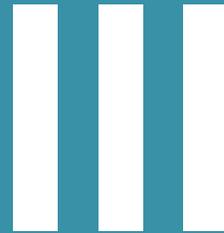




2016 Pay Report



Structural Engineering
Engagement and Equity
Committee of the Structural
Engineers Association of
Northern California



The information contained in this report was gathered from a SEAONC-sponsored survey administered online by the SEAONC SE3 Committee in early 2016. While the information presented in this document is believed to be an accurate, unbiased representation of the data received in the survey, the matters discussed are sometimes subject to differences in opinion or approach. As such, neither SEAONC nor its board, committees, writers, editors, or firms, nor individuals who have contributed to this report make any warranty, expressed or implied, or assume any legal liability or responsibility for the use of or reference to findings, conclusions, or recommendations expressed herein.

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EXECUTIVE SUMMARY

The Structural Engineers Association of Northern California (SEAONC) Structural Engineering Engagement and Equity (SE3) Committee conducted a nationwide survey of structural engineering professionals in 2016. This survey received over 2,100 completed responses and garnered a number of findings on topics including career development, work-life balance, and pay, for which a report was released in December 2016. In 2017, the SEAONC SE3 Committee conducted a more in-depth analysis of the 2016 survey data to (1) provide more detailed information on pay based on a variety of factors, (2) discover the overall influences on pay, and (3) investigate the details of the gender pay gap that was reported in the 2016 report.

Chapter 1 of this report is composed of an introduction, including the purpose of the report, a brief overview of the 2016 survey, and a list of key terms used throughout the report. It also includes a description of the data set used for this report as well as some of the limitations on the findings for the reader to be aware of when interpreting the data presented.

Chapter 2 of this report provides demographic data corresponding to eight factors, and Chapter 3 provides pay data for each of those eight factors. These factors are as follows: position, years of experience, firm size, degrees achieved, licensure, average hours worked per week, geographic region, and whether the respondent has or previously had dependents. These specific demographic factors were chosen due to the hypothesis that they would be most likely to affect pay.

In Chapter 4, five more factors are explored with respect to pay: whether a respondent has considered leaving the profession, overall career satisfaction, satisfaction with pay, difficulty discussing advancement, and mentorship. These factors involve more subjective, opinion-based answers from respondents, and the data are broken down by gender in this chapter to show the influence of each factor on both men and women.

While interesting, the bivariate (two-variable) analyses in Chapters 3 and 4 provide limited information regarding the understanding of overall influences on pay in the structural engineering profession as well as the details of the gender pay gap. The reader is therefore cautioned against drawing conclusions from these independent comparisons. The overall influences on pay and the gender pay gap are best addressed via multivariable regression analyses, the effects of which are discussed in Chapters 5 and 6.

Thus, the data in Chapters 5 and 6 are the most comprehensive, and perhaps most compelling, portion of the report. Chapter 5 details the 13 factors that were found to influence the pay of the survey respondents, the most significant of which were a respondent's number of years of experience and his or her position. These factors are ranked by percent influence on pay, then by dollar-amount influence on pay. Chapter 5 also details the interaction of gender with other factors and discusses how gender-based terms entered into the final model of pay.

As discussed in Chapter 6, two of the 13 factors that influence pay were found to affect men and women differently: being a principal/owner/CEO/founder and being a sole practitioner. Holding all else constant, male principals were found to make \$26,300 more per year on average than female principals, and male sole practitioners were found to make \$50,100 more per year on average than female sole practitioners. The remaining 11 factors that influence pay were found to be "gender neutral," meaning that they affect men and women roughly equally when present. However, the "gender-neutral" factors are often more or less prevalent in one gender, with the overall result that average pay is lower for women than for men.

CHAPTER ONE

1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

In 2016, the Structural Engineering Engagement and Equity (SE3) Committee, part of the Structural Engineers Association of Northern California (SEAONC), administered a nationwide study of structural engineering professionals that received over 2,100 completed responses from 43 states. The study included survey questions on topics such as career development, work-life balance, and pay. A variety of findings from this study, as well as a list of best practices, were published in a report in December 2016, which is available at se3project.org/full-report.

In 2017, the SEAONC SE3 Committee decided to create this more in-depth report regarding the pay data provided by the 2016 survey respondents. The purpose of this report is to provide readers with information regarding current pay trends based on the 2016 survey data. Another goal of this report is to investigate the gender pay gap that was discovered in the data and noted in the 2016 report, to see if further analysis can shed more light on the factors, reasons, and possible solutions to the issue of pay equity.

1.2 BRIEF OVERVIEW OF THE 2016 SE3 SURVEY

The mission of the SEAONC SE3 Committee is to study and improve engagement and equity in the structural engineering profession. The group was established in 2015 as an ad hoc group of SEAONC members, and funding was provided by SEAONC to develop and disseminate a survey to structural engineering professionals around the country. The 2016 survey was released in February 2016 and was open for approximately three months. During this time, 2,161 completed responses were received from engineers around the country, approximately half of which were from engineers in California.

The survey responses were analyzed to investigate career satisfaction, career development, pay and benefits, and work-life balance. Key findings not associated with pay included the following:

- The respondents were generally satisfied with their careers; 81% of the respondents reported that they were either “satisfied” or “very satisfied” with their career overall.
- 56% of the respondents had considered leaving the profession, the top reasons for which were seeking higher pay, better work-life balance, and less stress.
- Respondents who had left the profession noted poor management/leadership as one of the leading reasons they had left, suggesting that overall, poor management/leadership is a core cause for people leaving the structural engineering profession.
- Employees who worked more hours each week were more likely to have considered leaving the profession.

The key findings associated with pay in the 2016 study were the genesis of this more in-depth report. Pay data were received from 1,955 survey respondents. The average (mean) annual income of all respondents who were still practicing structural engineering was \$106,800 (for California respondents only, the average was \$117,600). These figures included part-time respondents, which constituted a small portion (~6%) of the sample. Key findings regarding compensation included the following:

- Respondents overall indicated that pay/compensation was the top reason that they had considered leaving the structural engineering profession and, for those who had left the profession, one of the leading reasons why they had left.
- Male respondents earned, on average, \$27,500 more than female respondents. This pay gap was skewed toward higher positions and more years of experience; there was essentially no pay gap found for entry-level respondents.

Detailed findings from the entire 2016 study can be found in the *SE3 2016 Survey Report*, which can be found online at se3project.org/full-report.

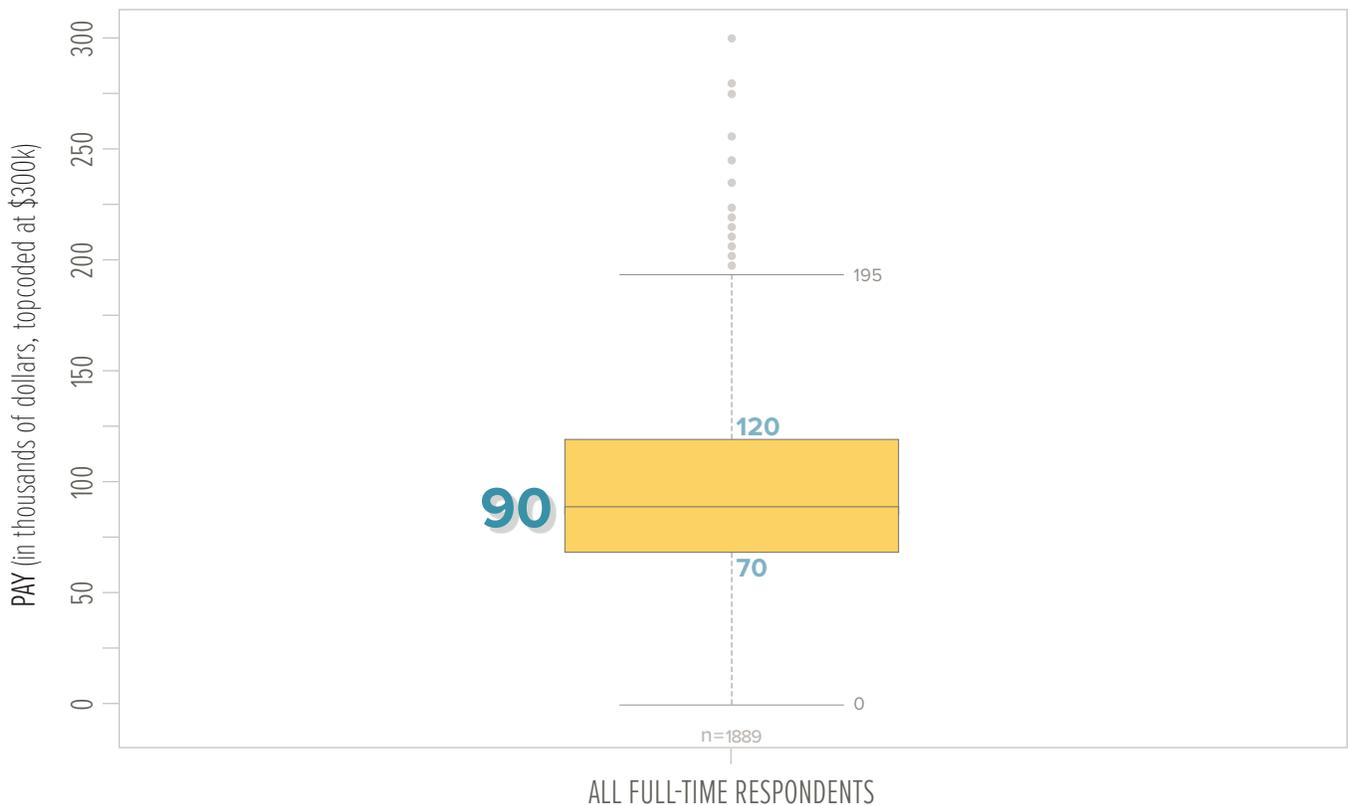
1.3 TERMS AND DEFINITIONS

The following terms are used throughout this report and are defined here to assist the reader in understanding their meaning and intent:

Boxplot charts: Boxplot charts summarize income distributions using five numbers, as follows (listed from top to bottom as each number appears in Figure 1.1):

- **Upper bound:** An estimate of the upper threshold separating outliers from non-outliers. The upper bound pay value in Figure 1.1 is \$195,000.
- **75th percentile (Q3):** The pay threshold below which 75% of respondents fall. The 75th percentile pay value in Figure 1.1 is \$120,000.
- **50th percentile (median, or Q2):** The pay threshold above and below which 50% of respondents fall. The 50th percentile pay value in Figure 1.1 is \$90,000.
- **25th percentile (Q1):** The pay threshold below which 25% of respondents fall. The 25th percentile pay value in Figure 1.1 is \$70,000.
- **Lower bound:** An estimate of the lower threshold separating outliers from non-outliers. The lower bound pay value in Figure 1.1 is \$0.
- **Interquartile range (IQR):** The difference between the 75th and 25th percentiles. The IQR in Figure 1.1 is \$120,000 minus \$70,000, or \$50,000.
- **Sample size (n):** The number of respondents included in the category of data displayed. The sample size in Figure 1.1 is $n = 1,889$ people.

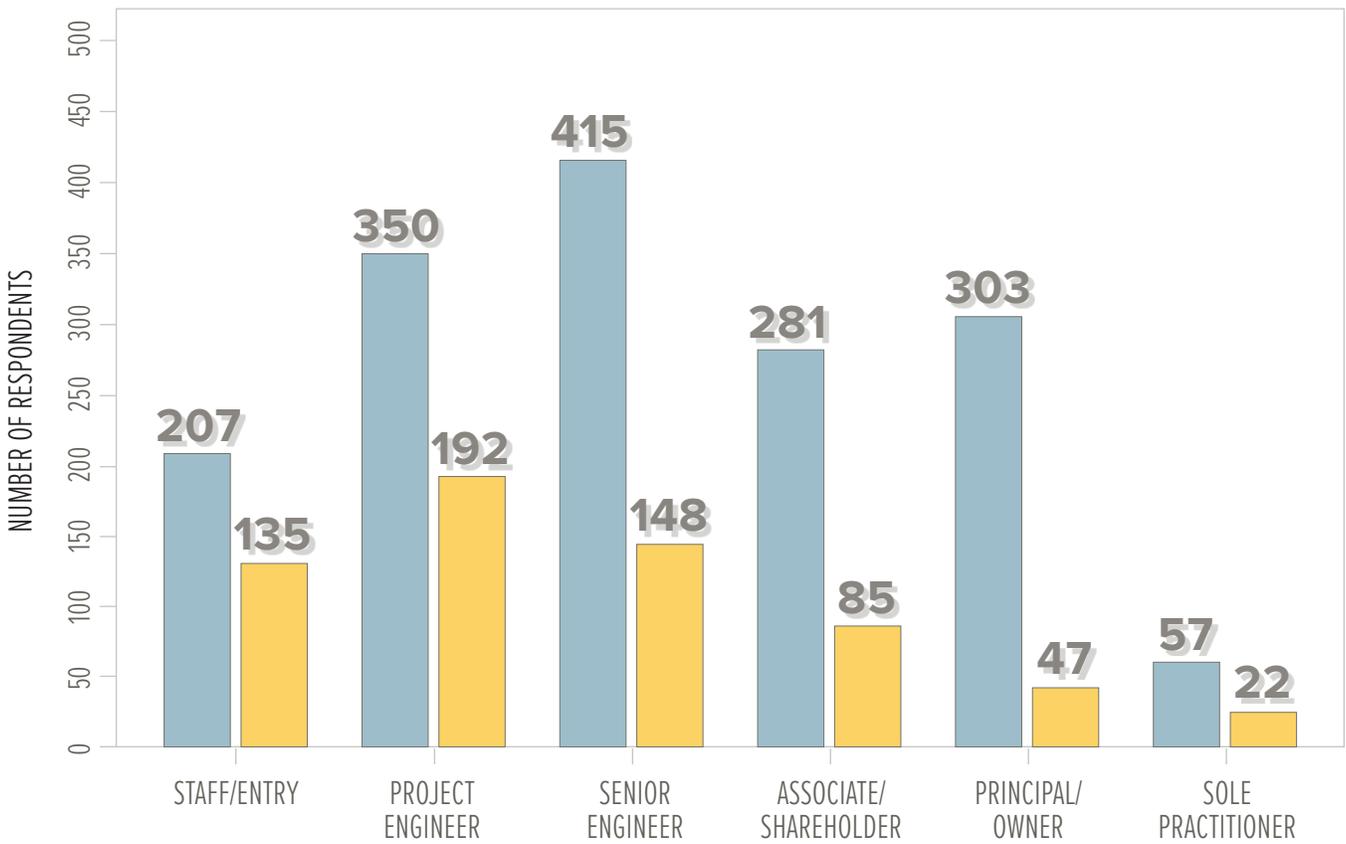
FIGURE 1.1 BOXPLOT CHART



Histogram: A frequency chart summarizing the distribution of numerical data. Figure 1.2 shows a histogram summarizing the number of survey respondents in each position, broken down by gender.

