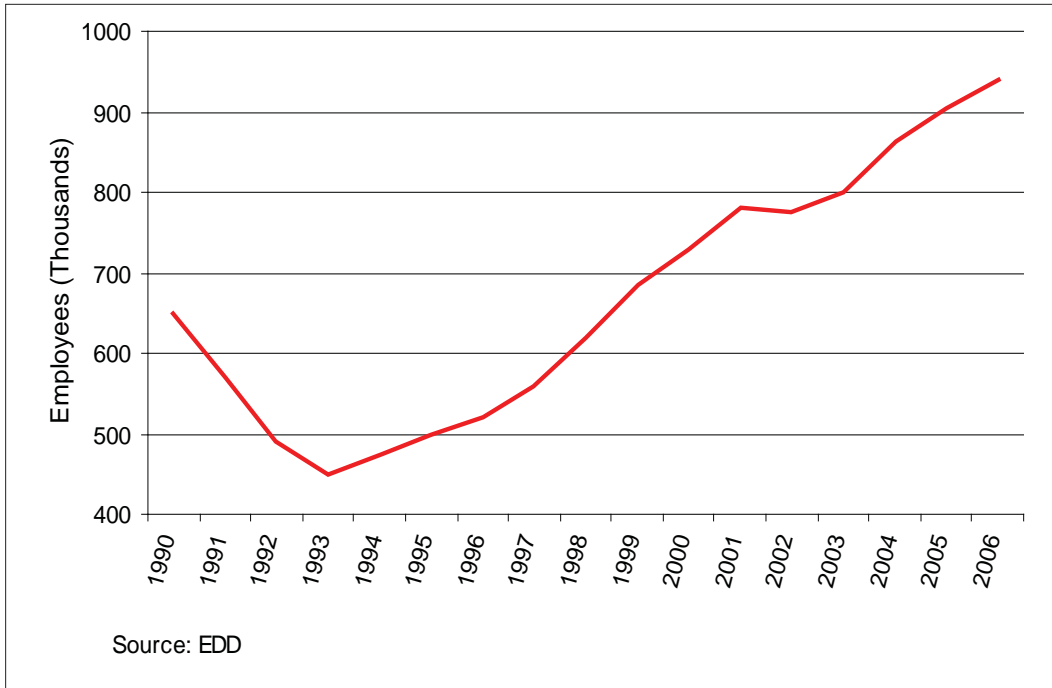


**IV. Construction Employment in California and Levels of Transportation Funding**

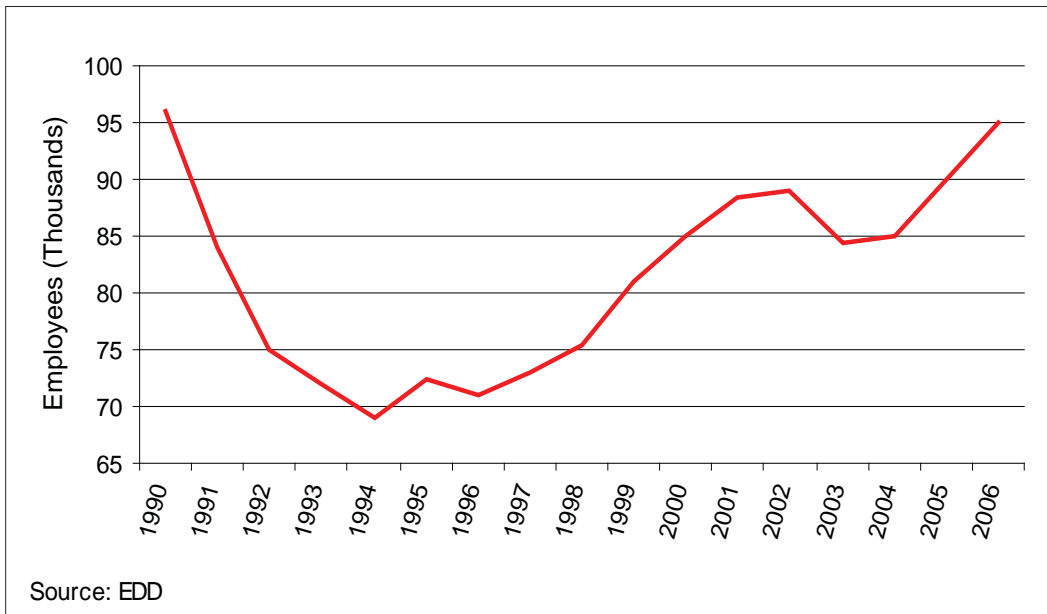
*Historical Data and Comparisons*

EDD maintains data on construction employment from 1990 to the latest year available. Figures 8, 9, and 10 contain the historical data from 1990 to the present on total construction employment in California and totals in Heavy and Civil Engineering Construction and HSB construction.

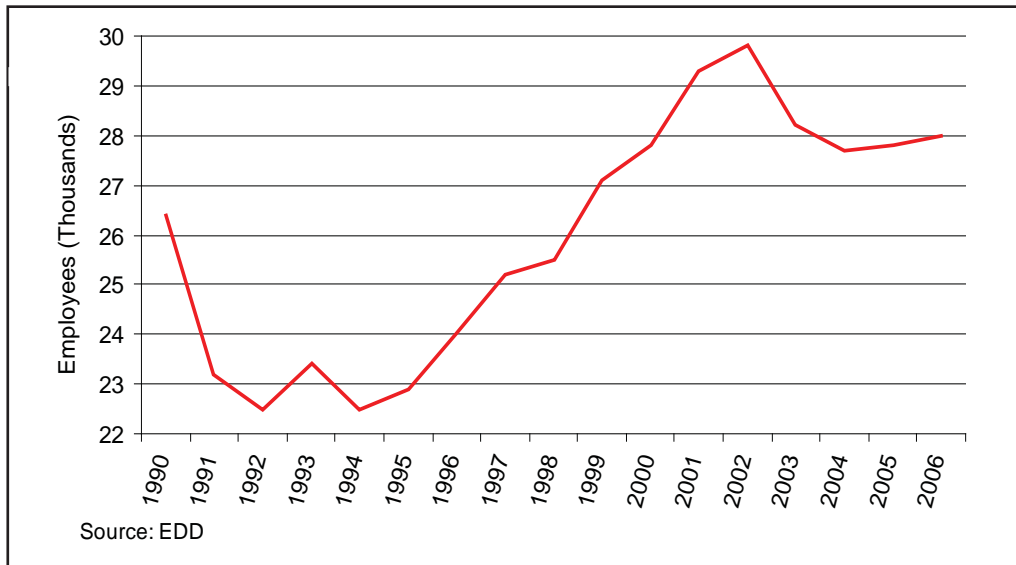
**Figure 8  
Construction Employment in California**



**Figure 9  
Heavy and Civil Engineering Construction Employment in California**



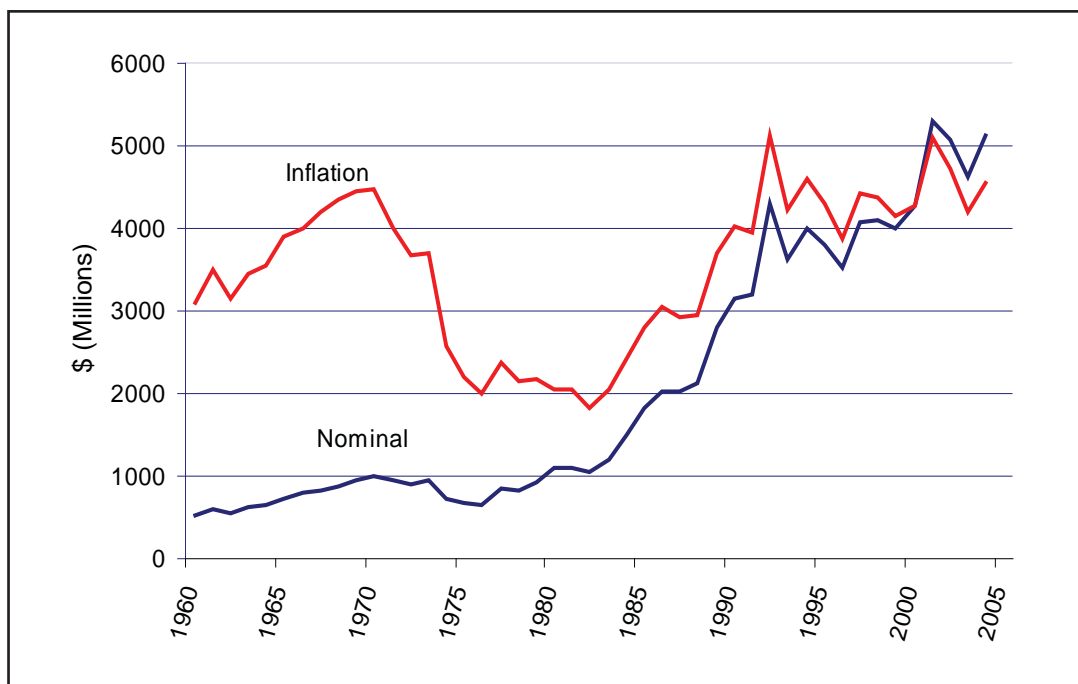
**Figure 10**  
**HSB Construction Employment California**



The figures show that construction employment in the early 1990s actually decreased both overall and among these two subsectors. However, since 1993, construction employment overall and among these subsectors has increased and, in the case of total construction employment, has increased steadily.

Figure 11 shows the total state highway expenditures between 1960 and 2004. These expenditures have risen in absolute numbers over the past 40 years, increasing most sharply and steadily since 1980. In inflation-adjusted dollars, the expenditures have increased significantly since 1980, but went through downturns throughout much of the 1990s.

**Figure 11**  
**Total State Highway Expenditures**

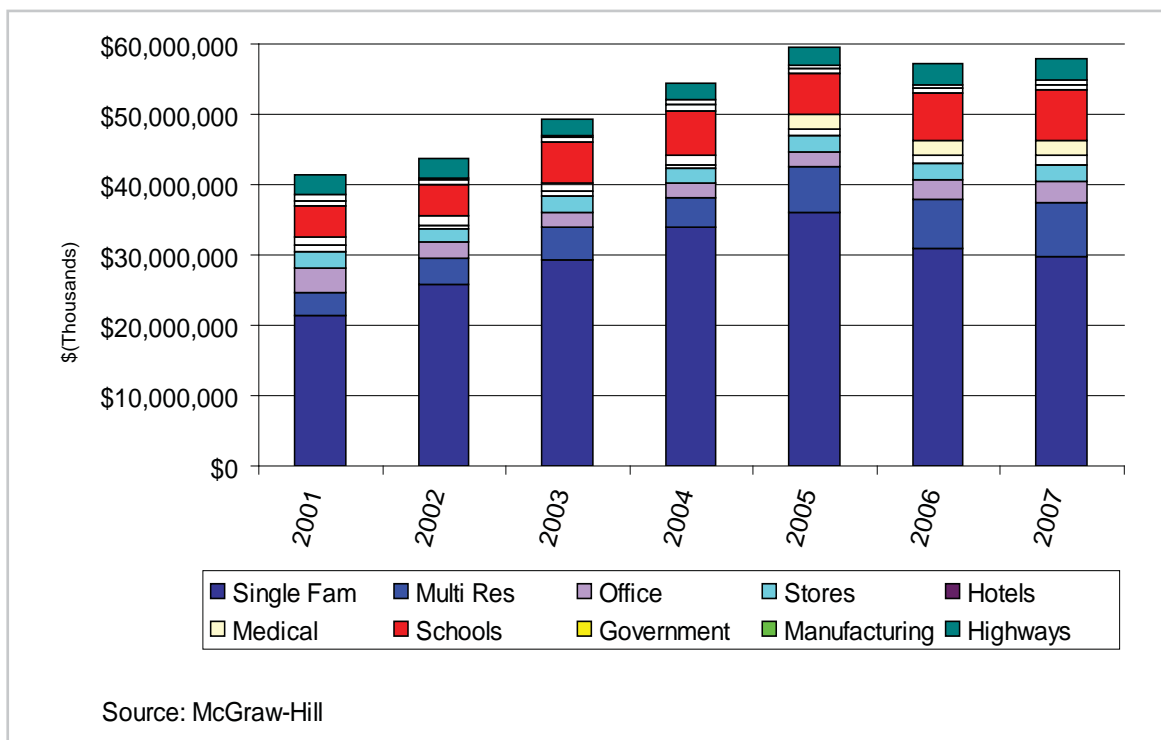


Total construction employment does not follow the ups and downs of highway spending. Construction employment decreased from 1990 to 1993 but increased steadily from 1993 onward. Highway spending, in contrast, decreased from a high of \$4.3 billion in 1993 to \$3.5 billion in 1996. It increased fitfully during the late 1990s before getting a dramatic bump up in the 2000–2001 budget to \$5.3 billion.

HSB construction follows state highway spending to a greater extent than total construction, but not completely. Before increasing steadily from 1994 to 2002, HSB construction decreased from 1993 to 1994. It did not follow the ups and downs of inflation-adjusted highway spending from 1995 to 2000.