FIGURE 1.2 POSITION

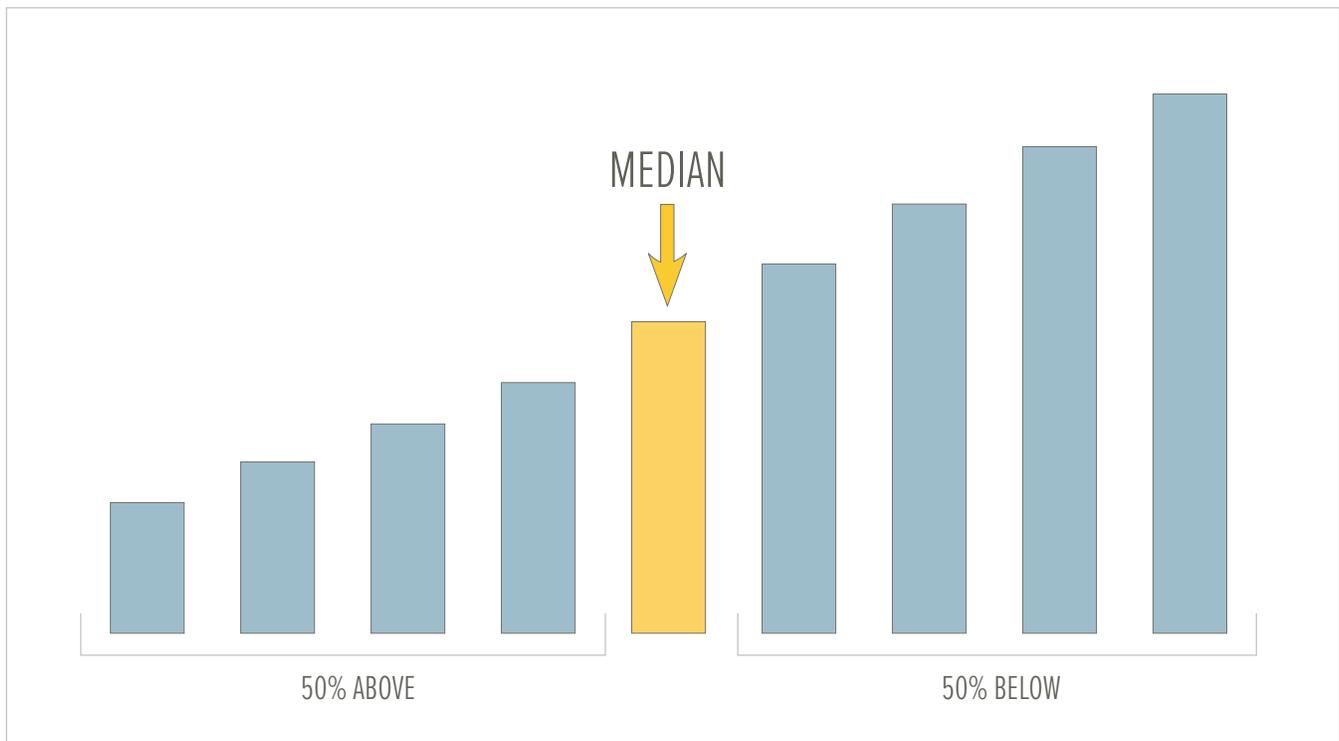
■ = men ■ = women



Mean (average): The arithmetic average of a set of values. Data from the *SE3 2016 Survey Report* generally included mean values for pay.

Median (50th percentile, or Q2): The value or quantity lying at the midpoint of a set of values, such that there is an equal probability of falling above or below it, as shown in Figure 1.3. Since the 2016 survey sample includes a few respondents who reported very low or very high incomes, the median is more reliable than the mean (average) as a measure of typical pay for a given subgroup. Data in this report generally include median pay values.

FIGURE 1.3 MEDIAN



Pay (income, compensation, salary): For the purposes of the 2016 survey, “pay,” “income,” “compensation,” and “salary” are equivalent and are defined as “gross annual income, including bonuses.” These terms are used interchangeably throughout this report.

Topcoding: For respondents who reported pay exceeding \$300,000, pay has been recoded (topcoded) as \$300,000. This compacts the range needed to depict all pay distributions and has no material impact on the results of this specific analysis.

1.4 DATA SETS USED FOR THE ANALYSES

A total of 2,242 survey responses were included in the data sample used for this report. All responses to the original survey were included, including partial survey responses where statistically appropriate (2,161 of the responses were complete; 81 were partial). The specific demographics of all respondents can be found in Chapter 2. Not every respondent answered each survey question; therefore, some subsets of data include fewer than 2,242 respondents.

Most, but not all, survey responses included pay data. Additionally, some responses that did include pay data were removed from the data sets used for pay analyses based on the presence of certain outliers or conditions that did not apply when examining full-time practicing structural engineers. The respondents who provided pay data in the 2016 survey who were excluded from the final data set used for pay analyses in Chapter 5 of this report were the following:

- Those not based in the United States or US territories
- Those who are no longer practicing structural engineering
- Those who reported working fewer than 40 hours per week
- Non-sole practitioners who reported annual earnings below \$30,000¹
- Those who reported their position as “intern”

In total, 1,889 responses with valid pay data were used in the bivariate analyses in Chapters 3 and 4. Again, not every respondent answered each survey question. As such, some subsets of data in Chapters 3 and 4 include fewer than 1,889 respondents.

For the final statistical model, respondents with missing or invalid values for any of the predictor variables used in the model were excluded from the final data set. This resulted in 1,876 respondents being used for the final model of pay in Chapter 5.

Note that for some of the categorical variables, the number of respondents in any one category was small. The impact of including or excluding a distinctive but small group of respondents was tested during the analysis to determine whether that group’s attribute was a significant predictor of pay. Only statistically significant conclusions are reported herein.

¹ As the analyses intended to examine data from full-time employees, these data points were excluded, as they imply earnings of less than \$15 per hour, which were outliers that appeared to be due to data entry errors regarding either pay or hours worked (or both). The exact salary at which this cutoff was made, such as \$35,000 or \$40,000, had no significant impact on the predictive models.

1.5 INTERPRETING THE DATA

An initial step in the process of analyzing the data was to examine the relationship between the distribution of pay and a number of independent factors, considered one at a time. The results of these bivariate (two-variable) comparisons are presented in Chapters 3 and 4, via boxplot charts.

The reader is cautioned against drawing conclusions from the bivariate comparisons, as examining a factor in isolation can be misleading. The interpretation of variations in pay is, therefore, best reserved for Chapters 5 and 6, which present conclusions based on interfactor correlations. These interfactor correlations are captured through the final model of pay, as described in Section 5.4.

CHAPTER TWO

2.0 DEMOGRAPHICS OF RESPONDENTS

2.1 NUMBER OF RESPONDENTS

A total of 2,242 survey responses were used to provide demographic breakdowns for this report. As noted in Section 1.4, these included partial survey responses. Additionally, not all respondents answered each survey question; therefore, some subsets of data include fewer than 2,242 respondents.

One respondent indicated “other” for the gender category and identified as “transgender.” This respondent was included in the multivariable analyses but excluded from plots based on binary gender identity (i.e., men/women). Note that in upcoming SE3 surveys, information affiliated with gender identity (and other demographic information) will be explored in more detail.

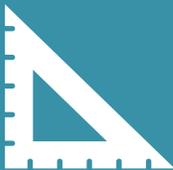
2.2 POSITION

For this survey, respondents indicated which of five positions they held at their firm. The position choices and corresponding descriptions that were presented in the survey are described below.

POSITION DEFINITIONS IN THE 2016 SE3 SURVEY:



STAFF/ENTRY-LEVEL: Project technical support and design/analysis with close supervision (detailed structural design and analysis, computer modeling, calculations, drawing coordination, construction administration or field support)



PROJECT ENGINEER: Project design and coordination with some autonomy (detailed structural design and analysis; drawing development; construction administration or field support; close interaction with design team, including architects, other consultants, owners, and contractors; some opportunities for marketing and project proposal development)



SENIOR STRUCTURAL ENGINEER AND/OR PROJECT MANAGER: Project coordination and management of project-related design/analysis tasks; overseeing design team decisions, with regular interaction with the client and other members of the project management team; regular marketing/proposal responsibilities



ASSOCIATE/SHAREHOLDER: Similar responsibilities as senior structural engineer, with enhanced autonomy and level of responsibilities in proposal writing, marketing, and business development activities; possibly owns a small share of the firm



PRINCIPAL/OWNER/CEO/FOUNDER: Individual with a significant portion of the firm's shares, has control over the direction of the business within their sector, defines the corporate mission and values, heavy involvement in client and business development initiatives, proposals, and marketing activities

A “sole practitioner” was defined as a person who chose their position as principal/owner/CEO/founder and also specified the number of employees at their firm to be one.

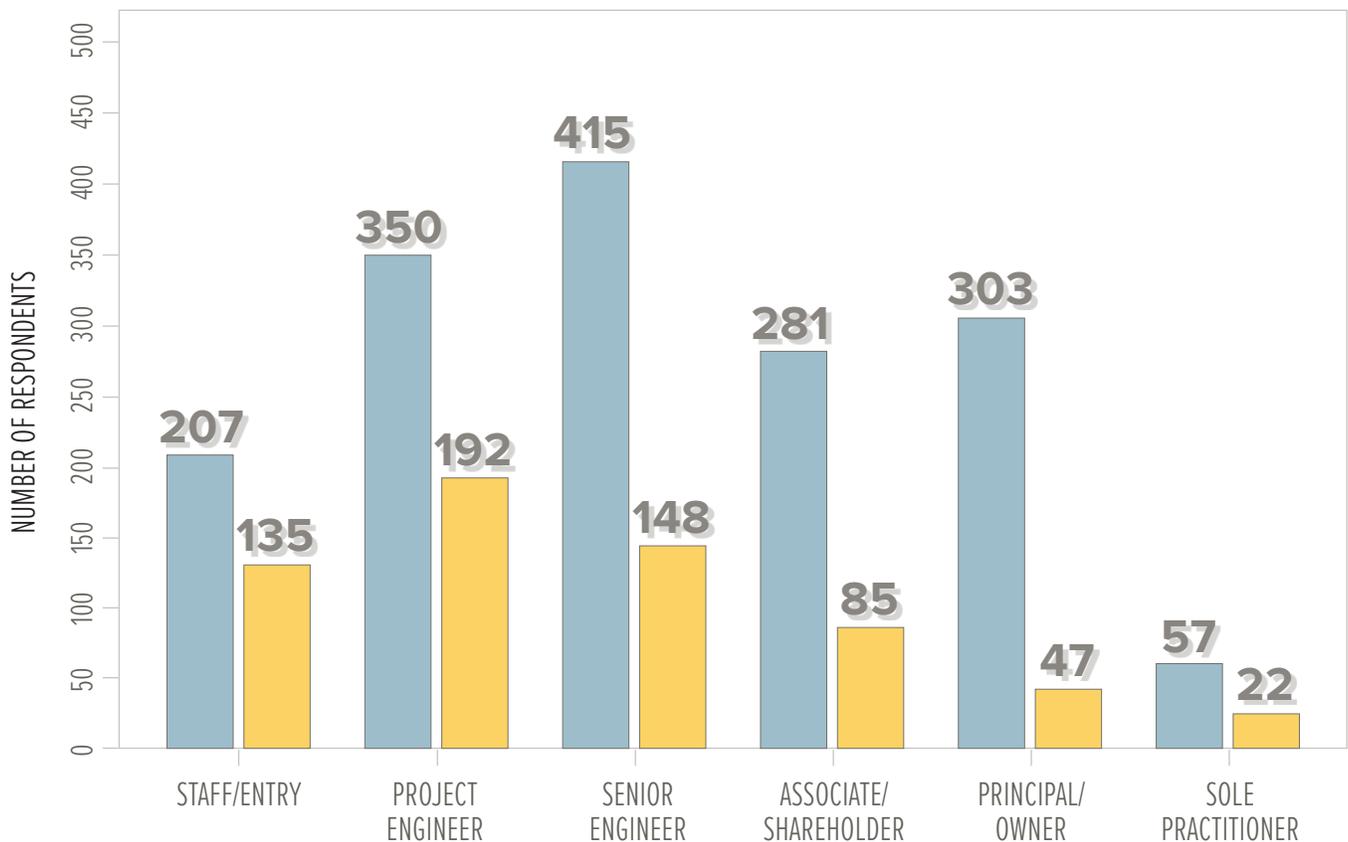
The following number of respondents reported being included in each position. These data are shown graphically in Figure 2.1.

- 342 (15%) were staff/entry-level: 135 (6%) women and 207 (9%) men
- 542 (24%) were project engineers: 192 (8%) women and 350 (16%) men
- 563 (25%) were senior structural engineers and/or project managers: 148 (7%) women and 415 (18%) men
- 366 (17%) were associates/shareholders: 85 (4%) women and 281 (13%) men
- 429 (19%) were principals/owners/CEOs/founders: 69 (3%) women and 360 (16%) men

Additionally, of the 429 people who indicated their position as “principal/owner/CEO/founder,” 79 (3.5% of the total number of respondents) were sole practitioners: 22 (1.0%) women and 57 (2.5%) men. Sole practitioners were generally separated from other principal/owners in the data presented throughout this report, as their pay was often distinctly different than the rest of the principals/owners.