Transportation construction volume (Figure 12) represents a minority percentage of the overall total construction. Because it represents roughly only 5 percent of total construction, even a large infusion, such as doubling the current budget, would theoretically bring the total share up to only 10 percent. Given the transferability of skills (within occupations across industries or out of occupation), attracting and sustaining a viable labor supply of HSB construction employment represented by numbers of construction laborers, operating engineers, carpenters, cement masons, and ironworkers has proven difficult in the past. The trend may continue and may affect highway projects in the future unless addressed by remedies that examine the economic impact of prevailing wages and expenditures along with the role of labor organizations in transportation construction goals.

**Figure 12**  
**California Construction Volume**



**V. Movement of Construction Workers Among Subsectors**

Estimating the supply of transportation-related construction workers in California starts with the current numbers in the transportation-related and infrastructure subsectors. However, the great majority of construction workers are not limited to a specific subsector. They move around among craft work in subsectors. For example, the supply of operating engineers available for work in the transportation field includes not only the operating engineers working in HSB construction at any period, but also operating engineers working in certain of the other subsectors, particularly in the other subsectors of Heavy and Civil Engineering Construction.

Among most subsectors, the transferability of skills in these occupations is very high. For example, carpenters who work in the four subsectors that make up Heavy and Civil Engineering can move easily among these four subsectors. Even additional training needed to move among subsectors can often be done in a matter of months. Carpenters who work in the other subsectors of Building Construction or Specialty Trade Contracting may need additional training to move into HSB construction, but the training in many cases will be short-term.

To understand the movement of construction workers among subsectors, structured interviews were conducted with employers and employee representatives, particularly those with the main source of training for these five transportation-related crafts, the union apprenticeship training programs. Below is a summary of findings:

- A. *Construction Laborers.* Construction laborers move among all of the construction subsectors, depending on the availability of work. Construction laborers who work on HSB projects also work on projects in each of the other major subsectors of residential and nonresidential building and the specialty trade contracting, as well as on the other subsectors of Heavy and Civil Engineering Construction.
- B. *Operating Engineers.* Operating engineers move among jobs in HSB construction and two other subsectors, Utility System Construction and Other Heavy and Civil Engineering Construction. Operating engineers also move between the other major subsectors of residential and nonresidential building construction to transportation work. However, operating engineers rarely move between transportation projects and specialty trade contracting.
- C. *Carpenters.* Carpenters who work in utility system construction and other heavy and civil construction have the skills for transportation projects. Carpenters who work in the other subsectors of building construction and specialty trade contracting generally require additional training to take on construction projects.
- D. *Cement Masons.* Cement masons move among all of the construction subsectors, depending on the availability of work. Cement masons working on commercial building construction, for example, have the skills to move over to transportation projects. The only exception to this transferability of skills is in a few specialty areas of cement masonry related to curb, gutter, and sidewalk work.

## **VI. Annual Exits and Entries Among Transportation-Related Construction Occupations**

In each transportation-related construction occupation, the supply is influenced by workers exiting and entering the occupation on a regular basis.

### ***Workers Exiting the Occupation***

EDD estimates a net replacement rate for each occupation, including each of the five transportation-related construction occupations. EDD bases its rates mainly on the federal Bureau of Labor Statistics national studies of employee turnover by occupation. The replacement rate for any occupation includes workers who retire and workers who leave the occupation. The replacement rate combined with new job growth gives the indication of annual openings in an occupation on the state or county level. The rate does not include the movement of workers who remain in the occupation but change employers.

For projecting the supply of construction workers, the net replacement rate helps to identify the skilled workers who are exiting on a regular basis. For the five transportation-related construction occupations, EDD has made the following estimates of annual net replacement rates, formally defined by EDD as the net of (1) experienced workers who leave an occupation and start working in another occupation, who stop working altogether, or who leave the geographic area minus (2) experienced workers who move into such an opening.

**Table 4**  
**Net Replacement Rate Among Occupations**

<b>Occupation</b>	<b>Net Replacement Rate</b>
Construction Laborers	1.3% (130,200 total in 2004—1,730 Net Replacements)
Operation Engineers	2.6% (31,800 total in 2004—820 Net Replacements)
Carpenters	1.6% (195,500 total in 2004—3,180 Net Replacements)
Cement Masons	2.0% (28,500 total in 2004—570 Net Replacements)
Ironworkers	2.0% (6,200 total in 2004—120 Net Replacements)

Note: Net Replacements are based on projected average annual number of replacements between 2004 and 2014 as reported by EDD. The rate is attained by dividing net replacement number by EDD projected employment figure in 2004. Following this methodology, the rate changes only minimally throughout the remaining projection period.

### ***Workers Entering the Occupation***

Each of the five occupations relies heavily on an apprenticeship program as the main training approach and entry portal for skilled workers in transportation construction. The Department of Industrial Relations (DIR) Division of Apprenticeship Standards maintains data on state- and county-level apprenticeships. Table 5 shows the numbers statewide for entering apprentices for each of the five occupations from 2000 to 2006. Included are both the union and non-union apprenticeships (union apprenticeships constitute around 90 percent of the total apprenticeships).

**Table 5**  
**New Apprentices in California—Total Construction**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	73	529	3225	376	1319
2001	348	508	3641	380	1328
2002	620	492	3307	319	655
2003	846	481	4042	385	910
2004	1471	613	5081	470	941
2005	1729	796	5281	589	1195
2006	1777	725	6238	652	1606
2007*	3376	583	5382	548	1288
2008*	3431	592	5469	557	1309
2009*	3487	602	5558	566	1330
2010*	3544	612	5649	576	1352
2011*	3601	621	5741	585	1374
2012*	3660	632	5834	594	1396
2013*	3719	642	5929	604	1419
2014*	3780	652	6026	614	1442
2015*	3841	663	6124	624	1466
2016*	3904	674	6223	634	1489
2017*	3967	685	6325	644	1514

Sources: DIR, Milken Institute

\* indicates projection

## VII. Estimating the Supply of Skilled Construction Workers in California

### *For Upcoming Transportation-Related Projects*

Building on the dynamics of construction employment in California, we developed the following formula for estimating the supply of skilled construction workers for transportation-related projects:

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$$\text{Estimate of Skilled Workers in HSB} = \text{Current Employment Skilled Workers in HSB} \\ + \text{New Entering Apprentices in HSB} - \text{Net Replacements in HSB}$$


---

The estimate starts with the current supply of skilled workers in the HSB subsector. Added to this amount is the projected number of apprentices entering the subsector annually, and subtracted is the net replacements. The results for the years 2007-2016 are shown in Table 6.

**Table 6**  
**Projections of Skilled Workforce in California—HSB**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>	<b>Total</b>
2005	7,886	5,311	2,099	1,544	672	17,512
2006	7,968	5,401	2,268	1,585	742	17,965
2007	8,284	5,482	2,165	1,602	703	18,237
2008	8,369	5,589	2,204	1,636	716	18,514
2009	8,455	5,697	2,244	1,671	728	18,795
2010	8,541	5,807	2,285	1,707	740	19,081
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Sources: DIR, EDD, Milken Institute

One of the main California construction employment dynamics discussed is the movement of construction workers among subsectors. Thus, estimating the supply of skilled workers for transportation projects must include an estimate of the skilled workers in other construction subsectors who are available for these projects. Table 7 provides estimates of the skilled workforce across all construction subsectors.

---


$$\text{Estimate of Skilled Workers in Construction} = \text{Current Employment Skilled Workers in Construction} \\ + \text{New Entering Apprentices in Construction} - \text{Net Replacements in Construction}$$


---

**Table 7**  
**Projections of Skilled Workforce in California—Total Construction**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>	<b>Total</b>
2005	131,464	32,378	201,294	29,125	7,382	401,643
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2014	145,473	38,210	238,641	35,229	8,681	466,234
2015	146,929	38,951	243,207	35,990	8,832	473,908
2016	148,401	39,706	247,860	36,767	8,985	481,718

Sources: DIR, EDD, Milken Institute

While it is not possible to quantify the number of these workers outside HSB who can move immediately, or with short-term training, into transportation projects, our research has found such movement to be the norm in each of these five occupations. The large numbers of workers outside HSB shown in Table 7 indicate that owners and employers need not face a severe shortage of workers for its transportation-related projects, so long as the timely and effective linkages with construction employers, training providers, and the workforce system are made.

### **VIII. Consistency of Supply Estimates with Projections of Construction Employment**

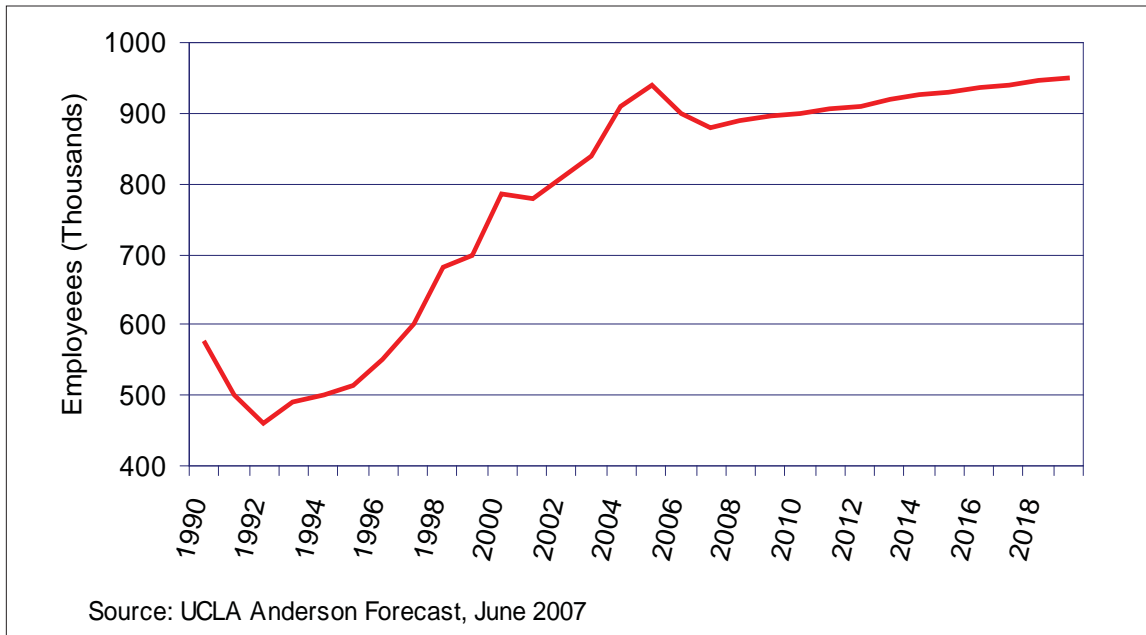
The presence of a large pool of workers outside HSB who will be available for construction projects in the coming years is supported by the major independent projections of California employment, including construction employment undertaken in recent years.

Construction employment in California stood at 943,200 in July 2006. Over the next year, it declined to 925,200 workers in July 2007, the most recent month for which data is available. The decline has been mainly because of the decline of employment in residential construction. During June 2007 and July 2007, construction employment declined by 7,800 jobs, reflecting the downturn in new starts in residential construction in the state.

The major long-term projections of construction employment in California do not project construction continuing to grow at anywhere near the explosive growth rates of the 1990s and the early 2000s. At the same time, the projections do show construction employment continuing as a major sector employer.

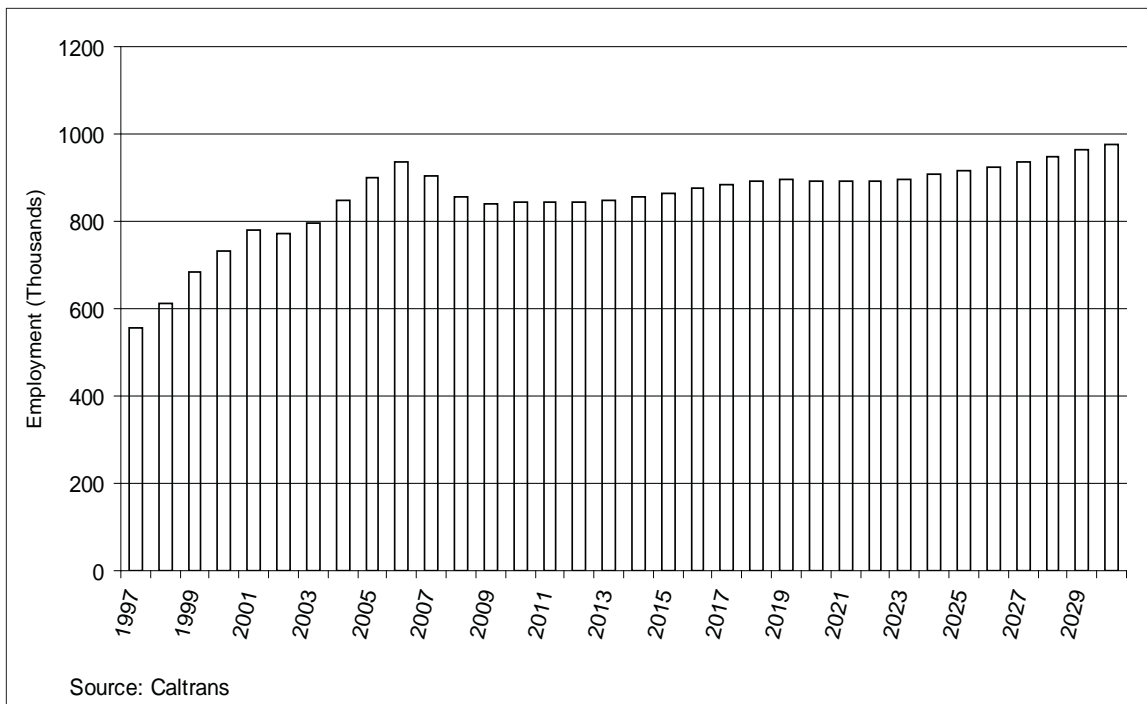
The annual UCLA Anderson School Forecast is perhaps the most well-known of the employment projections in the state. The 2007 Anderson School projection for construction employment in California (Figure 13) is for employment to increase over 900,000 workers through the start of 2009 and then dip slightly for a few years before climbing to the mid-900,000s by 2019.

**Figure 13**  
**California Construction Employment Forecast (UCLA)**



Caltrans developed statewide and county-wide projections of employment. As shown in Figure 14, the California Construction Employment Forecast projects construction employment to decline sharply in the next two to three years and then begin to grow slowly, reaching 900,000 only in 2024.

**Figure 14**  
**California Construction Employment Forecast (Caltrans)**



While these two forecasts differ in their construction employment forecasts, both show construction employment to continue at 850,000-900,000 workers for some years. For transportation project labor needs, both forecasts show a continued large number of workers outside the HSB subsector who possess construction experience and skills.

## **IX. Recommendations to Ensure an Adequate Supply of Skilled Workers for Proposition 1B Projects**

Any estimate of supply is subject to the many unforeseen changes in the state economy that will inevitably arise each year (that is, the current sub-prime mortgage downturn and its impacts on employment). Further, as noted in Section II, this estimate of skilled construction workers does not address the increased competition for workers from projects connected with the other major infrastructure bonds. At the same time, transportation projects will need additional workers, so too will other infrastructure projects in California that received an influx of new funding because of the following bond measures passed by voters in November 2006:

- Proposition 1C: \$2.85 billion housing and emergency shelter bond (including funds for infrastructure related to new residential development).
- Proposition 1D: \$10.4 billion K-12/university facilities bond.
- Proposition 1E: \$4.09 billion flood-prevention bond.

The flood-prevention funding is concentrated in one geographic area of the state, but other funding will be distributed throughout the state. Additional funding for major infrastructure water supply and flood prevention is available through Proposition 84, the \$5.4 million “Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act.”

The construction workers outside the HSB subsector who are most likely to have the skills for transportation are those in the four subsectors grouped as Heavy and Civil Engineering. Yet, these are precisely the workers who are likely to have the skills to compete for the new jobs in these infrastructure sectors of flood prevention, school construction, and infrastructure related to residential development.

These dynamics of construction employment in California, as well as dynamics discussed in previous sections and the estimates, point to several proactive measures that may be taken to ensure an adequate supply of skilled workers for the Proposition 1B projects specifically and for transportation-related projects generally.

- A. By early 2008, distribute the supply-and-demand research undertaken by Caltrans to workforce stakeholders, such as the Associated General Contractors of California (AGC), the Engineering and Utility Contractors Association (EUCA), the Southern California Contractors Association (SCCA), the appropriate apprenticeship programs, the local Workforce Investment Boards (WIBs), and local community college and adult education programs. For a government agency, deciding on the number of workers to be trained is always a balance between wanting to meet anticipated increases in demand and not wanting to train too many workers and leave a portion unemployed after training. State government does not want to heighten expectations so much among training providers and apprenticeship programs that an excess in workers results. Yet, in the very near future, training providers and apprenticeship programs should be alerted to the supply-and-demand estimates to ensure they undertake additional training for new and incumbent workers, if the training is needed.

The first step is to distribute the supply-and-demand research that Caltrans has undertaken to the workforce stakeholders in each county. Chief among these stakeholders will be local employers and the main construction industry associations, particularly the AGC, the EUCA, and the SCCA. The employers will have the clearest vision in each of the state’s main areas of the job openings and labor shortages that might be expected and the changing impacts of the residential market downturn.

The apprenticeship programs are key stakeholders. Each of the five occupations studied in this report has strong, established apprenticeship programs, with training centers throughout the state and an ability to increase numbers of apprentices as demand justifies. These training centers also have the capacity to undertake targeted training for incumbent workers outside the HSB subsector who might need certain classes to make the transition into transportation projects.

Other key stakeholders are the WIBs, the 50 local entities throughout the state that administer the main part of the federal Workforce Investment Act (WIA) funds that come to California each year, the community college districts in California, the adult education programs in California, and the administrators of the Governor's Career Technical Education (CTE) Initiative.

Additionally, the methodology developed in this report might be shared with stakeholders interested in supply estimates for other construction subsectors. As noted, flood prevention, school construction, and infrastructure related to residential projects (particularly in urban areas) will all see an influx of new state and local funding.

- B. In early 2008, follow up the distribution of research with a meeting with the local WIB or combination of local WIBs in a region to develop training goals for the county and region. Soon after distributing the supply-and-demand research, a next step is to pull together the local stakeholders to develop training goals for the county and region. Separate training goals should be set for each of the five, and perhaps additional, occupations. The training goals might be set on a county or region-wide basis. In the East Bay, for example, the four WIBs—Alameda, Contra Costa, Richmond, and Oakland—have formed an association, East Bay Works, to undertake joint planning and select program administration.
- C. Build on the training programs, particularly the apprenticeship programs that already exist throughout the state and that possess additional training capacity, both for training new workers and for providing additional training to incumbent workers. A new training system is not needed in California; a well-functioning training system already exists in the state. The workforce challenge will be to build on the existing system. The primary element of this training is the apprenticeship programs, particularly the union-based apprenticeship programs that currently train around 90 percent of apprentices in most occupations. The system also includes pre-apprenticeship programs in literacy, math skills, and work orientation to prepare workers so they can succeed in the apprenticeship training.
- D. Identify public funds available to construction training programs and employers through the federal WIA, and develop a strategy to compete for these funds. The bulk of the more than \$400 million of WIA funds that come to California each year are administered by the local WIBs. The WIBs are uniformly looking to use training funds for the job fields in their areas that offer decent pay and benefits. Public sector construction jobs are high on the WIBs' lists of favored training opportunities, because they meet the pay-and-benefits criterion and are within the reach of Californians who do not possess college degrees. Accessing WIA funds will require WIB contacts on a county-by-county or region-by-region basis.

- E. Identify public funds available to construction training programs and employers through the Governor's CTE Initiative, along with the state's community college and adult education systems, and develop a strategy to compete for these funds. A further funding opportunity for construction training comes from Governor Schwarzenegger's CTE Initiative and its accompanying new funding. As the California Construction Education and Research Foundation has demonstrated, high schools represent a promising pool of potential workers for construction jobs, including the sizable segment of high school students who do not go on to college. The CTE Initiative provides funding for a variety of valued pre-apprenticeship skills.

Related to the pre-apprenticeship training through CTE is the pre-apprenticeship training available through the community college districts in California. Vocational education, aimed at job placements in decent-paying jobs, is one of the main mandates for these districts. Similarly, the state's adult education system provides resources for worker recruitment and pre-apprenticeship training. Accessing the community college and adult education resources will require a county-by-county effort, similar to the accessing of WIA funds.

In the course of the research for the estimates developed in this report, Caltrans made contacts with each of the stakeholders identified in the five workforce measures, the employers and employer associations, the WIBs, the community colleges, the adult education programs, and the CTE administrators. None was hesitant about the workforce efforts. All expressed strong interest in working together with Caltrans to ensure a skilled workforce to meet the demands of transportation projects on a timely basis and to maximize employment opportunities for unemployed and underemployed Californians.



# SKILLED CONSTRUCTION LABOR IN CALIFORNIA

## Estimating Workforce Availability

### Volume 2—County-Level Details

State of California  
Department of Transportation  
Division of Construction  
March 2008





# Contents

**The Importance of and Methodology for Estimating the Supply of Construction Workers on the County Level.....1**

**County-Level Estimates.....3**

- A. San Francisco Bay Area Region (Santa Clara, San Benito, San Francisco, San Mateo, Marin, Alameda, Contra Costa, Napa, Sonoma, and Solano Counties).....3
- B. Northern Counties Region (Butte, Colusa, Glenn, Lassen, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, and Trinity Counties) ..... 17
- C. Sacramento Region (El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba Counties)..... 19
- D. Mother Lode Region (Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, and Tuolumne Counties) .....21
- E. Central Valley Region (Fresno, Madera, Merced, Kern, Kings, San Joaquin, Stanislaus, and Tulare Counties) .....23
- F. North Coast Region (Del Norte, Humboldt, Lake, and Mendocino Counties) .....25
- G. Central Coast Region (Monterey, San Luis Obispo, Santa Cruz, and Santa Barbara Counties) .....27
- H. Inland Empire Region (Riverside and San Bernardino Counties).....29
- I. Los Angeles County.....31
- J. Ventura County .....33
- K. Orange County .....35
- L. San Diego and Imperial Counties .....37

## Figures and Tables

<b>Table 1</b>	<b>Projections of Skilled Workforce—Total Construction</b> .....	2
<b>Table 2</b>	<b>Projections of Skilled Workforce—HSB</b> .....	2
<b>Figure A</b>	<b>Map of San Francisco Bay Area Region</b> .....	<b>3</b>
Table A-1	Total Construction Employment by Occupation, San Francisco Bay Area Region .....	3
Table A-2	New Entering Apprentices—Total Construction, San Francisco Bay Area Region .....	4
Table A-3	Net Replacement Rate by Occupation, San Francisco Bay Area Region, 2004 .....	4
Table A-4	Projections of Skilled Workforce—Total Construction, San Francisco Bay Area Region .....	5
Table A-5	Projections of Skilled Workforce—HSB, San Francisco Bay Area Region .....	5
Table A-6	Total Construction Employment by Occupation, San Francisco Bay Area Region by County .....	6
Table A-7	New Entering Apprentices—Total Construction, San Benito and Santa Clara Counties .....	6
Table A-8	New Entering Apprentices—Total Construction, Marin, San Francisco, and San Mateo Counties .....	7
Table A-9	New Entering Apprentices—Total Construction, Alameda and Contra Costa Counties .....	7
Table A-10	New Entering Apprentices—Total Construction, Napa County .....	8
Table A-11	New Entering Apprentices—Total Construction, Solano County .....	9
Table A-12	New Entering Apprentices—Total Construction, Sonoma County .....	9
Table A-13	Net Replacements, 2004, San Francisco Bay Area Region by County .....	10
Table A-14	Projections of Skilled Workforce—Total Construction, San Benito and Santa Clara Counties .....	10
Table A-15	Projections of Skilled Workforce—Total Construction, Marin, San Francisco, and San Mateo Counties .....	11
Table A-16	Projections of Skilled Workforce—Total Construction, Alameda and Contra Costa Counties .....	11
Table A-17	Projections of Skilled Workforce—Total Construction, Napa County .....	12
Table A-18	Projections of Skilled Workforce—Total Construction, Solano County .....	12
Table A-19	Projections of Skilled Workforce—Total Construction, Sonoma County .....	13
Table A-20	Projections of Skilled Workforce—HSB, San Benito and Santa Clara Counties .....	13
Table A-21	Projections of Skilled Workforce—HSB, Marin, San Francisco, and San Mateo Counties .....	14
Table A-22	Projections of Skilled Workforce—HSB, Alameda and Contra Costa Counties .....	14
Table A-23	Projections of Skilled Workforce—HSB, Napa County .....	15
Table A-24	Projections of Skilled Workforce—HSB, Solano County .....	15
Table A-25	Projections of Skilled Workforce—HSB, Sonoma County .....	16
<b>Figure B</b>	<b>Map of Northern Counties Region</b> .....	<b>17</b>
Table B-1	New Entering Apprentices—Total Construction, Northern Counties .....	17
Table B-2	Total Construction Employment by Occupation, Northern Counties Region, 2002 .....	18
Table B-3	Net Replacement Rate by Occupation, Northern Counties Region, 2002 .....	18
Table B-4	Projections of Skilled Workforce—Total Construction, Northern Counties .....	18
Table B-5	Projections of Skilled Workforce—HSB, Northern Counties .....	18