FIGURE 2.1 POSITION

■ = men ■ = women



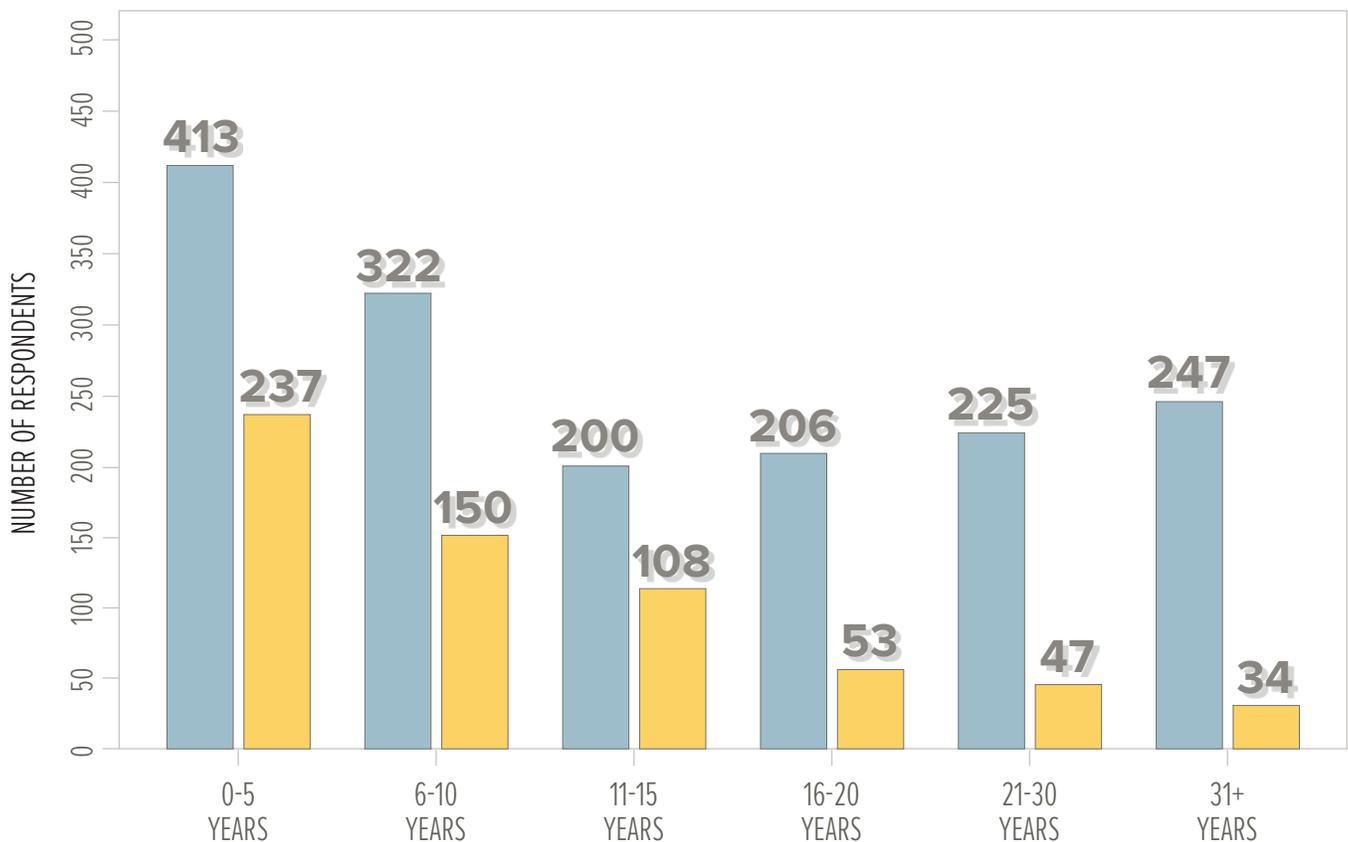
2.3 YEARS OF EXPERIENCE

Respondents who provided pay data had anywhere between one and 30+ years of experience. The respondents indicated the following number of years of experience working in the structural engineering profession, as shown in Figure 2.2:

- 650 (29%) had 0-5 years of experience: 237 (11%) women and 413 (18%) men
- 472 (21%) had 6-10 years of experience: 150 (7%) women and 322 (14%) men
- 308 (14%) had 11-15 years of experience: 108 (5%) women and 200 (9%) men
- 259 (12%) had 16-20 years of experience: 53 (2%) women and 206 (10%) men
- 272 (12%) had 21-30 years of experience: 47 (2%) women and 225 (10%) men
- 281 (12%) had more than 30 years of experience: 34 (1%) women and 247 (11%) men

FIGURE 2.2 YEARS OF EXPERIENCE

■ = men ■ = women

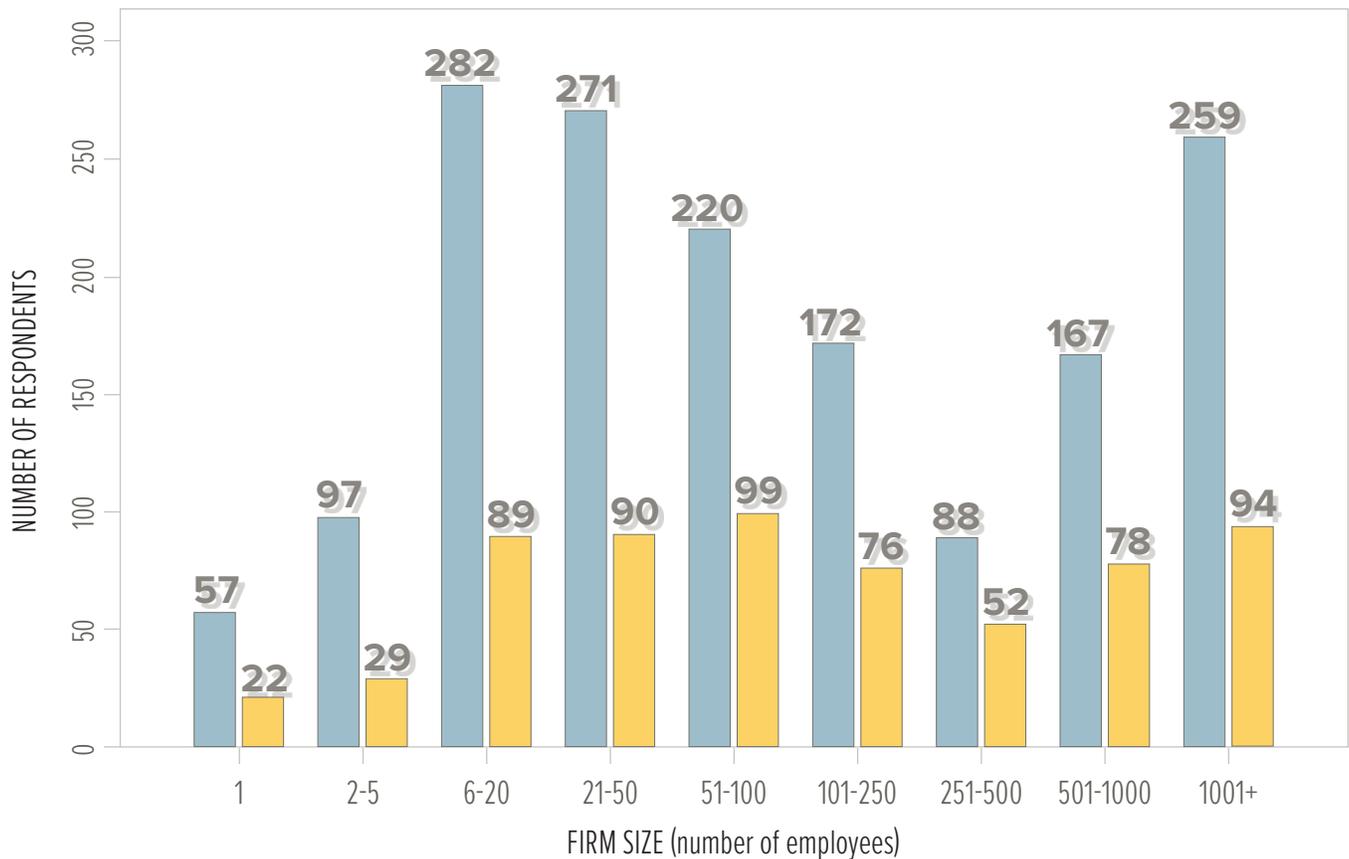


2.4 FIRM SIZE

Respondents indicated the firm size of their current employer by reporting the number of employees in the firm. Of the respondents, 79 (3.5%) were sole practitioners (those with one employee in their firm), of which 22 (1.0%) were women and 57 (2.5%) were men. The most commonly reported firm sizes were firms with 6-100 employees, for which 1,051 respondents (47%) indicated they worked. Figure 2.3 below gives a more detailed look at the distribution of firm size across nine size categories.

FIGURE 2.3 FIRM SIZE

■ = men ■ = women

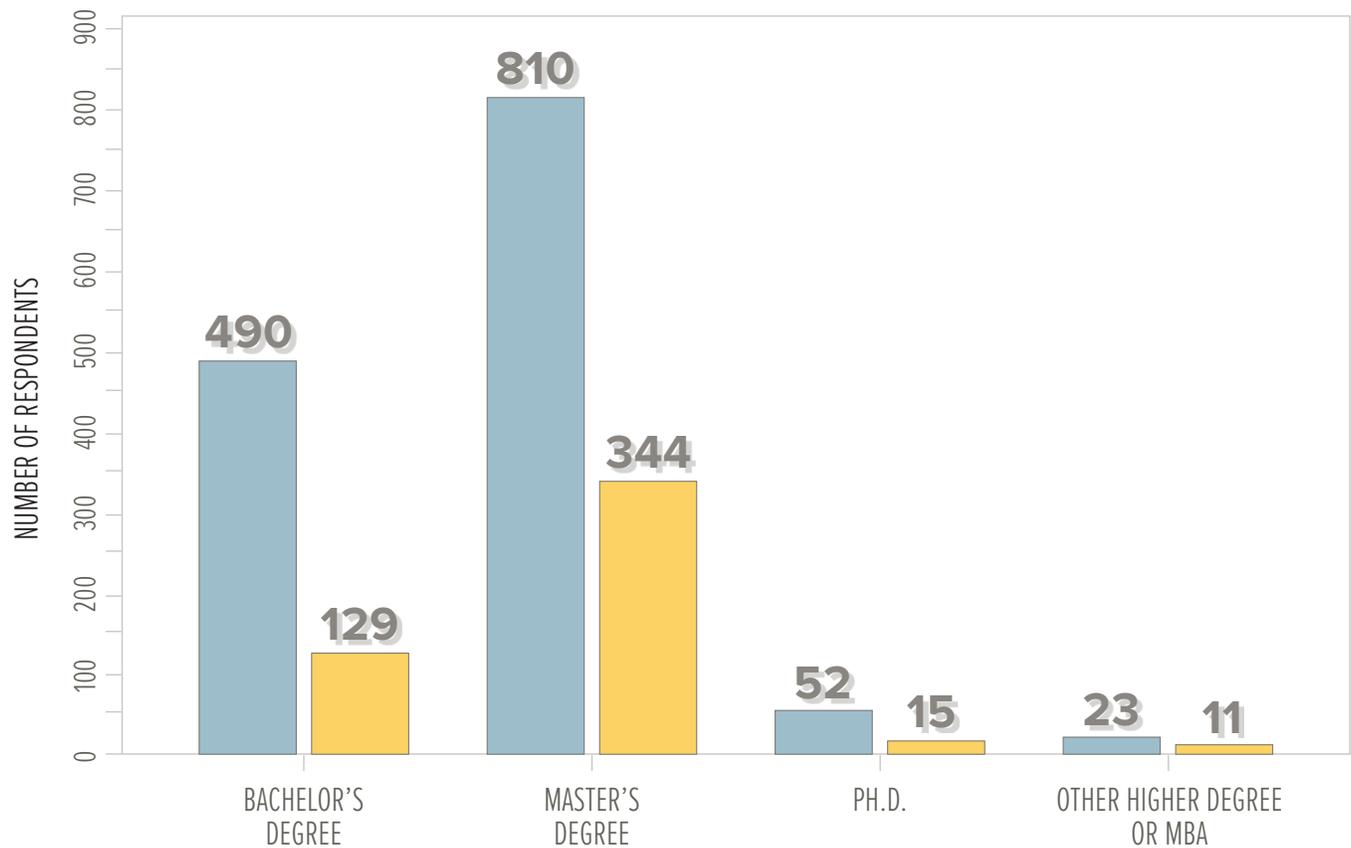


2.5 DEGREES ACHIEVED

Out of the respondents who provided pay data, 619 (33%) had bachelor's degrees in civil or structural engineering as their highest level of educational attainment, of which 490 (26%) were men and 129 (7%) were women; 1,154 respondents (61%) had a master's degree in civil or structural engineering, of which 810 (43%) were men and 344 (19%) were women. Sixty-seven people (4%) responded that they had a PhD in civil or structural engineering, of which 52 (3%) were men and 15 (1%) were women. Thirty-four respondents (2%) had earned some other technical degree or an MBA (23 men and 11 women). These data are shown in Figure 2.4.