<b>Figure C</b>	<b>Map of Sacramento Region</b> .....	19
Table C-1	New Entering Apprentices—Total Construction, Sacramento Region .....	19
Table C-2	Total Construction Employment by Occupation, Sacramento Region, 2004 .....	20
Table C-3	Net Replacement Rate by Occupation, Sacramento Region, 2004 .....	20
Table C-4	Projections of Skilled Workforce—Total Construction, Sacramento Region .....	20
Table C-5	Projections of Skilled Workforce—HSB, Sacramento Region .....	20
<b>Figure D</b>	<b>Map of Mother Lode Region</b> .....	21
Table D-1	New Entering Apprentices—Total Construction, Mother Lode Region .....	21
Table D-2	Total Construction Employment by Occupation, Mother Lode Region, 2002 .....	22
Table D-3	Net Replacement Rate by Occupation, Mother Lode Region, 2002 .....	22
Table D-4	Projections of Skilled Workforce—Total Construction, Mother Lode Region .....	22
Table D-5	Projections of Skilled Workforce—HSB, Mother Lode Region .....	22
<b>Figure E</b>	<b>Map of Central Valley Region</b> .....	23
Table E-1	New Entering Apprentices—Total Construction, Central Valley Region .....	23
Table E-2	Total Construction Employment by Occupation, Central Valley Region, 2004 .....	24
Table E-3	Net Replacement Rate by Occupation, Central Valley Region, 2004 .....	24
Table E-4	Projections of Skilled Workforce—Total Construction, Central Valley Region .....	24
Table E-5	Projections of Skilled Workforce—HSB, Central Valley Region .....	24
<b>Figure F</b>	<b>Map of North Coast Region</b> .....	25
Table F-1	New Entering Apprentices—Total Construction, North Coast Region .....	25
Table F-2	Total Construction Employment by Occupation, North Coast Region, 2004 .....	26
Table F-3	Net Replacement Rate by Occupation, North Coast Region, 2004 .....	26
Table F-4	Projections of Skilled Workforce—Total Construction, North Coast Region .....	26
Table F-5	Projections of Skilled Workforce—HSB, North Coast Region .....	26
<b>Figure G</b>	<b>Map of Central Coast Region</b> .....	27
Table G-1	New Entering Apprentices—Total Construction, Central Coast Region .....	27
Table G-2	Total Construction Employment by Occupation, Central Coast Region, 2004 .....	28
Table G-3	Net Replacement Rate by Occupation, Central Coast Region, 2004 .....	28
Table G-4	Projections of Skilled Workforce—Total Construction, Central Coast Region .....	28
Table G-5	Projections of Skilled Workforce—HSB, Central Coast Region .....	28
<b>Figure H</b>	<b>Map of Inland Empire</b> .....	29
Table H-1	New Entering Apprentices—Total Construction, Inland Empire .....	29
Table H-2	Total Construction Employment by Occupation, Inland Empire, 2004 .....	30
Table H-3	Net Replacement Rate by Occupation, Inland Empire, 2004 .....	30
Table H-4	Projections of Skilled Workforce—Total Construction, Inland Empire .....	30
Table H-5	Projections of Skilled Workforce—HSB, Inland Empire .....	30

**Figure I Map of Los Angeles County** .....31

Table I-1 New Entering Apprentices—Total Construction, Los Angeles County .....31

Table I-2 Total Construction Employment by Occupation, Los Angeles County, 2004.....32

Table I-3 Net Replacement Rate by Occupation, Los Angeles County, 2004.....32

Table I-4 Projections of Skilled Workforce—Total Construction, Los Angeles County .....32

Table I-5 Projections of Skilled Workforce—HSB, Los Angeles County .....32

**Figure J Map of Ventura County**.....33

Table J-1 New Entering Apprentices—Total Construction, Ventura County.....33

Table J-2 Total Construction Employment by Occupation, Ventura County, 2004 .....34

Table J-3 Net Replacement Rate by Occupation, Ventura County, 2004 .....34

Table J-4 Projections of Skilled Workforce—Total Construction, Ventura County .....34

Table J-5 Projections of Skilled Workforce—HSB, Ventura County.....34

**Figure K Map of Orange County** .....35

Table K-1 New Entering Apprentices—Total Construction, Orange County.....35

Table K-2 Total Construction Employment by Occupation, Orange County, 2004 .....36

Table K-3 Net Replacement Rate by Occupation, Orange County, 2004 .....36

Table K-4 Projections of Skilled Workforce—Total Construction, Orange County .....36

Table K-5 Projections of Skilled Workforce—HSB, Orange County.....36

**Figure L Map of San Diego and Imperial Counties**.....37

Table L-1 New Entering Apprentices—Total Construction, San Diego and Imperial Counties.....37

Table L-2 Total Construction Employment by Occupation, San Diego and Imperial Counties, 2004 .....38

Table L-3 Net Replacement Rate by Occupation, San Diego and Imperial Counties, 2004 .....38

Table L-4 Projections of Skilled Workforce—Total Construction, San Diego and Imperial Counties.....38

Table L-5 Projections of Skilled Workforce—HSB, San Diego and Imperial Counties.....38

## The Importance of and Methodology for Estimating the Supply of Construction Workers on the County Level

The statewide analysis in Volume 1 of this report is necessary as a starting point for Department of Transportation (Caltrans) supply estimates on the county level in California. In Volume 2, we estimate the supply of transportation-related construction workers among California counties for transportation-related projects for the years 2007-2016.

The county-level estimates are important because the main links with the public and private workforce programs will be made at this level. In California, construction workers move frequently among counties and regions as they take up new assignments. It is not unusual for a construction worker to have a project in, say, Alameda County, followed by a subsequent project in Contra Costa, Santa Clara, Solano, or farther east. Still, estimating the supply of skilled workers on the county or regional level provides the ability to best project the balance between supply and demand and the workforce actions needed to achieve this balance.

The formulas developed in Volume 1 for estimating the supply of skilled workers by certain occupations statewide are used to estimate county-level supplies. These formulas, which provide estimates of skilled workers for the Highway, Street, and Bridge (HSB) subsector and for total construction are re-stated below.

---


$$\text{Estimate of Skilled Workers in Construction} = \text{Current Employment Skilled Workers in Construction} + \text{New Entering Apprentices in Construction} - \text{Net Replacements in Construction}$$


---

---


$$\text{Estimate of Skilled Workers in HSB} = \text{Current Employment Skilled Workers in HSB} + \text{New Entering Apprentices in HSB} - \text{Net Replacements in HSB}$$


---

For the counties, the supply estimates for total construction skilled workforce use the state-level formula above. The supply estimates for the HSB subsector, though, require the use of the additional formula set forth below. Each term in this formula is subscripted by “i,” where “i” represents construction laborers, operating engineers, carpenters, cement masons, and ironworkers, individually.

---


$$\text{Estimate of County HSB}_i = \text{State HSB}_i * \frac{\text{County Total Construction}_i}{\text{State Total Construction}}$$


---

This additional formula is needed since the California Employment Development Department (EDD) does not maintain data on subsector employment on the county level. Employment numbers for operating engineers employed in HSB work, for example, do not exist. EDD maintains data on the total number of operating engineers in the county (or group of counties) but not of operating engineers in the subsector of HSB for the county. Thus, to develop estimates of skilled workers on a county level for transportation projects, this additional formula is applied starting with estimates of total construction skilled workforces in the county and using the state-level ratios between HSB employment and total construction employment developed in Volume 1.

As explained in Volume 1, the net replacement rate is calculated by EDD for each occupation to identify the net of skilled workers who are entering and exiting on a regular basis. The rate is defined by EDD as the net of (1) experienced workers who leave an occupation and start working in another occupation, stop working altogether, or leave the geographic area minus (2) experienced workers who move into such an opening. As the net replacement rate measures only “experienced” workers, it is helpful in identifying the skilled workforce necessary for transportation work. At the same time, this rate does not include new workers in formal apprenticeship programs, even though these workers bring skills to the jobsite from the time they start working. Thus, statistics regarding new entering apprentices statewide and in each county, compiled by the Department of Industrial Relations’ Division of Apprenticeship Standards (DIR), are added to the formula.

Tables 1 and 2 summarize the skilled workforce projections for construction and for HSB in 2008, according to the selected county groupings.

**Table 1**  
**Projections of Skilled Workforce—Total Construction**  
**By County Grouping, 2008**

<b>County Grouping</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
San Francisco Bay Area Region	28,566	7,182	54,301	5,680	1,028
Northern Counties	1,787	563	1,906	836	--
Sacramento	10,519	2,384	17,298	3,078	349
Mother Lode	992	426	1,284	256	--
Central Valley	13,029	2,727	16,014	4,303	--
North Coast	1,032	323	2,029	273	--
Central Region	4,766	1,396	7,973	1,049	--
Los Angeles	25,683	4,238	26,685	4,148	1,553
Ventura	3,320	1,166	3,492	569	--
Orange	12,461	2,581	21,150	2,959	888
San Diego/Imperial	14,090	3,955	22,337	2,709	--
Inland Empire	22,483	4,441	31,958	5,805	1,921
<i>California</i>	<i>138,729</i>	<i>31,382</i>	<i>206,428</i>	<i>31,665</i>	<i>5,740</i>

Sources: DIR, EDD, Milken Institute

**Table 2**  
**Projections of Skilled Workforce—HSB**  
**By County Grouping, 2008**

<b>County Grouping</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
San Francisco Bay Area Region	1,745	1,179	562	300	94
Northern Counties	109	92	20	44	--
Sacramento	642	391	179	163	32
Mother Lode	61	70	13	14	--
Central Valley	796	448	166	227	
North Coast	63	53	21	14	--
Central Region	291	229	83	55	--
Los Angeles	1,569	696	276	219	142
Ventura	203	191	36	30	--
Orange	761	424	219	156	81
San Diego/Imperial	861	649	231	143	--
Inland Empire	1,373	729	331	307	176
<i>California</i>	<i>8,472</i>	<i>5,150</i>	<i>2,136</i>	<i>1,672</i>	<i>525</i>

Sources: DIR, EDD, Milken Institute

### County-Level Estimates

#### A. San Francisco Bay Area Regions (Santa Clara, San Benito, San Francisco, San Mateo, Marin, Alameda, Contra Costa, Napa, Sonoma, and Solano Counties)

**Figure A**  
**Map of San Francisco Bay Area Region**



On the county level in California, EDD groups counties together often as single labor markets. The following are EDD groupings for the Bay Area counties followed in this analysis: San Benito/Santa Clara, San Francisco/San Mateo/Marin, Alameda/Contra Costa, Napa, Sonoma, and Solano.

The 2004 total construction employment of the five transportation-related occupations under study in these Bay Area counties is shown in Figure A-1.

**Table A-1**  
**Total Construction Employment by Occupation**  
**San Francisco Bay Area Region, 2004**

Occupation	Number
Construction Laborers	28,071
Operating Engineers	6,969
Carpenters	52,145
Cement Masons	5,423
Ironworkers	933*

Source: EDD

\*EDD does not provide estimates on San Francisco, Marin, San Mateo, and Solano Counties

Added to the current supply of skilled workers is the number of new entering apprentices. DIR maintains data on new entering apprentices by occupation and on the county level. A historical seven-year (2000-2006) average growth of occupation shares was derived and used to forecast the county supply of new apprentices in each field. This growth rate was applied to the 2006 historical data to forecast the 2007 apprentice numbers for the specific construction occupations. This methodology is carried forward in obtaining apprentice numbers throughout the remainder of the projection period. This approach resulted in the smoothest, yet mostly conservative, estimation numbers possible, based on the DIR historical data available. Counties characterized by large apprentice numbers in each of the different occupations and with smooth growth rates in the historical period had the most reliable new apprentice projections for 2007-2016. Table A-2 contains the annual numbers for entering construction apprentices for EDD-defined county regions from 2000 to 2016.

**Table A-2  
New Entering Apprentices—Total Construction  
San Francisco Bay Area Region**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	11	167	1,047	69	556
2001	23	160	984	75	550
2002	39	133	788	52	168
2003	115	131	847	66	297
2004	116	102	1,124	70	228
2005	131	182	1,133	111	253
2006	196	150	1,338	125	374
2007*	303	145	1,278	126	--
2008*	307	147	1,292	128	--
2009*	310	149	1,307	130	--
2010*	314	151	1,322	132	--
2011*	317	153	1,337	133	--
2012*	321	155	1,353	135	--
2013*	325	157	1,369	137	--
2014*	329	159	1,385	139	--
2015*	333	161	1,401	141	--
2016*	337	164	1,418	143	--

Sources: DIR, Milken Institute

\* indicates projection

Note: In 2000-2003 and 2005-2006, the share of apprentice laborers experienced strong growth. Most apprentice programs, excluding laborers, experienced a drop in levels in 2002, largely stemming from the county historical apprentice numbers. Historically, the number of entering apprentice laborers has exhibited erratic growth over the averaging period, which, in turn, serves as the underlying cause of the aggressiveness between the last year of history (2006) and first year of projection (2007) for apprentice laborers.

Average annual net replacements rates between 2004 and 2014 at the county level are provided by EDD. The 2004 fraction of net replacement to occupation employment is held constant throughout the last year of our projections. The net replacement rates for the Bay Area region are listed in Table A-3.

**Table A-3  
Net Replacement Rate by Occupation  
San Francisco Bay Area Region, 2004**

<b>Occupation</b>	<b>Net Replacements</b>	<b>Rate</b>
Construction Laborers	375	1.3%
Operating Engineers	177	2.6%
Carpenters	833	1.6%
Cement Masons	108	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\* Not Announced by EDD

The methodology uses county-level panel data on each of the five specific occupations. The average annual net job replacement from EDD varied according to the 2004 fixed employment share of net replacements to total occupation employment. When subtracted from our current labor stock and new apprentice numbers, the annual net job replacement summed up to the estimated county labor supply. This methodology is carried forward in obtaining net replacement numbers throughout the remainder of the projection period.

**Table A-4**  
**Projections of Skilled Workforce—Total Construction**  
**San Francisco Bay Area Region**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	28,071	6,969	52,145	5,423	933
2006	28,241	7,018	53,003	5,516	1,017
2007	28,454	7,096	53,609	5,597	1,013
2008	28,566	7,182	54,301	5,680	1,028
2009	28,680	7,269	55,006	5,764	1,044
2010	28,795	7,357	55,725	5,849	1,061
2011	28,912	7,447	56,457	5,937	1,077
2012	29,031	7,537	57,202	6,025	1,094
2013	29,152	7,629	57,962	6,115	1,111
2014	29,274	7,723	58,736	6,207	1,128
2015	29,399	7,817	59,525	6,300	1,146
2016	29,525	7,913	60,330	6,394	1,164

Sources: DIR, EDD, Milken Institute

Once the estimates of skilled construction workers over all subsectors on the county level are arrived at, numbers of skilled construction workers for transportation projects can be estimated. The methodology uses the ratio of skilled workers in HSB to total construction employment to achieve estimates of the HSB skilled workforce on the county level, as shown in Table A-5.

**Table A-5**  
**Projections of Skilled Workforce—HSB**  
**San Francisco Bay Area Region**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	1,684	1,143	544	288	85
2006	1,695	1,151	583	293	96
2007	1,737	1,165	555	296	93
2008	1,745	1,179	562	300	94
2009	1,752	1,193	569	304	95
2010	1,759	1,207	576	309	97
2011	1,767	1,222	583	313	98
2012	1,775	1,237	590	318	100
2013	1,782	1,252	597	323	101
2014	1,790	1,267	604	327	103
2015	1,798	1,283	612	332	105
2016	1,807	1,299	619	337	106

Sources: DIR, EDD, Milken Institute

**County Breakdowns**

**Table A-6  
Total Construction Employment by Occupation  
San Francisco Bay Area Region by County**

<b>Occupation</b>	<b>San Benito/ Santa Clara</b>	<b>San Francisco/ San Mateo/ Marin</b>	<b>Alameda/ Contra Costa</b>	<b>Napa*</b>	<b>Solano</b>	<b>Sonoma</b>	<b>Total</b>
Construction Laborers	6,382	5,493	12,002	536	1,869	1,790	
Operating Engineers	1,127	1,098	3,276	290	446	730	6,969
Carpenters	6,916	17,752	18,398	1,084	4,349	3,645	
Cement Masons	967	810	2,513	92	412	629	5,423
Ironworkers	134	NA**	724	NA**	NA**	76	933

Sources: EDD, Milken Institute

\* Based on 2002 data

\*\* Not Announced by EDD

**Table A-7  
New Entering Apprentices—Total Construction  
San Benito and Santa Clara Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	1	24	224	23	54
2001	3	28	174	25	95
2002	4	21	172	24	21
2003	22	11	192	23	31
2004	11	17	227	30	36
2005	19	26	223	44	23
2006	18	29	272	48	62
2007*	30	29	259	49	67
2008*	31	29	262	50	67
2009*	31	29	265	50	68
2010*	31	30	268	51	69
2011*	32	30	271	51	70
2012*	32	30	275	52	71
2013*	32	31	278	53	71
2014*	33	31	281	53	72
2015*	33	31	284	54	73
2016*	34	32	288	54	74

Sources: DIR, Milken Institute

\* indicates projection

**Table A-8**  
**New Entering Apprentices—Total Construction**  
**Marin, San Francisco, and San Mateo Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	2	50	243	13	86
2001	0	41	244	12	70
2002	8	34	191	6	31
2003	12	32	237	12	46
2004	13	14	284	5	41
2005	20	52	294	11	26
2006	12	16	318	8	48
2007*	12	17	318	8	--
2008*	12	17	318	8	--
2009*	12	17	319	8	--
2010*	12	17	320	8	--
2011*	12	18	320	8	--
2012*	12	18	321	8	--
2013*	12	18	322	8	--
2014*	12	18	322	8	--
2015*	12	18	323	8	--
2016*	12	18	324	8	--

Sources: DIR, Milken Institute

\* indicates projection

**Table A-9**  
**New Entering Apprentices—Total Construction**  
**Alameda and Contra Costa Counties**

<b>Year</b>	<b>Construction Laborers**</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	6	62	421	25	279
2001	20	59	379	24	264
2002	23	51	282	16	72
2003	65	54	281	21	147
2004	57	43	417	16	100
2005	64	65	412	37	156
2006	127	65	480	38	180
2007*	208	59	435	38	159
2008*	210	60	440	38	160
2009*	212	60	444	38	162
2010*	214	61	448	39	164
2011*	217	61	453	39	165
2012*	219	62	457	40	167
2013*	221	63	462	40	169
2014*	223	63	467	40	170
2015*	225	64	471	41	172
2016*	228	65	476	41	174

Sources: DIR, Milken Institute

\* indicates projection

\*\* see next page

\*\* Note: In 2000-2004 as well as 2005-2006, the share of apprentice laborers experienced strong growth. Every apprentice program, excluding construction laborers, experienced a drop in levels in 2002, largely stemming from the historical apprentice numbers in the county, provided by Department of Industrial Relations. Historically, new entering apprentice laborers have exhibited erratic growth over the years the underlying cause of the aggressiveness between the last year of history (2006) and first year of projection (2007) for apprentice laborers.

**Table A-10**  
**New Entering Apprentices—Total Construction**  
**Napa County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	0	1	8	0	19
2001	0	2	6	0	21
2002	2	2	6	0	5
2003	1	1	5	0	3
2004	1	0	13	4	2
2005	6	2	12	0	5
2006	4	4	18	1	8
2007*	4	4	18	1	8
2008*	4	4	19	1	8
2009*	4	4	19	1	8
2010*	4	4	19	1	8
2011*	5	4	19	1	9
2012*	5	4	20	1	9
2013*	5	4	20	1	9
2014*	5	5	20	1	9
2015*	5	5	21	1	9
2016*	5	5	21	1	9

Sources: DIR, Milken Institute

\* indicates projection

**Table A-11**  
**New Entering Apprentices—Total Construction**  
**Solano County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	1	16	75	4	102
2001	0	17	90	11	79
2002	2	16	92	6	30
2003	13	22	77	5	56
2004	24	18	109	10	42
2005	19	20	126	9	37
2006	20	25	168	20	62
2007*	22	26	173	21	63
2008*	22	26	178	22	65
2009*	23	27	183	22	67
2010*	24	28	189	23	69
2011*	24	29	195	24	71
2012*	25	30	201	25	73
2013*	26	31	207	25	75
2014*	27	31	213	26	77
2015*	28	32	219	27	80
2016*	28	33	226	28	82

Sources: DIR, Milken Institute

\* indicates projection

**Table A-12**  
**New Entering Apprentices—Total Construction**  
**Sonoma County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	1	14	76	4	16
2001	0	13	91	3	21
2002	0	9	45	0	9
2003	2	11	55	5	14
2004	10	10	74	5	7
2005	3	17	66	10	6
2006	15	11	82	10	14
2007*	27	10	74	10	13
2008*	27	10	75	10	13
2009*	27	10	76	10	13
2010*	28	11	77	10	14
2011*	28	11	78	10	14
2012*	28	11	80	10	14
2013*	29	11	81	10	14
2014*	29	11	82	10	14
2015*	29	11	83	11	15
2016*	30	11	84	11	15

Sources: DIR, Milken Institute

\* indicates projection

**Table A-13  
Net Replacements, 2004  
San Francisco Bay Area Region by County**

<b>Occupation</b>	<b>San Benito/ Santa Clara</b>	<b>San Francisco/ San Mateo/ Marin</b>	<b>Alameda/ Contra Costa</b>	<b>Napa*</b>	<b>Solano</b>	<b>Sonoma</b>
Construction Laborers	85	74	161	7	24	24
Operating Engineers	28	28	84	7	11	19
Carpenters	109	288	293	17	68	58
Cement Masons	19	16	50	2	8	13
Ironworkers	2	NA**	11	NA**	NA**	1

Source: EDD

\* Based on 2002 data

\*\* Not Announced by EDD

**Table A-14  
Projections of Skilled Workforce—Total Construction  
San Benito and Santa Clara Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	6,382	1,127	6,916	967	134
2006	6,419	1,150	7,068	982	175
2007	6,469	1,170	7,161	995	183
2008	6,508	1,191	7,271	1,008	187
2009	6,547	1,212	7,382	1,021	190
2010	6,586	1,234	7,495	1,033	194
2011	6,625	1,256	7,610	1,047	198
2012	6,665	1,279	7,727	1,060	202
2013	6,705	1,301	7,845	1,073	206
2014	6,745	1,325	7,965	1,087	210
2015	6,785	1,348	8,088	1,101	214
2016	6,826	1,372	8,212	1,114	219

Sources: DIR, EDD, Milken Institute

**Table A-15**  
**Projections of Skilled Workforce—Total Construction**  
**Marin , San Francisco, and San Mateo Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	5,493	1,098	17,752	810	--
2006	5,461	1,067	17,843	813	--
2007	5,438	1,073	17,909	818	--
2008	5,415	1,077	17,977	824	--
2009	5,393	1,082	18,044	829	--
2010	5,370	1,086	18,113	835	--
2011	5,347	1,091	18,181	840	--
2012	5,324	1,095	18,250	846	--
2013	5,302	1,100	18,319	852	--
2014	5,280	1,105	18,388	857	--
2015	5,257	1,109	18,457	863	--
2016	5,235	1,114	18,527	869	--

Sources: DIR, EDD, Milken Institute

**Table A-16**  
**Projections of Skilled Workforce—Total Construction**  
**Alameda and Contra Costa Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	12,002	3,276	18,398	2,513	724
2006	12,093	3,312	18,718	2,550	757
2007	12,203	3,342	18,929	2,586	745
2008	12,234	3,380	19,192	2,624	756
2009	12,265	3,417	19,459	2,662	767
2010	12,297	3,455	19,730	2,701	778
2011	12,328	3,494	20,005	2,740	790
2012	12,359	3,533	20,284	2,780	801
2013	12,391	3,572	20,566	2,820	813
2014	12,422	3,612	20,853	2,861	825
2015	12,454	3,652	21,143	2,903	837
2016	12,486	3,693	21,438	2,945	850

Sources: DIR, EDD, Milken Institute

**Table A-17**  
**Projections of Skilled Workforce—Total Construction**  
**Napa County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	536	290	1,084	92	-
2006	539	294	1,108	95	-
2007	546	295	1,125	96	-
2008	551	297	1,143	98	-
2009	557	299	1,161	100	-
2010	563	301	1,180	101	-
2011	570	303	1,198	103	-
2012	576	304	1,217	105	-
2013	582	306	1,237	106	-
2014	588	308	1,256	108	-
2015	595	310	1,276	110	-
2016	601	312	1,296	112	-

Sources: DIR, EDD, Milken Institute

**Table A-18**  
**Projections of Skilled Workforce—Total Construction**  
**Solano County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	1,869	446	4,349	412	--
2006	1,915	458	4,537	434	--
2007	1,963	466	4,693	446	--
2008	2,011	474	4,855	458	--
2009	2,060	483	5,022	471	--
2010	2,110	491	5,195	484	--
2011	2,162	500	5,374	497	--
2012	2,214	509	5,560	511	--
2013	2,268	518	5,751	525	--
2014	2,324	527	5,949	539	--
2015	2,381	536	6,154	554	--
2016	2,439	546	6,366	569	--

Sources: DIR, EDD, Milken Institute

**Table A-19**  
**Projections of Skilled Workforce—Total Construction**  
**Sonoma County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	1,790	730	3,645	629	76
2006	1,813	737	3,729	642	85
2007	1,835	749	3,792	655	85
2008	1,846	762	3,864	668	86
2009	1,858	776	3,937	682	87
2010	1,869	789	4,012	696	88
2011	1,881	803	4,088	710	89
2012	1,892	817	4,165	724	90
2013	1,904	832	4,244	739	92
2014	1,916	846	4,325	754	93
2015	1,928	861	4,407	770	94
2016	1,939	876	4,491	785	95

Sources: DIR, EDD, Milken Institute

**Table A-20**  
**Projections of Skilled Workforce—HSB**  
**San Benito and Santa Clara Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	383	185	72	51	12
2006	385	189	78	52	16
2007	395	192	74	53	17
2008	397	195	75	53	17
2009	400	199	76	54	17
2010	402	203	77	55	18
2011	405	206	79	55	18
2012	407	210	80	56	18
2013	410	214	81	57	19
2014	413	217	82	57	19
2015	415	221	83	58	20
2016	418	225	84	59	20

Sources: DIR, EDD, Milken Institute

**Table A-21**  
**Projections of Skilled Workforce—HSB**  
**San Francisco, San Mateo, and Marin Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	329	180	185	43	--
2006	328	175	196	43	--
2007	332	176	186	43	--
2008	331	177	186	43	--
2009	329	178	187	44	--
2010	328	178	187	44	--
2011	327	179	188	44	--
2012	325	180	188	45	--
2013	324	181	189	45	--
2014	323	181	189	45	--
2015	322	182	190	46	--
2016	320	183	190	46	--