FIGURE 2.4 HIGHEST DEGREE ACHIEVED

■ = men ■ = women

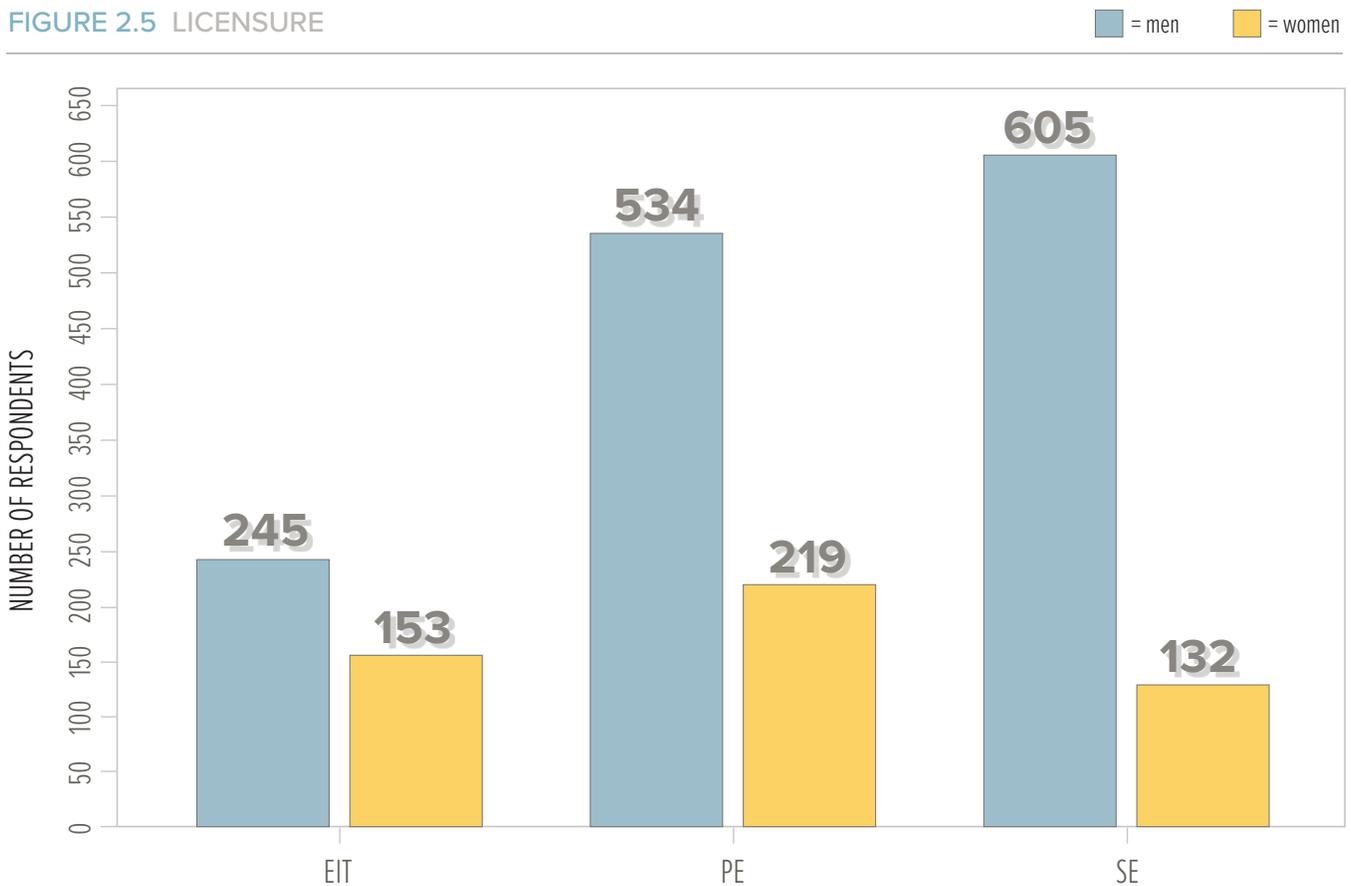


2.6 LICENSURE

In terms of licensure, 398 (21%) of the respondents reported that they had an engineer-in-training (EIT) certificate; 245 (13%) of those respondents were men and 153 (8%) were women. Seven hundred and fifty-three (40%) of the respondents indicated that they had their professional engineer license; 534 (28%) of those were men and 219 (12%) were women. Finally, 737 (39%) of the respondents had their structural engineer license; 605 (32%) of those were men and 132 (7%) were women. These data are shown in Figure 2.5.

It should be noted that not all states offer structural engineer (SE) licensure. At the time of publication of this report, only the states of Alaska, Arizona, California, Hawaii, Idaho, Illinois, Nebraska, Nevada, Oregon, Utah, and Washington offered SE licensure. Later versions of the survey asked different questions to respondents from SE licensure states versus non-SE licensure states in order to clarify license information.

FIGURE 2.5 LICENSURE



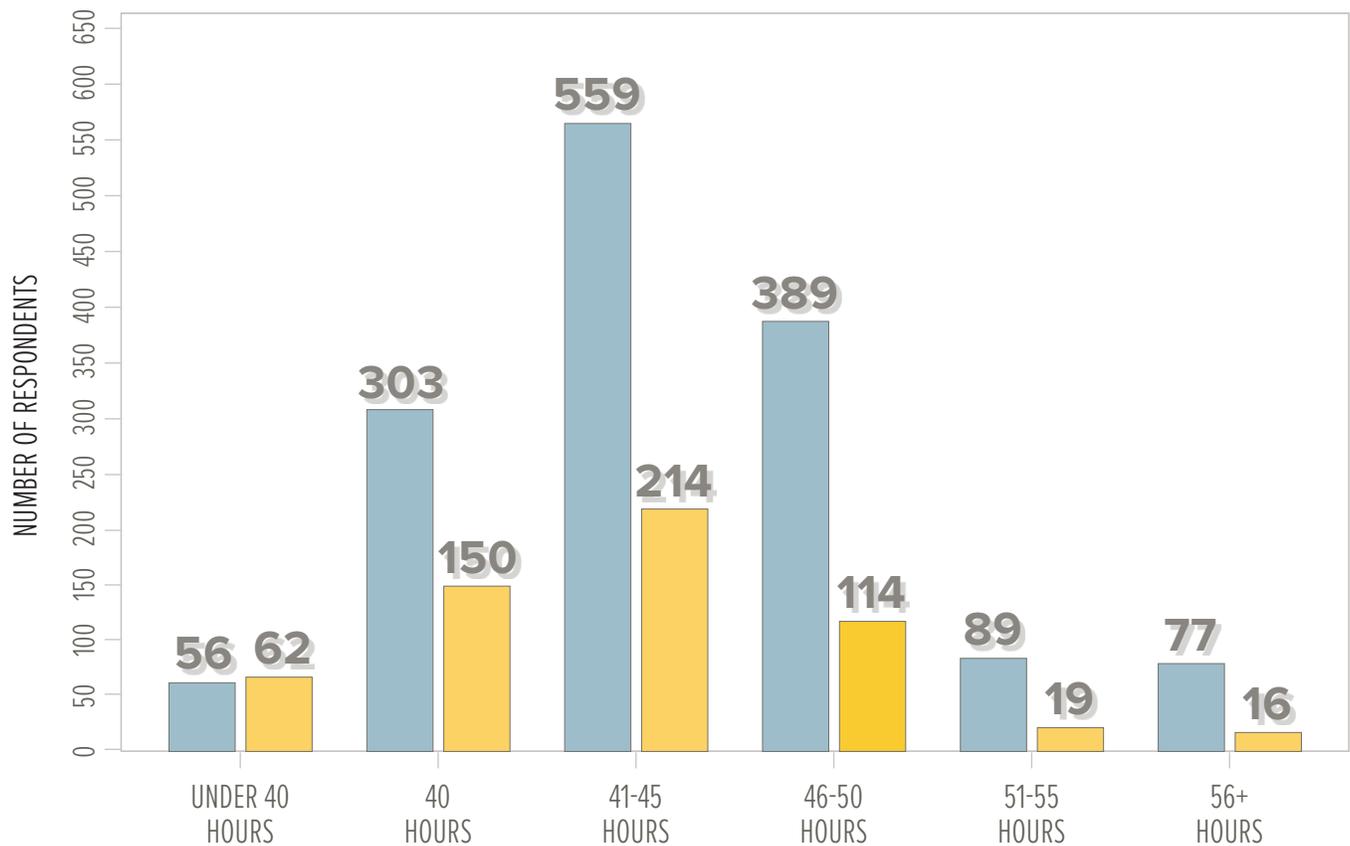
2.7 AVERAGE HOURS WORKED PER WEEK

Out of the respondents who provided pay data, the breakdown of full-time structural engineers based on how many hours they reported working on average per week was as follows, as shown in Figure 2.6:

- 118 (6%) worked fewer than 40 hours per week: 56 (3%) men and 62 (3%) women
- 453 (22%) worked around 40 hours per week: 303 (15%) men and 150 (7%) women
- 773 (38%) worked 41-45 hours per week: 559 (28%) men and 214 (10%) women
- 503 (25%) worked 46-50 hours per week: 389 (19%) men and 114 (6%) women
- 108 (5%) worked 51-55 hours per week: 89 (4%) men and 19 (1%) women
- 93 (4%) worked over 56 hours per week: 77 (3%) men and 16 (1%) women

FIGURE 2.6 AVERAGE HOURS WORKED PER WEEK

■ = men ■ = women



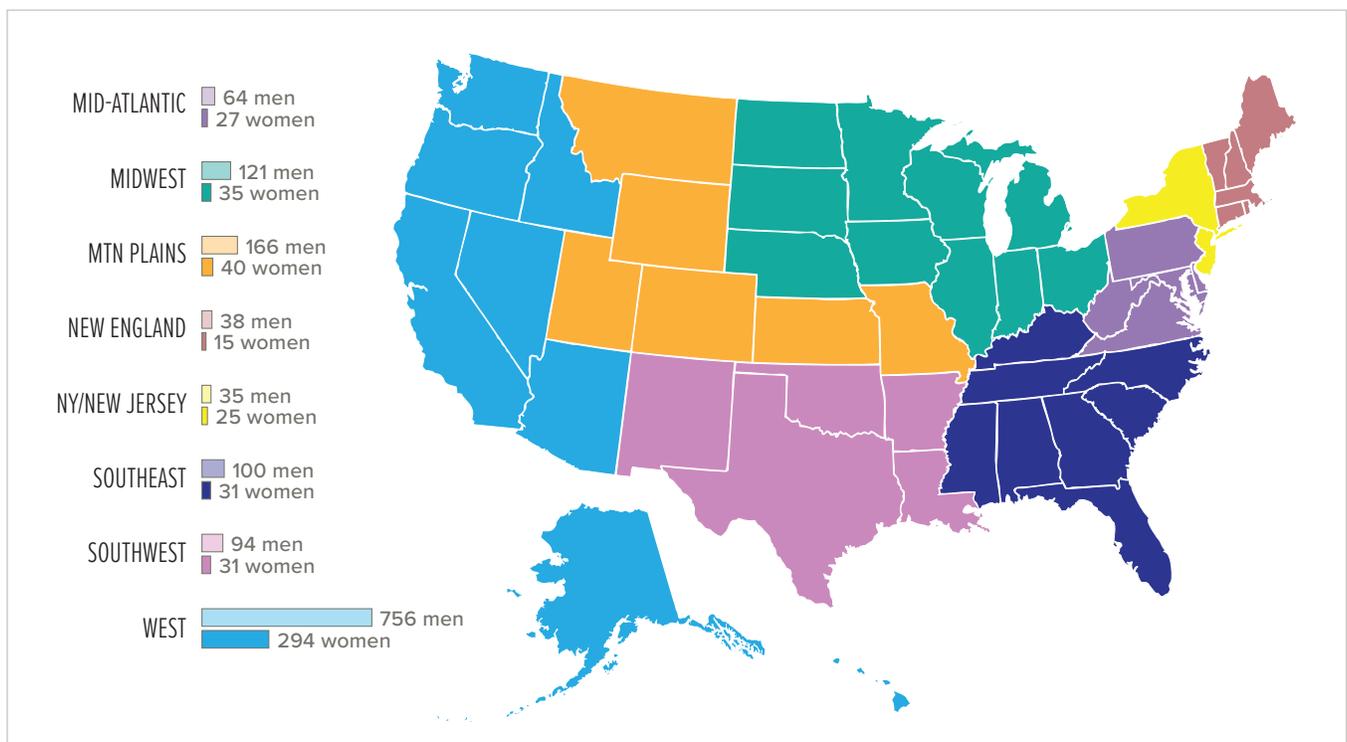
2.8 REGION

The geographical distribution of the respondents providing pay data was as follows, as shown in Figure 2.7:

- Mid-Atlantic: 91 (5%): 64 (3%) men and 27 (2%) women
- Midwest: 156 (8%): 121 (6%) men and 35 (2%) women
- Mountain Plains: 206 (11%): 166 (9%) men and 40 (2%) women
- New England: 53 (3%); 38 (2%) men and 15 (1%) women
- New York and New Jersey: 60 (3%); 35 (2%) men and 25 (1%) women
- Southeast: 131 (7%); 100 (5%) men and 31 (2%) women
- Southwest: 125 (7%); 94 (5%) men and 31 (2%) women
- West: 1,050 (56%); 756 (40%) men and 294 (16%) women

These regional divisions are defined by the US Department of Labor Bureau of Labor Statistics.

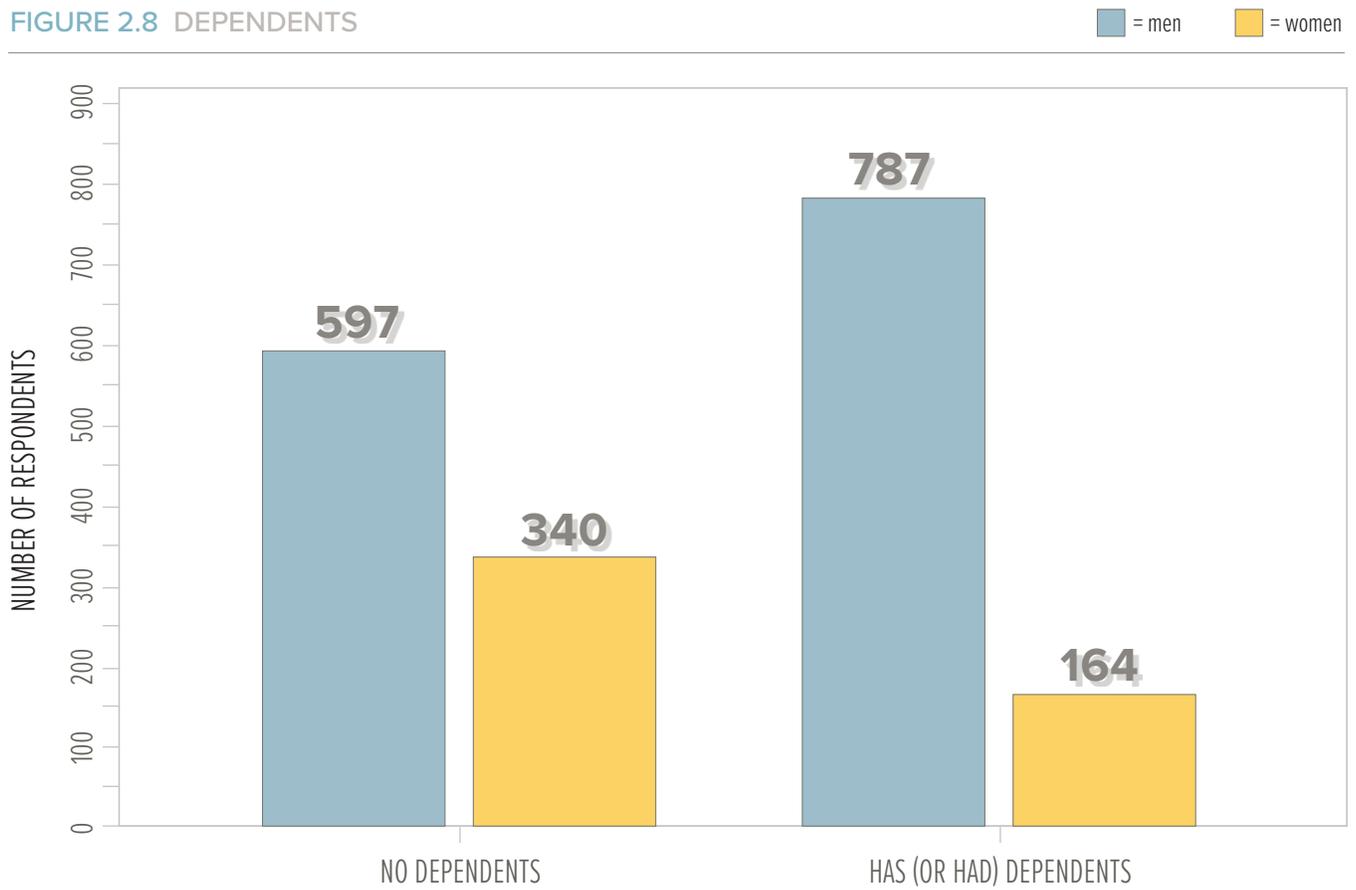
FIGURE 2.7 REGION



2.9 DEPENDENTS

Out of the respondents providing pay data, 937 (just under 50%) did not have dependents, of which 597 (32%) were men and 340 (18%) were women. Nine hundred and fifty-one (just over 50%) responded that they have dependents, of which 787 (41%) were men and 164 (9%) were women. These data are shown in Figure 2.8.

FIGURE 2.8 DEPENDENTS



CHAPTER THREE

3.0 PAY DATA BY DEMOGRAPHICS

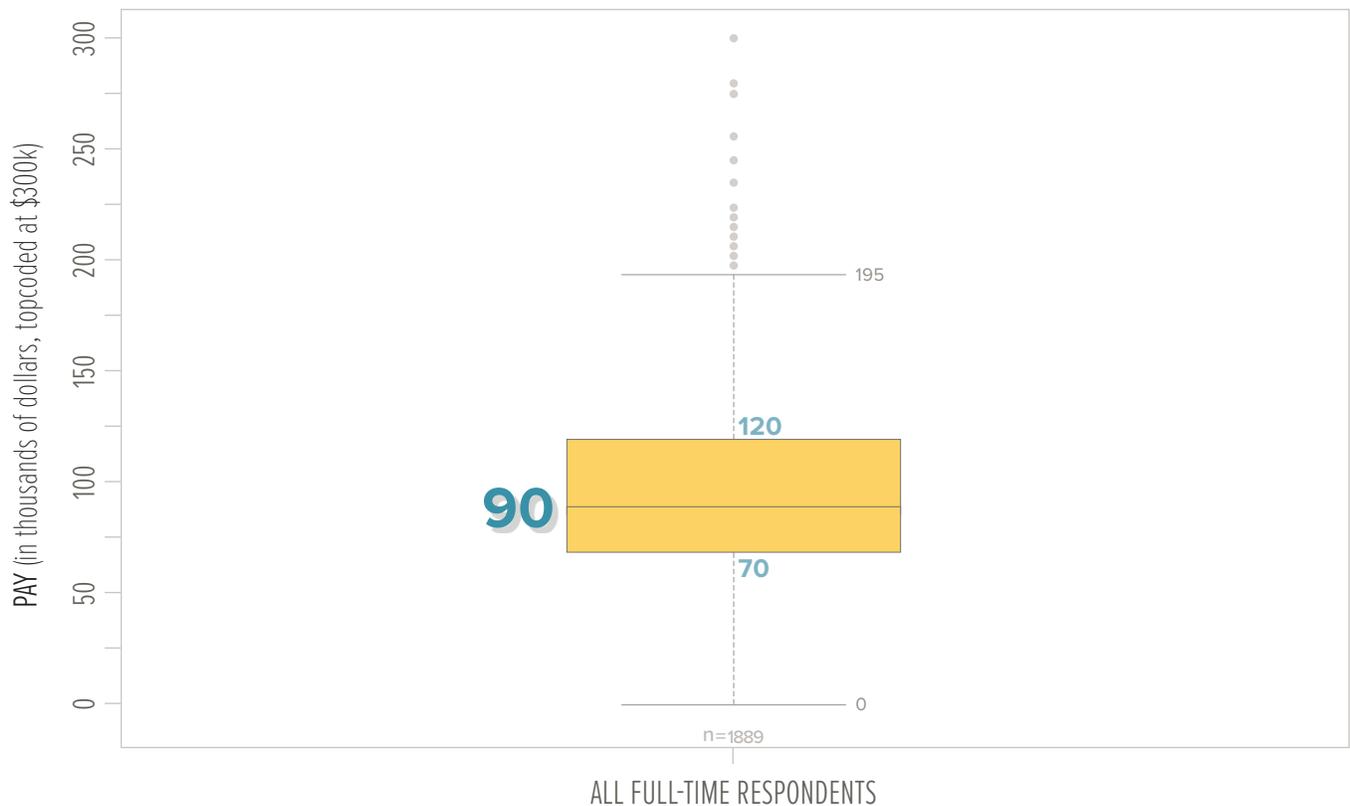
Note: The data in this chapter are independent comparisons of two variables (bivariate analyses). The reader is cautioned against drawing conclusions from these comparisons, as examining a factor in isolation can be misleading. The interpretation of variations in pay is, therefore, best reserved for Chapters 5 and 6, which present conclusions based on interfactor correlations.

3.1 INCOME OF ALL RESPONDENTS

The income of all full-time respondents, defined as those who reported working 40 or more hours per week on average, is shown in Figure 3.1. This includes 1,889 full-time respondents. The median annual income for this group is \$90,000; the 25th and 75th percentiles are \$70,000 and \$120,000, respectively.

Note that the median number of years of experience for the survey respondents who provided pay data was 10 years (out of 1,877 respondents who provided both pay and experience answers).

FIGURE 3.1 INCOME OF ALL RESPONDENTS



3.2 INCOME BY POSITION

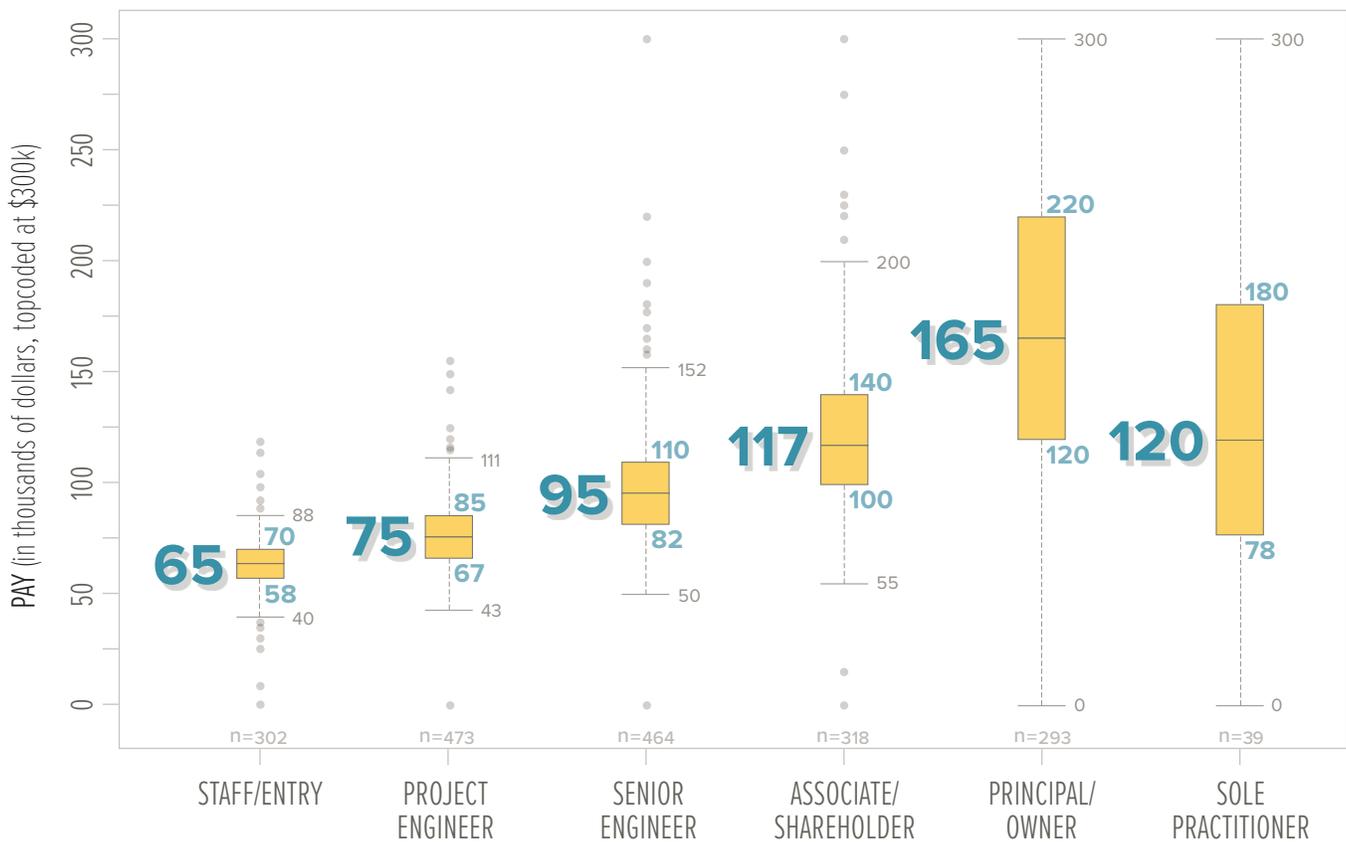
The income of full-time respondents by position is shown in Figure 3.2. The survey identified five positions that respondents could choose from:

- Staff/entry-level
- Project engineer
- Senior engineer/project manager
- Associate/shareholder
- Principal/owner/CEO/founder

These positions are described in more detail in Section 2.2 of this report.

Additionally, of those who responded that they were a “principal/owner/CEO/founder,” some were sole practitioners. Responses from sole practitioners are noted separately from responses from other principals/owners in Figure 3.2.

FIGURE 3.2 INCOME BY POSITION



For respondents who were not sole practitioners, median pay ranged from \$65,000 for staff/entry-level to \$165,000 for principals/owners. The lower the position, the more compressed the distribution, particularly the upper half of the distribution. This is a pattern common to most industries, as pay increases tend to be proportional rather than absolute.

For sole practitioners, median pay was comparable to median pay for associates/shareholders. The range of pay was much wider among sole practitioners, however. The difference between the 75th and 25th percentiles (IQR) was \$102,000 for sole practitioners but only \$40,000 for associates/shareholders.

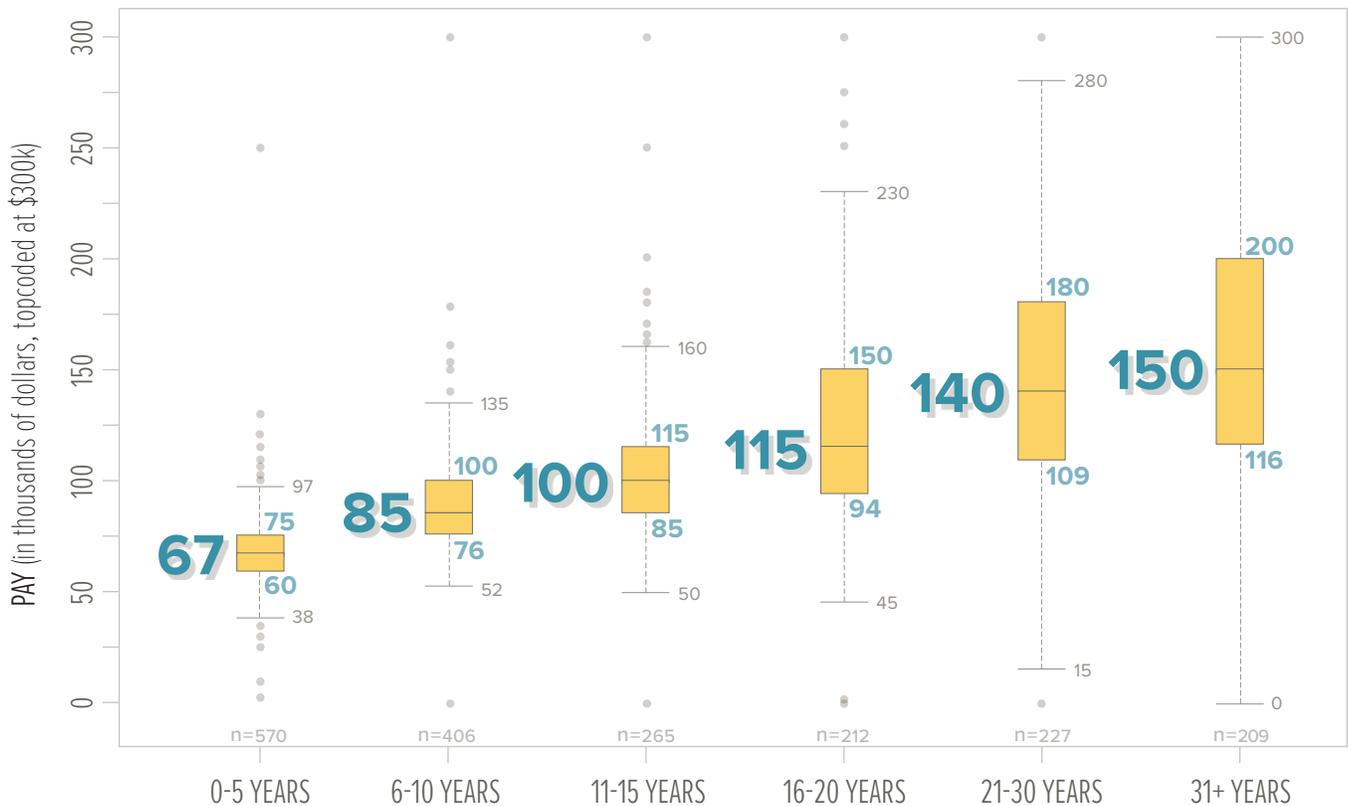
3.3 INCOME BY YEARS OF EXPERIENCE

The income of full-time respondents by years of experience is shown in Figure 3.3. The years of experience are broken into six ranges of varying length.