Sources: DIR, EDD, Milken Institute

**Table A-22**  
**Projections of Skilled Workforce—HSB**  
**Alameda and Contra Costa Counties**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	720	537	192	133	66
2006	726	543	206	136	71
2007	745	549	196	137	68
2008	747	555	199	139	69
2009	749	561	201	141	70
2010	751	567	204	143	71
2011	753	573	206	145	72
2012	756	580	209	147	73
2013	758	586	212	149	74
2014	760	593	215	151	75
2015	762	599	217	153	76
2016	764	606	220	155	78

Sources: DIR, EDD, Milken Institute

**Table A-23**  
**Projections of Skilled Workforce—HSB**  
**Napa County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	32	48	11	5	--
2006	32	48	12	5	--
2007	33	48	12	5	--
2008	34	49	12	5	--
2009	34	49	12	5	--
2010	34	49	12	5	--
2011	35	50	12	5	--
2012	35	50	13	6	--
2013	36	50	13	6	--
2014	36	51	13	6	--
2015	36	51	13	6	--
2016	37	51	13	6	--

Sources: DIR, EDD, Milken Institute

**Table A-24**  
**Projections of Skilled Workforce—HSB**  
**Solano County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	112	73	45	22	--
2006	115	75	50	23	--
2007	120	77	49	24	--
2008	123	78	50	24	--
2009	126	79	52	25	--
2010	129	81	54	26	--
2011	132	82	55	26	--
2012	135	84	57	27	--
2013	139	85	59	28	--
2014	142	86	61	28	--
2015	146	88	63	29	--
2016	149	90	65	30	--

Sources: DIR, EDD, Milken Institute

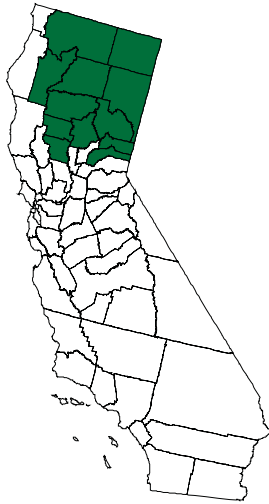
**Table A-25**  
**Projections of Skilled Workforce—HSB**  
**Sonoma County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2005	107	120	38	33	7
2006	109	121	41	34	8
2007	112	123	39	35	8
2008	113	125	40	35	8
2009	113	127	41	36	8
2010	114	130	41	37	8
2011	115	132	42	37	8
2012	116	134	43	38	8
2013	116	137	44	39	8
2014	117	139	44	40	8
2015	118	141	45	41	9
2016	119	144	46	41	9

Sources: DIR, EDD, Milken Institute

**B. Northern Counties Region (Butte, Colusa, Glenn, Lassen, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, and Trinity Counties)**

**Figure B**  
**Map of Northern Counties Region**



The 12 counties in the northernmost section of California are grouped together by EDD. Total employment among these counties in 2002 totaled 94,250 workers and is projected by EDD to grow over the next decade at a rate of 13.5 percent to 106,980 workers. Construction employment in the 12 counties totaled 5,510 in 2002 and is projected by EDD to grow to 6,880 by 2012.

The most recent EDD data on total construction employment of the five transportation related occupations is set forth below:

**Table B-1**  
**New Entering Apprentices—Total Construction**  
**Northern Counties**

Year	Construction Laborers	Operating Engineer	Carpenters	Cement Masons	Ironworkers
2000	10	2	0	9	13
2001	31	6	1	5	16
2002	15	3	6	5	8
2003	16	3	1	1	18
2004	19	3	1	5	7
2005	13	0	3	9	8
2006	18	4	1	9	3
2007*	20	3	2	8	3
2008*	20	4	2	8	3
2009*	20	4	2	8	3
2010*	21	4	2	9	3
2011*	21	4	2	9	3
2012*	21	4	2	9	3
2013*	22	4	2	9	3
2014*	22	4	2	9	3
2015*	22	4	2	9	3
2016*	23	4	2	9	3

Sources: DIR, Milken Institute

\* indicates projection

**Table B-2**  
**Total Construction Employment by Occupation**  
**Northern Counties Region, 2002**

Occupation	Number
Construction Laborers	1,660
Operating Engineers	520
Carpenters	1,710
Cement Masons	740
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table B-3**  
**Net Replacement Rate by Occupation**  
**Northern Counties Region, 2002**

Occupation	Net Replacements	Rate
Construction Laborers	22	1.3%
Operating Engineers	13	2.5%
Carpenters	27	1.6%
Cement Masons	15	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table B-4**  
**Projections of Skilled Workforce—Total Construction**  
**Northern Counties**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	1,703	536	1,784	760	--
2006	1,729	545	1,826	788	--
2007	1,758	553	1,866	811	--
2008	1,787	563	1,906	836	--
2009	1,817	573	1,947	862	--
2010	1,847	583	1,988	888	--
2011	1,878	593	2,030	915	--
2012	1,909	604	2,074	943	--
2013	1,940	615	2,118	972	--
2014	1,972	626	2,163	1,002	--
2015	2,005	637	2,209	1,033	--
2016	2,038	648	2,256	1,064	--

Sources: DIR, EDD, Milken Institute

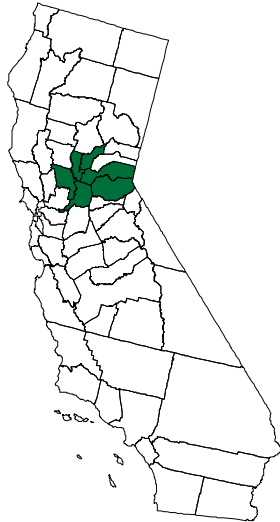
**Table B-5**  
**Projections of Skilled Workforce—HSB**  
**Northern Counties**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	102	88	19	40	--
2006	104	89	20	42	--
2007	107	91	19	43	--
2008	109	92	20	44	--
2009	111	94	20	45	--
2010	113	96	21	47	--
2011	115	97	21	48	--
2012	117	99	21	50	--
2013	119	101	22	51	--
2014	121	103	22	53	--
2015	123	105	23	54	--
2016	125	106	23	56	--

Sources: DIR, Milken Institute

**C. Sacramento Region (El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba Counties)**

**Figure C**  
**Map of Sacramento Region**



The counties in the Sacramento region are grouped together by EDD as a single labor market for employment calculations. Total employment in the Sacramento region stood at 947,100 in 2004 and is projected by EDD to grow by 20.7 percent by 2014 to 1,142,900. Construction employment stood at 76,110 in 2004 and is projected to grow to 90,340 by 2014.

**Table C-1**  
**New Entering Apprentices—Total Construction**  
**Sacramento Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	6	44	146	17	130
2001	9	53	204	16	122
2002	14	47	143	21	44
2003	37	45	177	21	95
2004	49	52	217	25	91
2005	50	49	184	34	131
2006	64	73	197	36	92
2007*	99	72	179	39	78
2008*	100	73	181	40	79
2009*	102	74	184	40	80
2010*	103	75	186	41	81
2011*	104	76	189	41	83
2012*	106	77	191	42	84
2013*	107	78	194	43	85
2014*	109	79	196	43	86
2015*	110	80	199	44	87
2016*	112	81	201	44	88

Sources: DIR, Milken Institute

\* indicates projection

**Table C-2**  
**Total Construction Employment by Occupation**  
**Sacramento Region, 2004**

Occupation	Number
Construction Laborers	10,220
Operating Engineers	2,180
Carpenters	16,170
Cement Masons	2,880
Ironworkers	260

Source: EDD

**Table C-3**  
**Net Replacement Rate by Occupation**  
**Sacramento Region, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	136	1.3%
Operating Engineers	56	2.6%
Carpenters	263	1.6%
Cement Masons	58	2.0%
Ironworkers	5	1.9%

Sources: EDD, Milken Institute

**Table C-4**  
**Projections of Skilled Workforce—Total Construction**  
**Sacramento Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	10,217	2,218	16,385	2,909	390
2006	10,314	2,288	16,698	2,964	354
2007	10,433	2,335	16,985	3,022	344
2008	10,519	2,384	17,298	3,078	349
2009	10,605	2,434	17,617	3,135	354
2010	10,693	2,485	17,942	3,193	359
2011	10,781	2,537	18,273	3,253	364
2012	10,869	2,590	18,610	3,313	369
2013	10,959	2,645	18,953	3,374	374
2014	11,049	2,701	19,303	3,437	379
2015	11,140	2,757	19,659	3,501	384
2016	11,232	2,815	20,021	3,566	389

Sources: DIR, EDD, Milken Institute

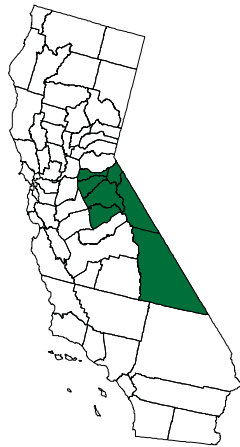
**Table C-5**  
**Projections of Skilled Workforce—HSB**  
**Sacramento Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	613	364	171	154	35
2006	619	375	184	158	33
2007	637	383	176	160	31
2008	642	391	179	163	32
2009	648	399	182	166	32
2010	653	408	185	169	33
2011	659	416	189	172	33
2012	664	425	192	175	34
2013	670	434	195	178	34
2014	676	443	199	181	35
2015	681	453	202	185	35
2016	687	462	206	188	36

Sources: DIR, EDD, Milken Institute

**D. Mother Lode Region (Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, and Tuolumne Counties)**

**Figure D  
Map of Mother Lode Region**



The Mother Lode Region consists of seven counties, whose total employment in 2002 was 58,340 and is projected by EDD to grow by 15.4 percent to 67,300 in 2012. Construction employment among the seven counties totaled 3,110 in 2002 and is projected by EDD to grow by 31% to 4,100 in 2012.

**Table D-1  
New Entering Apprentices—Total Construction  
Mother Lode Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	0	2	6	0	3
2001	1	1	5	0	1
2002	0	7	11	1	1
2003	3	5	14	0	1
2004	2	3	10	1	2
2005	2	2	7	0	2
2006	7	3	13	0	5
2007*	7	3	13	0	6
2008*	7	3	13	0	6
2009*	7	3	13	0	6
2010*	7	4	14	0	6
2011*	7	4	14	0	6
2012*	7	4	14	0	6
2013*	8	4	14	0	7
2014*	8	4	15	0	7
2015*	8	4	15	0	7
2016*	8	4	15	0	7

Sources: DIR, Milken Institute

\* indicates projection

**Table D-2**  
**Total Construction Employment by Occupation**  
**Mother Lode Region, 2002**

Occupation	Number
Construction Laborers	620
Operating Engineers	290
Carpenters	620
Cement Masons	70
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table D-3**  
**Net Replacement Rate by Occupation**  
**Mother Lode Region, 2002**

Occupation	Net Replacements	Rate
Construction Laborers	8	1.3%
Operating Engineers	8	2.8%
Carpenters	10	1.6%
Cement Masons	1	1.4%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table D-4**  
**Projections of Skilled Workforce—Total Construction**  
**Mother Lode Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	932	408	1,196	235	--
2006	955	415	1,229	242	--
2007	973	421	1,256	249	--
2008	992	426	1,284	256	--
2009	1,011	432	1,313	264	--
2010	1,031	438	1,342	271	--
2011	1,051	444	1,373	279	--
2012	1,072	450	1,404	287	--
2013	1,092	456	1,435	296	--
2014	1,114	463	1,467	304	--
2015	1,135	469	1,501	313	--
2016	1,157	475	1,534	322	--

Sources: DIR, EDD, Milken Institute

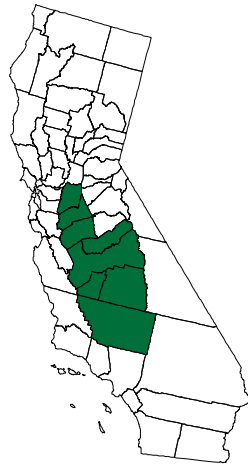
**Table D-5**  
**Projections of Skilled Workforce—HSB**  
**Mother Lode Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	56	67	12	12	--
2006	57	68	14	13	--
2007	59	69	13	13	--
2008	61	70	13	14	--
2009	62	71	14	14	--
2010	63	72	14	14	--
2011	64	73	14	15	--
2012	66	74	14	15	--
2013	67	75	15	16	--
2014	68	76	15	16	--
2015	69	77	15	17	--
2016	71	78	16	17	--

Sources: DIR, EDD, Milken Institute

**E. Central Valley Region (Fresno, Madera, Merced, Kern, Kings, San Joaquin, Stanislaus, and Tulare Counties)**

**Figure E  
Map of Central Valley Region**



The Central Valley Region includes the counties of Fresno, Madera, Merced, Kern, Kings, San Joaquin, Stanislaus, and Tulare. Fresno has the largest total labor force at 363,900 workers in 2004, followed by Kern at 270,800 workers and San Joaquin at 235,600 workers. Combined, the eight counties had a labor force of approximately 1,220,000 in 2004. Total construction employment stood at 22,180 in Fresno County in 2004, 15,400 in Kern County, 15,300 in San Joaquin County, and approximately 72,280 for the eight counties combined.