For all respondents, median pay showed a relatively steady increase with years of experience. For this survey, median pay among the most experienced respondents was \$150,000, which is 2.2 times the median pay of the least experienced respondents (\$67,000). The 75th percentile pay rose somewhat faster, by a factor of 2.7 from the least experienced respondent to the most experienced, while the 25th percentile pay rose slower, by a factor of just under 2.0.

As years of experience increased, the range of pay widened substantially. This is consistent with nearly all industries, as more years of experience translates to more years for individuals' career paths to diverge.

FIGURE 3.3 INCOME BY YEARS OF EXPERIENCE

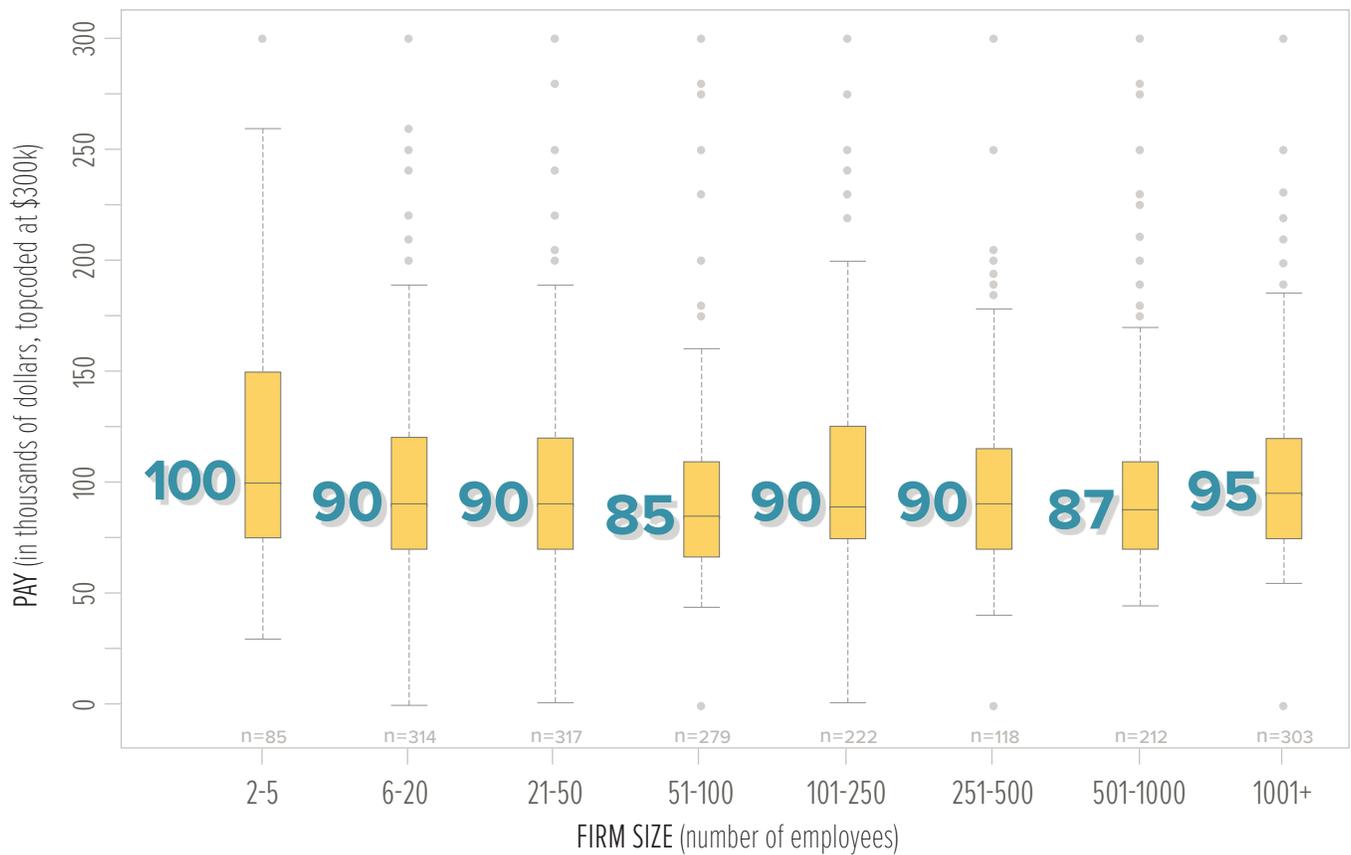


3.4 INCOME BY FIRM SIZE

The income of full-time respondents by firm size is shown in Figure 3.4.

Overall, firm size was a weak predictor of income, and no clear income patterns emerged regarding pay and firm size.

FIGURE 3.4 INCOME BY FIRM SIZE



3.5 INCOME BY DEGREES ACHIEVED

The income of full-time respondents by the highest degree achieved is shown in Figure 3.5.

The survey data in aggregate did not show any correlation between having more academic training and higher pay. Respondents with a master’s degree did not have a higher median income than respondents with a bachelor’s degree or a non-engineering degree.

However, when broken down further by years of experience, as shown in Figure 3.6, respondents with a master’s degree reported consistently higher income than those with a bachelor’s degree. Respondents with a PhD did not report consistently higher income than those with master’s degrees. Further analysis of this data also shows that respondents under 35 were considerably more likely to have a master’s degree than respondents over 35. This was true for both men and women.

FIGURE 3.5 INCOME BY HIGHEST DEGREE ACHIEVED

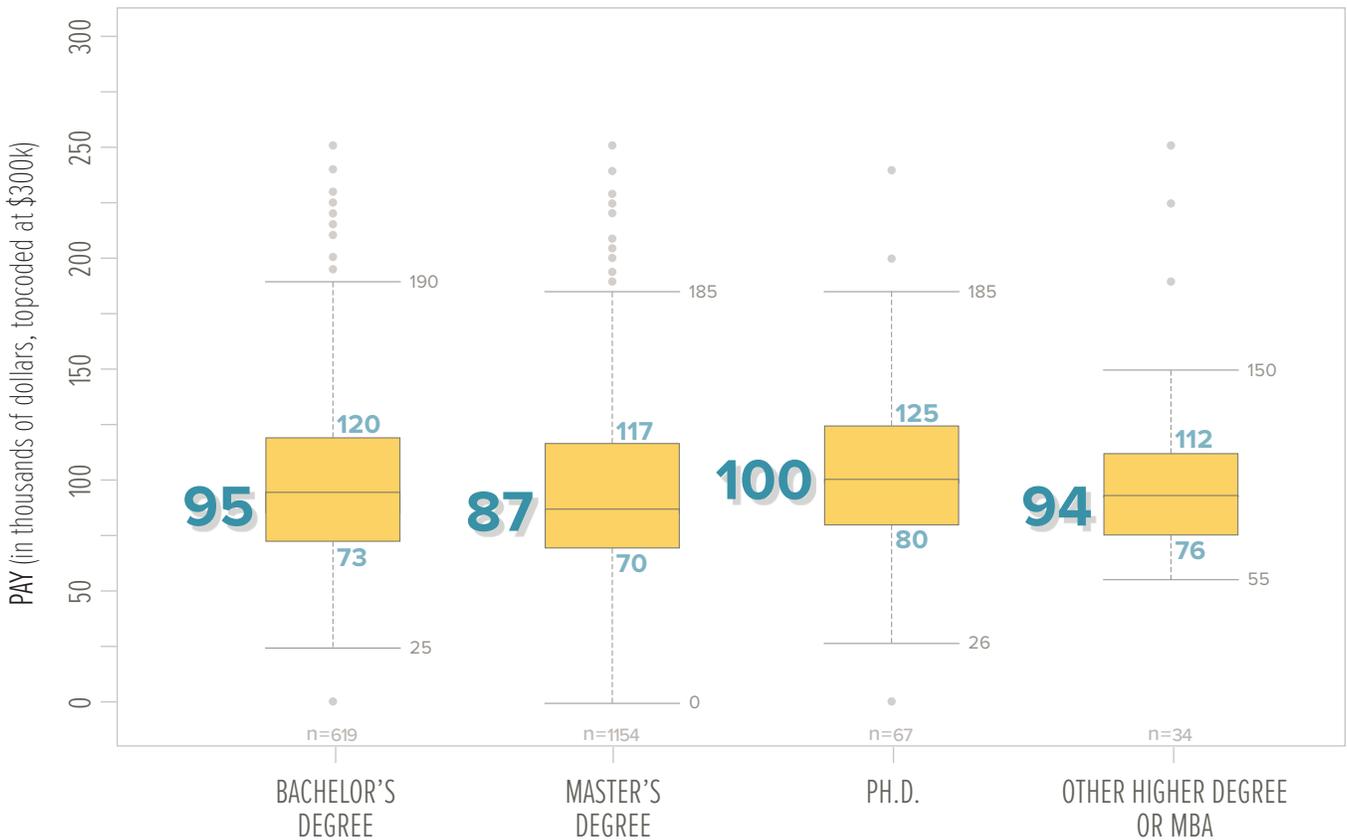


FIGURE 3.6 MEDIAN SALARY BY DEGREES AND YEARS OF EXPERIENCE

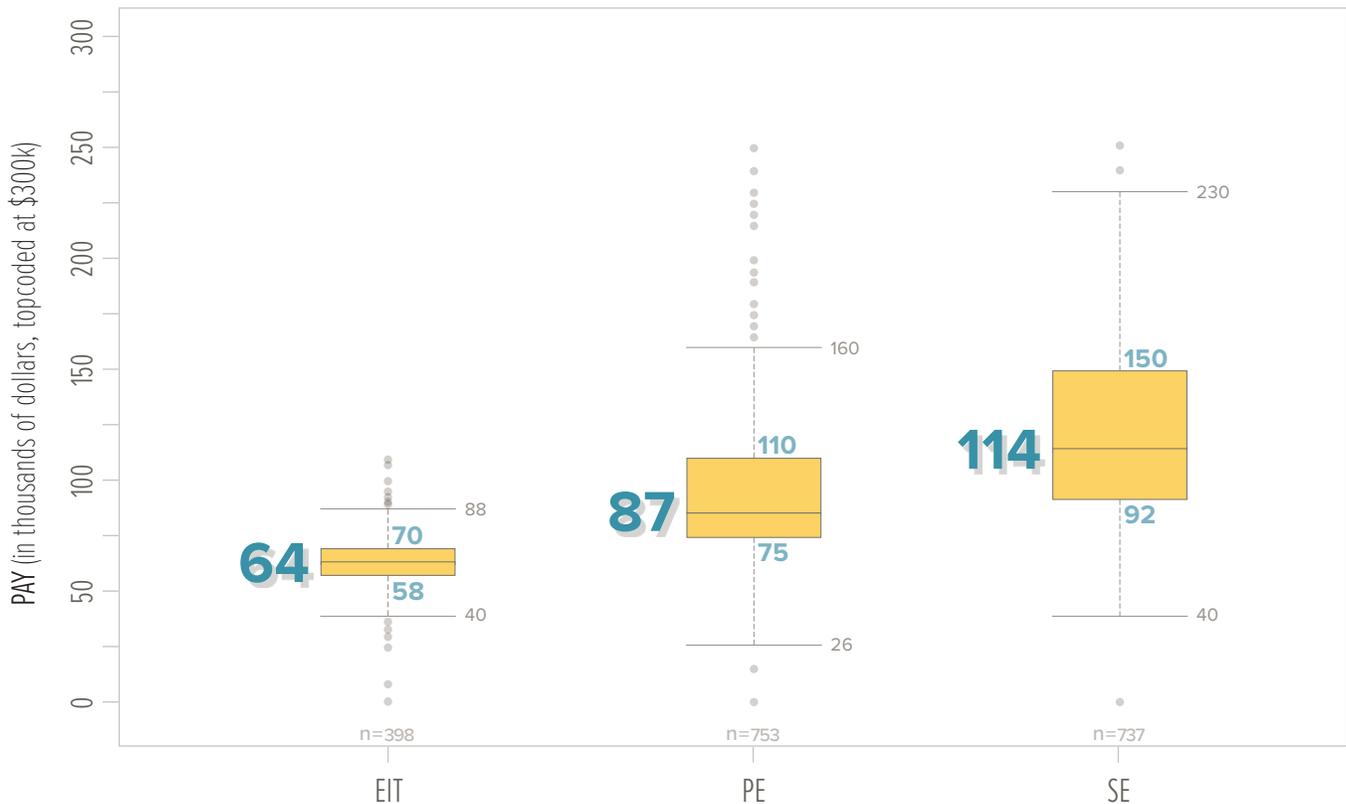
HIGHEST DEGREE ACHIEVED	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
BS in Engineering	60,000	80,000	94,000	101,500	115,000	140,000
	n=129	n=119	n=104	n=104	n=108	n=115
MS in Engineering	68,000	87,000	100,000	120,000	145,000	150,000
	n=433	n=276	n=161	n=119	n=123	n=95
PhD in Engineering	80,000	89,000	105,000	80,000	192,500	127,500
	n=15	n=20	n=9	n=5	n=6	n=16
Other higher degree or MBA	70,500	81,000	91,500	92,000	140,000	123,500
	n=4	n=10	n=6	n=5	n=7	n=4

3.6 INCOME BY LICENSURE

The income of full-time structural engineers with regard to licensure is shown in Figure 3.7. It should be noted that not all states offer structural engineer (SE) licensure. At the time of publication of this report, only the states of Alaska, Arizona, California, Hawaii, Idaho, Illinois, Nebraska, Nevada, Oregon, Utah, and Washington offered SE licensure. Later versions of the survey asked different questions to respondents from SE licensure states versus non-SE licensure states in order to clarify license information.

For respondents who had an engineer-in-training (EIT) certificate, the median income earned was \$64,000, with a narrow range of pay between the 25th and 75th percentiles (IQR). This corresponds to the narrow pay distribution shown for entry-level positions. At the professional engineer (PE) licensure level, the median income earned was between EIT and SE at \$87,000, and the IQR widened to \$35,000. At the SE licensure level, the median income earned increased to \$114,000, while the IQR widened further to \$58,000. This corresponds to the wider pay distribution shown by those with more years of experience.

FIGURE 3.7 INCOME BY LICENSURE



The same data were broken out for the state of California, due to the high number of Californian respondents. These data are shown in Figure 3.8. Engineers in California with an EIT certificate reported a median income of \$66,000. Engineers in California with a PE license reported a median income of \$85,000. These median incomes were within \$2,000 of the median for respondents nationwide (which included the California responses). At the SE licensure level, engineers in California reported making a median income of \$120,000, which is \$6,000 higher than the nationwide median.

FIGURE 3.8 INCOME BY LICENSURE: CALIFORNIA ONLY

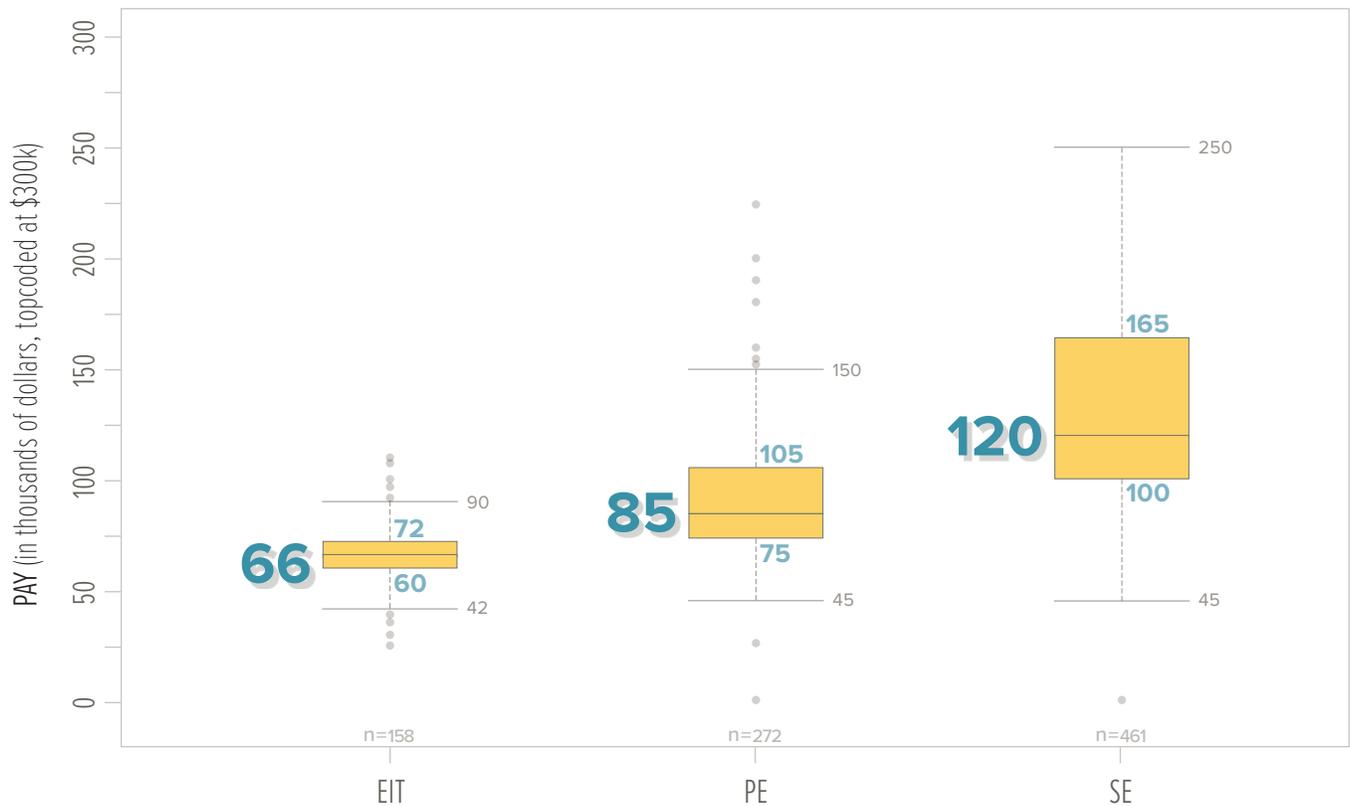


Figure 3.9 shows income versus licensure broken down further, by years of experience. The median income reported for engineers with an EIT certificate did not rise at the same rate as that of engineers with either a PE or SE license. Additionally, the rises in income for engineers with an SE were significantly higher than those for engineers with a PE.

For each range of experience, engineers with their SE license had the highest median income. The only exception was at 0-5 years, where engineers with their PE and SE licenses reported the same median income.

FIGURE 3.9 MEDIAN SALARY BY LICENSURE AND YEARS OF EXPERIENCE

LICENSURE	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
EIT	63,000	70,500	60,000	76,500	100,000	-
	n=377	n=26	n=3	n=2	n=2	n=0
PE	75,000	82,000	90,000	110,000	113,500	122,500
	n=192	n=229	n=126	n=82	n=88	n=86
SE	75,000	92,000	102,000	117,000	145,000	150,000
	n=13	n=171	n=155	n=149	n=157	n=151

Figure 3.10 shows income versus licensure and years of experience broken out for engineers in the state of California. Unlike the national data, the number of engineers with their PE license dropped off after 0-5 years of experience. It should be noted that engineers can test for their PE license after two years of experience in California, and that these requirements vary by state. Some states require more years of experience before being able to test for the PE license.

For most experience ranges, engineers with their SE license reported higher income than engineers with an EIT certificate or PE license, which is consistent with the national data.

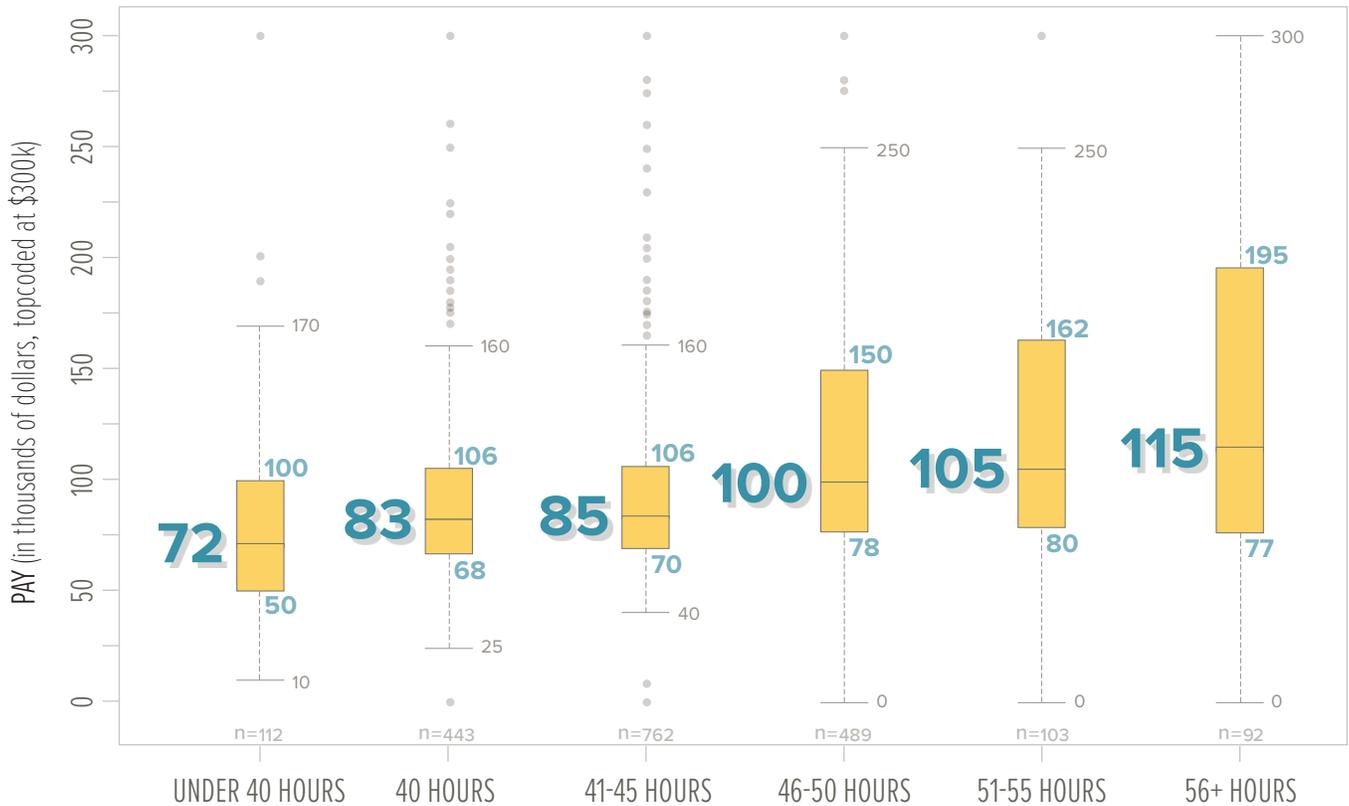
FIGURE 3.10 MEDIAN SALARY BY LICENSURE AND YEARS OF EXPERIENCE: CALIFORNIA ONLY

LICENSURE	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
EIT	65,000	90,000	50,000	76,500	100,000	-
	n=151	n=7	n=1	n=2	n=2	n=0
PE	77,000	88,000	85,000	125,000	125,000	132,500
	n=115	n=89	n=31	n=16	n=19	n=24
SE	101,000	100,000	110,000	125,000	150,000	160,000
	n=3	n=106	n=89	n=97	n=99	n=108

3.7 INCOME BY AVERAGE HOURS WORKED

Figure 3.11 shows the reported income earned in relation to the average weekly hours worked. Median income increased with the reported number of weekly hours worked. The IQR also increased with the average weekly hours worked. Comparing these ranges, the increase in pay varies from only \$2,000 between 40 hours and 41-45 hours to \$15,000 between 41-45 and 46-50 hours.

FIGURE 3.11 INCOME BY AVERAGE HOURS WORKED



3.8 INCOME BY REGION

Figure 3.12 shows the reported income earned in relation to the region in which one works. Median income was fairly similar between regions, with the exception of the New York/New Jersey region and the West region, which had higher medians than the remainder of the regions.

Refer to Section 2.8 for a map that indicates the locations of each region.

FIGURE 3.12 INCOME BY REGION

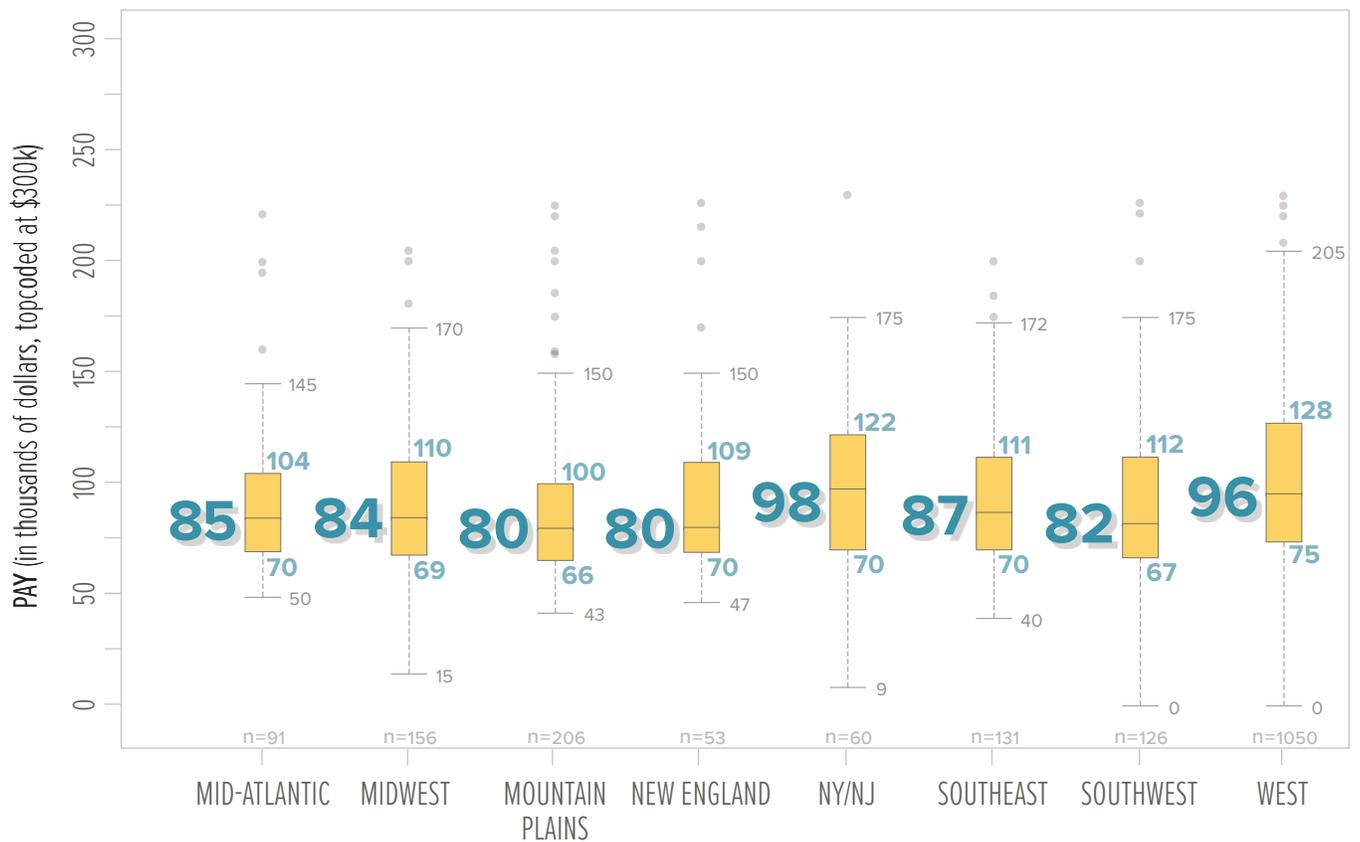


Figure 3.13 shows the median salary by region broken down by years of experience. The two regions that had the highest overall median salaries (New York/New Jersey and West) did not necessarily have the highest median salary for each level of experience. For example, the New England region had the second highest median income for years of experience from 0-5 years but one of the lowest overall median incomes. This may be due to the low number of respondents from New England who have a high level of experience.