**Table E-1  
New Entering Apprentices—Total Construction  
Central Valley Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	26	35	202	40	184
2001	35	58	422	55	192
2002	49	55	355	34	77
2003	53	44	337	50	128
2004	75	62	340	61	87
2005	102	72	420	98	102
2006	107	74	427	64	113
2007*	122	84	427	62	104
2008*	124	86	435	63	106
2009*	127	87	443	64	108
2010*	129	89	451	66	110
2011*	132	91	460	67	112
2012*	134	93	468	68	114
2013*	137	94	477	69	116
2014*	140	96	486	70	118
2015*	142	98	495	71	120
2016*	145	100	504	73	122

Sources: DIR, Milken Institute

\* indicates projection

**Table E-2**  
**Total Construction Employment by Occupation**  
**Central Valley Region, 2004**

Occupation	Number
Construction Laborers	12,260
Operating Engineers	2,610
Carpenters	14,440
Cement Masons	3,920
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table E-3**  
**Net Replacement Rate by Occupation**  
**Central Valley Region, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	165	1.3%
Operating Engineers	67	2.6%
Carpenters	235	1.6%
Cement Masons	80	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table E-4**  
**Projections of Skilled Workforce—Total Construction**  
**Central Valley Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	12,294	2,519	14,800	3,967	--
2006	12,532	2,584	15,201	4,049	--
2007	12,784	2,659	15,597	4,174	--
2008	13,029	2,727	16,014	4,303	--
2009	13,281	2,797	16,444	4,437	--
2010	13,539	2,869	16,886	4,575	--
2011	13,804	2,943	17,341	4,717	--
2012	14,075	3,018	17,809	4,865	--
2013	14,353	3,096	18,290	5,017	--
2014	14,638	3,177	18,785	5,174	--
2015	14,931	3,259	19,295	5,336	--
2016	15,231	3,344	19,819	5,503	--

Sources: DIR, EDD, Milken Institute

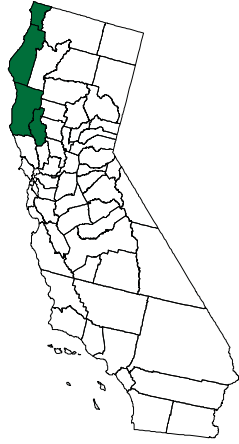
**Table E-5**  
**Projections of Skilled Workforce—HSB**  
**Central Valley Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	737	413	154	210	--
2006	752	424	167	215	--
2007	781	436	162	220	--
2008	796	448	166	227	--
2009	811	459	170	234	--
2010	827	471	174	241	--
2011	844	483	179	249	--
2012	860	495	184	257	--
2013	878	508	188	265	--
2014	895	521	193	273	--
2015	913	535	198	281	--
2016	932	549	203	290	--

Sources: DIR, EDD, Milken Institute

## F. North Coast Region (Del Norte, Humboldt, Lake, and Mendocino Counties)

**Figure F**  
**Map of North Coast Region**



The North Coast Region comprises the four counties of Del Norte, Humboldt, Lake, and Mendocino. Total employment among these counties stood at 124,130 in 2004 and is projected by EDD to grow to 136,340, an increase of 9.8 percent. Construction employment stood at 7,160 in 2004 and is projected to reach 8,400 in 2014, an increase of 17.4 percent.

**Table F-1**  
**New Entering Apprentices—Total Construction**  
**North Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	2	4	26	6	5
2001	1	8	18	8	4
2002	1	6	36	8	1
2003	0	8	19	7	2
2004	2	5	28	4	2
2005	1	10	22	4	3
2006	0	8	16	6	5
2007*	0	13	9	6	8
2008*	0	13	9	6	8
2009*	0	13	10	6	8
2010*	0	13	10	6	8
2011*	0	13	10	6	9
2012*	0	14	10	6	9
2013*	0	14	10	6	9
2014*	0	14	10	6	9
2015*	0	14	10	6	9
2016*	0	14	10	6	9

Sources: DIR, Milken Institute

\* indicates projection

**Table F-2**  
**Total Construction Employment by Occupation**  
**North Coast Region, 2004**

Occupation	Number
Construction Laborers	1,010
Operating Engineers	300
Carpenters	1,910
Cement Masons	250
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table F-3**  
**Net Replacement Rate by Occupation**  
**North Coast Region, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	14	1.4%
Operating Engineers	8	2.7%
Carpenters	31	1.6%
Cement Masons	5	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table F-4**  
**Projections of Skilled Workforce—Total Construction**  
**North Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	1,006	306	1,928	254	--
2006	1,014	309	1,959	262	--
2007	1,023	318	1,990	267	--
2008	1,032	323	2,029	273	--
2009	1,042	328	2,069	279	--
2010	1,051	333	2,110	285	--
2011	1,060	338	2,151	291	--
2012	1,070	343	2,193	297	--
2013	1,080	348	2,236	304	--
2014	1,089	353	2,280	310	--
2015	1,099	359	2,325	317	--
2016	1,109	364	2,370	324	--

Sources: DIR, EDD, Milken Institute

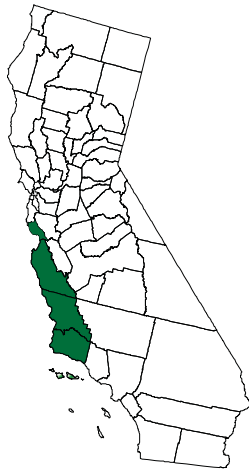
**Table F-5**  
**Projections of Skilled Workforce—HSB**  
**North Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	60	50	20	13	--
2006	61	51	22	14	--
2007	62	52	21	14	--
2008	63	53	21	14	--
2009	64	54	21	15	--
2010	64	55	22	15	--
2011	65	55	22	15	--
2012	65	56	23	16	--
2013	66	57	23	16	--
2014	67	58	23	16	--
2015	67	59	24	17	--
2016	68	60	24	17	--

Sources: DIR, EDD, Milken Institute

**G. Central Coast Region (Monterey, San Luis Obispo, Santa Cruz, and Santa Barbara Counties)**

**Figure G**  
**Map of Central Coast Region**



The Central Coast Region includes Monterey, San Luis Obispo, Santa Cruz, and Santa Barbara Counties. Total employment among these counties stood at around 606,000 in 2004. Total construction employment among these counties was approximately 28,800 in 2004.

**Table G-1**  
**New Entering Apprentices—Total Construction**  
**Central Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	2	32	202	13	28
2001	20	17	130	9	38
2002	45	14	116	2	6
2003	30	17	111	11	15
2004	21	19	161	22	24
2005	49	19	164	23	25
2006	71	20	176	15	18
2007*	106	17	143	20	18
2008*	108	18	145	20	18
2009*	109	18	147	20	18
2010*	111	18	149	21	18
2011*	113	18	151	21	18
2012*	115	19	153	21	18
2013*	116	19	155	22	19
2014*	118	19	157	22	19
2015*	120	20	159	23	19
2016*	122	20	161	23	19

Sources: DIR, Milken Institute

\* indicates projection

**Table G-2**  
**Total Construction Employment by Occupation**  
**Central Coast Region, 2004**

Occupation	Number
Construction Laborers	4,490
Operating Engineers	1,290
Carpenters	7,410
Cement Masons	940
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table G-3**  
**Net Replacement Rate by Occupation**  
**Central Coast Region, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	59	1.3%
Operating Engineers	33	2.6%
Carpenters	120	1.6%
Cement Masons	19	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table G-4**  
**Projections of Skilled Workforce—Total Construction**  
**Central Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	4,536	1,305	7,584	970	--
2006	4,614	1,336	7,729	988	--
2007	4,706	1,364	7,832	1,020	--
2008	4,766	1,396	7,973	1,049	--
2009	4,826	1,429	8,118	1,078	--
2010	4,888	1,462	8,266	1,109	--
2011	4,950	1,496	8,418	1,140	--
2012	5,013	1,531	8,574	1,172	--
2013	5,077	1,567	8,733	1,206	--
2014	5,142	1,604	8,897	1,240	--
2015	5,207	1,642	9,064	1,275	--
2016	5,274	1,680	9,235	1,311	--

Sources: DIR, EDD, Milken Institute

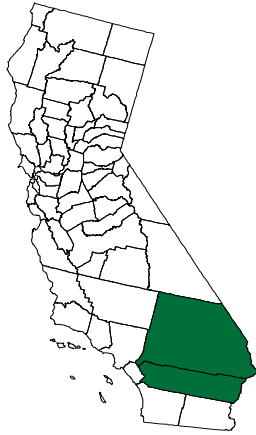
**Table G-5**  
**Projections of Skilled Workforce—HSB**  
**Central Coast Region**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	272	214	79	51	--
2006	277	219	85	53	--
2007	287	224	81	54	--
2008	291	229	83	55	--
2009	295	234	84	57	--
2010	299	240	85	59	--
2011	303	246	87	60	--
2012	306	251	88	62	--
2013	310	257	90	64	--
2014	314	263	92	65	--
2015	319	269	93	67	--
2016	323	276	95	69	--

Sources: DIR, EDD, Milken Institute

## H. Inland Empire Region (Riverside and San Bernardino Counties)

**Figure H**  
**Map of Inland Empire**



The Inland Empire counties of Riverside and San Bernardino had total employment of 1,281,800 in 2004. Employment in these two counties is projected by EDD to grow 24% between 2004 and 2014, to reach a total of 1,590,900 by 2014. Construction employment stood at 111,800 in 2004, and is projected by EDD to grow 30% to 145,300 by 2014.

**Table H-1**  
**New Entering Apprentices—Total Construction**  
**Inland Empire**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	1	34	329	44	94
2001	50	81	439	46	101
2002	132	67	445	52	82
2003	190	89	655	75	101
2004	394	149	872	69	129
2005	438	141	903	69	159
2006	448	144	998	89	239
2007*	759	121	809	73	197
2008*	775	123	827	75	201
2009*	792	126	844	76	206
2010*	809	129	862	78	210
2011*	826	132	881	79	215
2012*	844	134	900	81	219
2013*	862	137	919	83	224
2014*	880	140	939	85	229
2015*	899	143	959	86	234
2016*	919	146	980	88	239

Sources: DIR, Milken Institute

\* indicates projection

**Table H-2**  
**Total Construction Employment by Occupation**  
**Inland Empire, 2004**

Occupation	Number
Construction Laborers	20,010
Operating Engineers	3,980
Carpenters	28,050
Cement Masons	5,170
Ironworkers	1,580
Source: EDD	

**Table H-3**  
**Net Replacement Rate by Occupation**  
**Inland Empire, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	266	1.3%
Operating Engineers	102	2.6%
Carpenters	457	1.6%
Cement Masons	104	2.0%
Ironworkers	31	2.0%
Sources: EDD, Milken Institute		

**Table H-4**  
**Projections of Skilled Workforce—Total Construction**  
**Inland Empire**

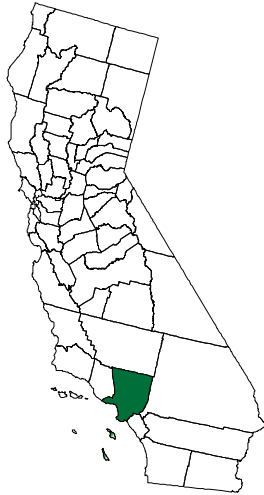
Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	20,656	4,124	29,341	5,294	1,749
2006	21,151	4,236	30,307	5,477	1,871
2007	21,958	4,324	31,016	5,630	1,873
2008	22,483	4,441	31,958	5,805	1,921
2009	23,020	4,561	32,930	5,986	1,971
2010	23,570	4,684	33,930	6,173	2,022
2011	24,134	4,810	34,962	6,365	2,075
2012	24,711	4,940	36,024	6,564	2,128
2013	25,301	5,074	37,119	6,768	2,184
2014	25,906	5,211	38,248	6,979	2,240
2015	26,525	5,352	39,411	7,197	2,298
Sources: DIR, EDD, Milken Institute					

**Table H-5**  
**Projections of Skilled Workforce—HSB**  
**Inland Empire**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	1,239	676	306	281	159
2006	1,269	695	334	291	176
2007	1,341	710	321	297	171
2008	1,373	729	331	307	176
2009	1,406	748	340	316	180
2010	1,440	769	350	326	185
2011	1,475	789	361	336	190
2012	1,511	811	371	346	194
2013	1,547	833	382	357	199
2014	1,584	855	393	368	205
2015	1,623	878	405	380	210
2016	1,662	902	417	391	215
Sources: DIR, EDD, Milken Institute					

**I. Los Angeles County**

**Figure I**  
**Map of Los Angeles County**



Employment in Los Angeles County totaled 4,361,000 in 2004 and is projected to grow to 4,811,500 in 2014, a growth rate of 10.3 percent. Construction employment in the county stood at 160,350 in 2004, projected to grow by 8 percent to 173,240 in 2014.

**Table I-1**  
**New Entering Apprentices—Total Construction**  
**Los Angeles County**

<b>Year</b>	<b>Construction Laborers</b>	<b>Operating Engineers</b>	<b>Carpenters</b>	<b>Cement Masons</b>	<b>Ironworkers</b>
2000	21	86	792	89	121
2001	179	71	960	109	154
2002	227	72	875	91	103
2003	292	71	1212	84	126
2004	407	100	1534	146	206
2005	478	137	1485	144	226
2006	448	104	1697	199	361
2007*	805	82	1435	173	332
2008*	811	83	1445	174	334
2009*	816	84	1455	176	337
2010*	822	84	1465	177	339
2011*	828	85	1475	178	341
2012*	833	85	1485	179	344
2013*	839	86	1496	180	346
2014*	845	87	1506	182	348
2015*	851	87	1516	183	351
2016*	857	88	1527	184	353

Sources: DIR, Milken Institute

\* indicates projection

**Table I-2**  
**Total Construction Employment by Occupation**  
**Los Angeles County, 2004**

Occupation	Number
Construction Laborers	24,820
Operating Engineers	4,080
Carpenters	24,680
Cement Masons	3,870
Ironworkers	1,210

Source: EDD

**Table I-3**  
**Net Replacement Rate by Occupation**  
**Los Angeles County, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	330	1.3%
Operating Engineers	105	2.6%
Carpenters	402	1.6%
Cement Masons	78	2.0%
Ironworkers	24	2.0%

Sources: EDD, Milken Institute

**Table I-4**  
**Projections of Skilled Workforce—Total Construction**  
**Los Angeles County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	25,063	4,156	26,000	3,981	1,420
2006	25,129	4,168	26,451	4,081	1,563
2007	25,582	4,192	26,431	4,100	1,542
2008	25,683	4,238	26,685	4,148	1,553
2009	25,786	4,285	26,941	4,196	1,563
2010	25,888	4,332	27,200	4,244	1,574
2011	25,991	4,380	27,461	4,293	1,585
2012	26,094	4,429	27,725	4,343	1,595
2013	26,198	4,478	27,992	4,393	1,606
2014	26,302	4,527	28,261	4,443	1,617
2015	26,407	4,577	28,532	4,495	1,628
2016	26,512	4,628	28,806	4,547	1,639

Sources: DIR, EDD, Milken Institute

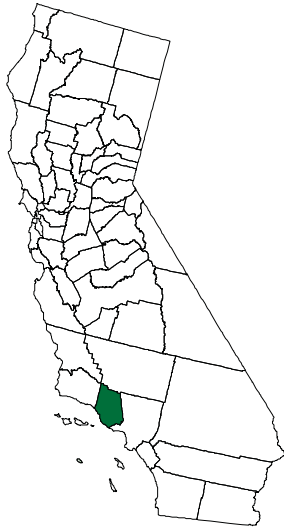
**Table I-5**  
**Projections of Skilled Workforce—HSB**  
**Los Angeles County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	1,503	682	271	211	129
2006	1,508	684	291	217	147
2007	1,562	688	274	217	141
2008	1,569	696	276	219	142
2009	1,575	703	279	221	143
2010	1,582	711	281	224	144
2011	1,588	719	283	227	145
2012	1,595	727	286	229	146
2013	1,602	735	288	232	147
2014	1,609	743	291	234	148
2015	1,615	751	293	237	149
2016	1,622	760	296	240	150

Sources: DIR, EDD, Milken Institute

## J. Ventura County

**Figure J**  
**Map of Ventura County**



Total employment in Ventura County stood at 331,100 jobs in 2004. Employment is projected by EDD to grow 12% between 2004 and 2014, to reach a total of 371,000 by 2014. Construction employment stood at 16,900 in 2004 and is projected by EDD to grow 11% to 18,000 by 2014. Of the 16,900 construction workers in the county in 2004, 4,800 were employed in the building construction and heavy civil employment and 12,100 in specialty trade contracting.

**Table J-1**  
**New Entering Apprentices—Total Construction**  
**Ventura County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	2	34	64	6	10
2001	20	5	52	6	8
2002	39	6	80	3	8
2003	43	9	83	4	10
2004	86	28	85	12	11
2005	106	26	109	12	14
2006	78	30	113	9	21
2007*	117	24	87	7	17
2008*	118	24	88	7	17
2009*	118	24	88	7	17
2010*	119	25	89	7	17
2011*	120	25	89	7	17
2012*	121	25	90	7	17
2013*	121	25	90	8	17
2014*	122	25	91	8	17
2015*	123	25	91	8	17
2016*	123	26	92	8	18

Sources: DIR, Milken Institute

\* indicates projection

**Table J-2**  
**Total Construction Employment by Occupation**  
**Ventura County, 2004**

Occupation	Number
Construction Laborers	3,260
Operating Engineers	1,120
Carpenters	3,320
Cement Masons	540
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table JI-3**  
**Net Replacement Rate by Occupation**  
**Ventura County, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	43	1.3%
Operating Engineers	29	2.6%
Carpenters	54	1.6%
Cement Masons	11	2.0%
Ironworkers	NA*	NA*

Sources: EDD, Milken Institute

\*Not Announced by EDD

**Table J-4**  
**Projections of Skilled Workforce—Total Construction**  
**Ventura County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	3,319	1,129	3,409	549	--
2006	3,287	1,146	3,447	554	--
2007	3,323	1,153	3,456	561	--
2008	3,320	1,166	3,492	569	--
2009	3,317	1,179	3,528	578	--
2010	3,314	1,192	3,564	586	--
2011	3,311	1,206	3,601	595	--
2012	3,308	1,219	3,638	604	--
2013	3,306	1,233	3,675	613	--
2014	3,303	1,247	3,713	622	--
2015	3,300	1,261	3,751	632	--
2016	3,297	1,275	3,790	641	--

Sources: DIR, EDD, Milken Institute

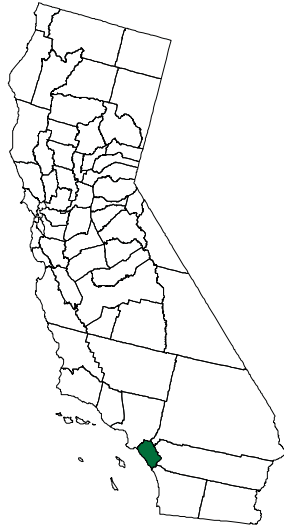
**Table J-5**  
**Projections of Skilled Workforce—HSB**  
**Ventura County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	199	185	36	29	--
2006	197	188	38	29	--
2007	203	189	36	30	--
2008	203	191	36	30	--
2009	203	193	36	30	--
2010	202	196	37	31	--
2011	202	198	37	31	--
2012	202	200	37	32	--
2013	202	202	38	32	--
2014	202	205	38	33	--
2015	202	207	39	33	--
2016	202	209	39	34	--

Sources: DIR, EDD, Milken Institute

**K. Orange County**

**Figure K  
Map of Orange County**



Orange County had employment of 1,599,600 workers in 2004 and is projected to increase by 18 percent to 1,887,000 in 2014. Construction employment for the county stood at 98,530 in 2004, projected to increase by 20.8 percent to 119,050 in 2014.

**Table K-1  
New Entering Apprentices—Total Construction  
Orange County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	1	26	205	25	36
2001	4	19	204	24	29
2002	54	20	193	17	30
2003	56	22	248	25	33
2004	102	35	304	22	40
2005	132	73	332	29	59
2006	130	47	334	38	74
2007*	221	40	277	32	63
2008*	224	41	281	32	63
2009*	227	41	285	33	64
2010*	230	42	289	33	65
2011*	233	42	293	34	66
2012*	237	43	297	34	67
2013*	240	44	301	35	68
2014*	243	44	306	35	69
2015*	247	45	310	36	70
2016*	250	45	314	36	71

Sources: DIR, Milken Institute

\* indicates projection

**Table K-2**  
**Total Construction Employment by Occupation**  
**Orange County, 2004**

Occupation	Number
Construction Laborers	11,990
Operating Engineers	2,420
Carpenters	19,560
Cement Masons	2,720
Ironworkers	NA*

Source: EDD

\*Not Announced by EDD

**Table K-3**  
**Net Replacement Rate by Occupation**  
**Orange County, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	160	1.3%
Operating Engineers	62	2.6%
Carpenters	318	1.6%
Cement Masons	55	2.0%
Ironworkers	15	1.9%

Sources: EDD, Milken Institute

**Table K-4**  
**Projections of Skilled Workforce—Total Construction**  
**Orange County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	12,062	2,475	19,968	2,757	831
2006	12,162	2,494	20,373	2,831	863
2007	12,355	2,533	20,726	2,891	870
2008	12,461	2,581	21,150	2,959	888
2009	12,568	2,629	21,581	3,029	908
2010	12,676	2,678	22,022	3,101	928
2011	12,785	2,728	22,471	3,174	948
2012	12,895	2,779	22,930	3,249	969
2013	13,006	2,831	23,398	3,326	990
2014	13,117	2,884	23,876	3,404	1,012
2015	13,230	2,938	24,363	3,485	1,034
2016	13,344	2,993	24,861	3,567	1,056

Sources: DIR, EDD, Milken Institute

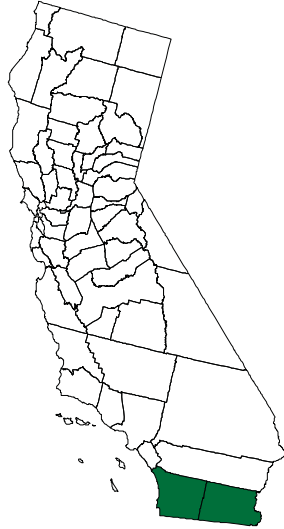
**Table K-5**  
**Projections of Skilled Workforce—HSB**  
**Orange County**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	724	406	208	146	76
2006	730	409	224	151	81
2007	754	416	215	153	79
2008	761	424	219	156	81
2009	768	431	223	160	83
2010	774	440	227	164	85
2011	781	448	232	168	87
2012	788	456	236	171	88
2013	795	465	241	175	90
2014	802	473	246	180	92
2015	809	482	250	184	94
2016	816	491	255	188	96

Sources: DIR, EDD, Milken Institute

## L. San Diego and Imperial Counties

**Figure L**  
**Map of San Diego and Imperial Counties**



San Diego had total employment of 1,392,700 in 2004, projected to grow by 14.7 percent to 1,597,700 by 2014. Imperial County had total employment of 55,000 in 2004 and is projected to grow by 12.2 percent to 61,700 by 2014. Combined, the two counties had construction employment of 98,430 in 2004, projected to grow to 110,030 by 2014.

**Table L-1**  
**New Entering Apprentices—Total Construction**  
**San Diego and Imperial Counties**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2000	0	41	172	63	131
2001	3	19	149	23	90
2002	8	46	226	33	117
2003	22	22	295	36	72
2004	209	44	350	29	106
2005	231	63	470	61	206
2006	220	42	844	57	293
2007*	380	35	764	46	245
2008*	383	35	771	46	248
2009*	387	35	779	46	250
2010*	390	36	786	47	252
2011*	394	36	794	47	255
2012*	398	36	802	48	257
2013*	401	37	810	48	259
2014*	405	37	818	49	262
2015*	409	37	826	49	264
2016*	412	38	834	49	266

Sources: DIR, Milken Institute

\* indicates projection

**Table L-2**  
**Total Construction Employment by Occupation**  
**San Diego and Imperial Counties, 2004**

Occupation	Number
Construction Laborers	13,700
Operating Engineers	3,770
Carpenters	20,840
Cement Masons	2,530
Ironworkers	1,030

Source: EDD

**Table L-3**  
**Net Replacement Rate by Occupation**  
**San Diego and Imperial Counties, 2004**

Occupation	Net Replacements	Rate
Construction Laborers	182	1.3%
Operating Engineers	97	2.6%
Carpenters	340	1.6%
Cement Workers	51	2.0%
Ironworkers	20	1.9%

Sources: EDD, Milken Institute

**Table L-4**  
**Projections of Skilled Workforce—Total Construction**  
**San Diego and Imperial Counties**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	13,796	3,819	21,231	2,585	--
2006	13,832	3,852	21,870	2,626	--
2007	14,039	3,900	22,058	2,661	--
2008	14,090	3,955	22,337	2,709	--
2009	14,142	4,012	22,619	2,757	--
2010	14,194	4,069	22,906	2,807	--
2011	14,247	4,128	23,196	2,858	--
2012	14,300	4,187	23,490	2,909	--
2013	14,353	4,246	23,788	2,962	--
2014	14,407	4,307	24,091	3,016	--
2015	14,462	4,369	24,397	3,071	--
2016	14,516	4,431	24,707	3,127	--

Sources: DIR, EDD, Milken Institute

**Table L-5**  
**Projections of Skilled Workforce—HSB**  
**San Diego and Imperial Counties**

Year	Construction Laborers	Operating Engineers	Carpenters	Cement Masons	Ironworkers
2005	828	626	221	137	--
2006	830	632	241	140	--
2007	857	640	229	141	--
2008	861	649	231	143	--
2009	864	658	234	146	--
2010	867	668	237	148	--
2011	871	677	239	151	--
2012	874	687	242	154	--
2013	878	697	245	156	--
2014	881	707	248	159	--
2015	885	717	251	162	--
2016	888	727	254	165	--

Sources: DIR, EDD, Milken Institute