FIGURE 3.13 MEDIAN SALARY BY REGION AND YEARS OF EXPERIENCE

REGION	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
Mid-Atlantic	65,000	80,000	89,000	130,000	115,000	141,000
	n=23	n=24	n=13	n=9	n=13	n=10
Midwest	63,000	80,000	90,000	115,000	115,000	116,000
	n=49	n=27	n=30	n=21	n=15	n=19
Mountain Plains	62,000	75,000	90,000	95,000	125,000	150,000
	n=63	n=53	n=43	n=27	n=25	n=16
New England	69,000	74,000	90,500	103,000	132,000	125,000
	n=16	n=16	n=2	n=7	n=7	n=10
New York/New Jersey	66,500	96,000	122,500	133,000	197,000	60,000
	n=16	n=18	n=8	n=10	n=6	n=5
Southeast	64,000	75,000	94,000	95,000	112,000	120,000
	n=33	n=33	n=15	n=15	n=21	n=21
Southwest	65,000	82,000	105,000	101,000	145,000	145,000
	n=47	n=26	n=21	n=7	n=11	n=17
West	70,000	93,500	100,000	120,000	145,000	150,000
	n=333	n=228	n=151	n=132	n=144	n=137

Figure 3.14 shows the reported income earned versus the city in which one works. Unlike the data above regarding regions, when median income was compared according to individual cities, the range of median incomes increased. Based on this figure, New York, Oakland, and San Francisco have the highest overall median incomes for full-time structural engineers. Note that the cities that were evaluated only included those with greater than approximately 40 respondents.

FIGURE 3.14 INCOME BY CITY

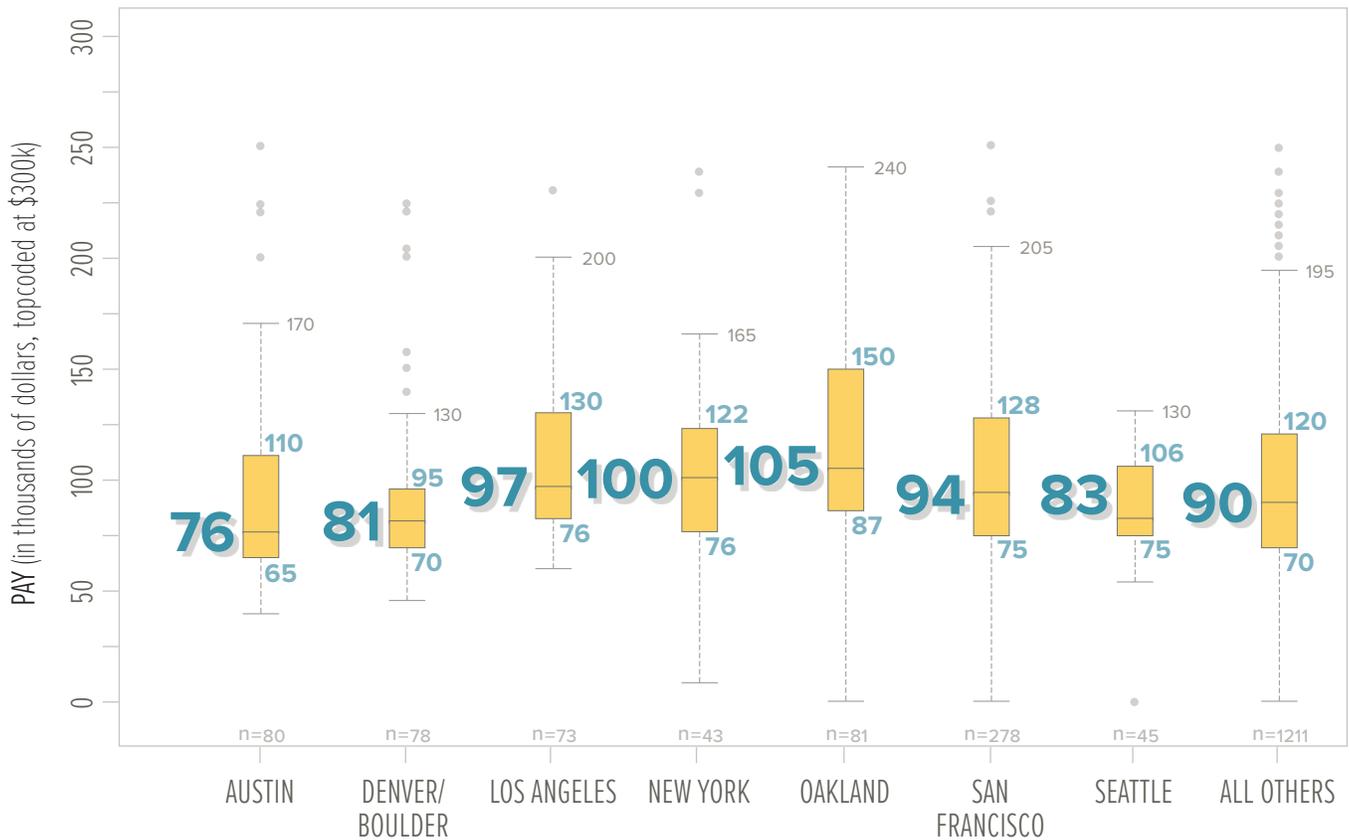


Figure 3.15 also shows the median salary by city but also broken down by years of experience. When salaries were broken down by years of experience, the cities with the highest overall medians did not necessarily have the highest medians in each category.

FIGURE 3.15 MEDIAN SALARY BY CITY AND YEARS OF EXPERIENCE

CITY	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
Austin	65,000	85,000	110,000	101,000	149,000	152,500
	n=39	n=13	n=10	n=3	n=4	n=14
Denver/Boulder	68,000	79,000	90,000	92,500	122,500	150,000
	n=29	n=18	n=15	n=8	n=4	n=9
Los Angeles	68,640	98,000	110,000	136,000	155,000	140,000
	n=25	n=17	n=11	n=10	n=8	n=6
New York	67,000	100,000	122,500	126,000	240,000	112,500
	n=11	n=15	n=6	n=7	n=3	n=2
Oakland	83,000	105,000	99,000	136,000	150,000	155,000
	n=25	n=18	n=11	n=9	n=13	n=14
San Francisco	71,000	95,000	110,000	137,500	190,000	182,500
	n=107	n=77	n=31	n=28	n=26	n=24
Seattle	72,000	89,500	99,500	116,000	205,000	100,000
	n=21	n=8	n=10	n=6	n=2	n=1
Other	64,000	80,000	97,000	109,500	120,000	140,000
	n=325	n=260	n=190	n=162	n=187	n=167

3.9 INCOME FOR RESPONDENTS WITH DEPENDENTS

Figure 3.16 shows the median salary as a function of having (or having previously had) dependents. The figure shows that respondents without dependents had a median income of \$75,000 while those with dependents had a median income of \$108,000.

FIGURE 3.16 INCOME AND DEPENDENTS

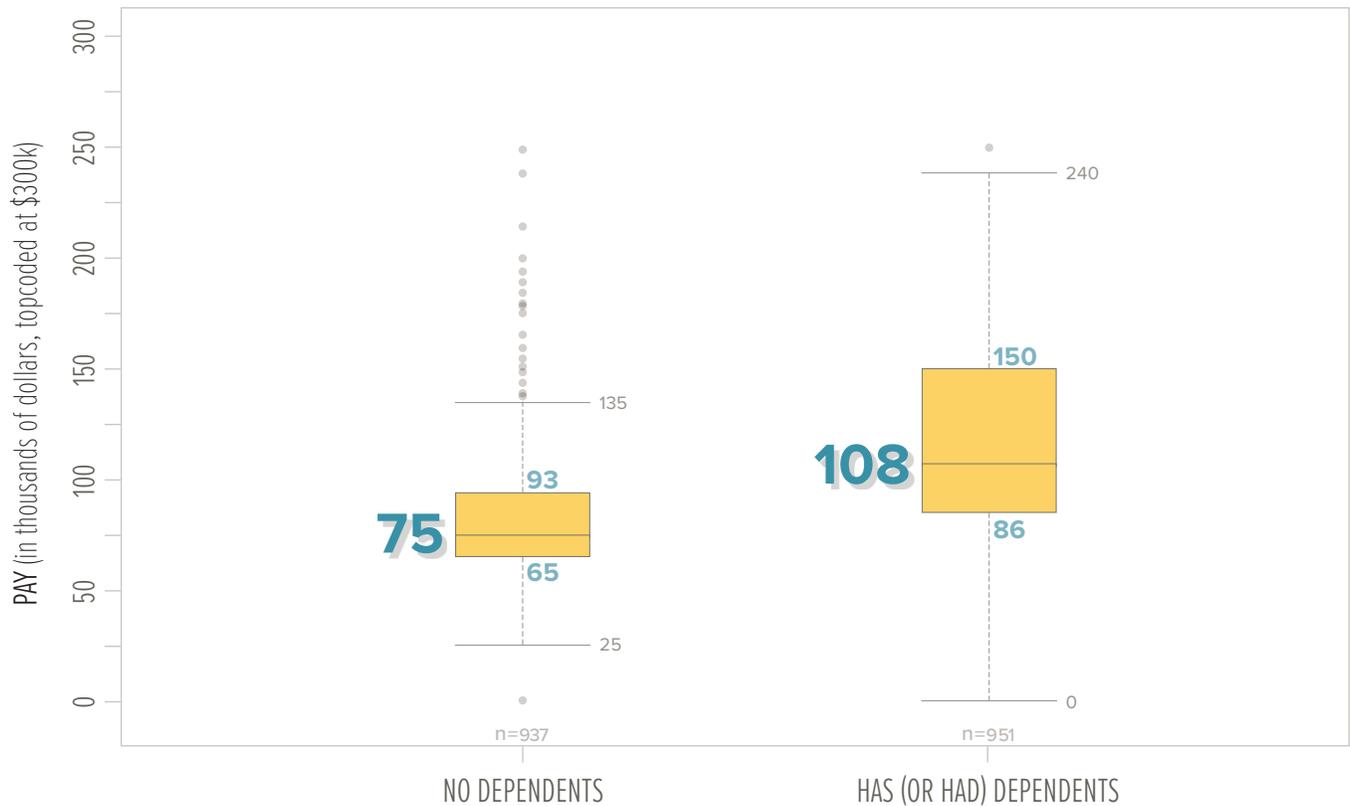


Figure 3.17 shows median salary in relation to having (or having previously had) dependents, broken down by years of experience. The figure shows that the majority of the respondents who answered “no” to the question “Do you have children and/or dependents?” had 10 or fewer years of experience. For people who answered “yes” to the question, the majority of the respondents had more than 10 years of experience. The years of experience of people with dependents and without dependents account for the large disparity in overall median income.

When comparing respondents who answered “yes” and “no” in each category, respondents who answered “yes” had a slightly higher median salary in every category above 10 years of experience.

FIGURE 3.17 MEDIAN SALARY BY DEPENDENTS AND YEARS OF EXPERIENCE

HAVE (HAD) DEPENDENTS	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
No	67,000	85,000	94,000	110,000	117,500	125,000
	n=518	n=235	n=81	n=39	n=48	n=49
Yes	65,500	85,000	100,000	115,000	135,000	150,000
	n=64	n=91	n=203	n=194	n=199	n=188

Figure 3.18 further breaks down the median salary in relation to having (or having previously had) dependents by years of experience and gender. With the exception of respondents with 0-5 years of experience with no dependents, men had a higher median salary than women in every category.

FIGURE 3.18 MEDIAN SALARY BY DEPENDENTS, GENDER, AND YEARS OF EXPERIENCE

DEPENDENTS AND GENDER	YEARS OF EXPERIENCE					
	0-5	6-10	11-15	16-20	21-30	31+
No dependents: Men	67,000	87,500	95,000	120,000	120,000	130,000
	n=319	n=156	n=48	n=27	n=28	n=39
No dependents: Women	68,000	85,000	90,000	102,500	112,500	130,000
	n=199	n=79	n=33	n=12	n=20	n=7
Dependents: Men	66,000	86,000	100,000	120,000	140,000	150,000
	n=51	n=133	n=137	n=157	n=175	n=171
Dependents: Women	65,000	80,000	91,000	98,000	113,500	128,000
	n=13	n=58	n=66	n=37	n=24	n=16

CHAPTER FOUR

4.0 PAY DATA OF OTHER INFLUENCES

Note: The data in this chapter are independent comparisons of variables. The reader is cautioned against drawing conclusions from these independent comparisons, as examining a factor in isolation can be misleading. The interpretation of variations in pay between variables is, therefore, best reserved for Chapters 5 and 6, which present conclusions based on interfactor correlations.

4.1 INCOME AND CONSIDERING LEAVING THE PROFESSION

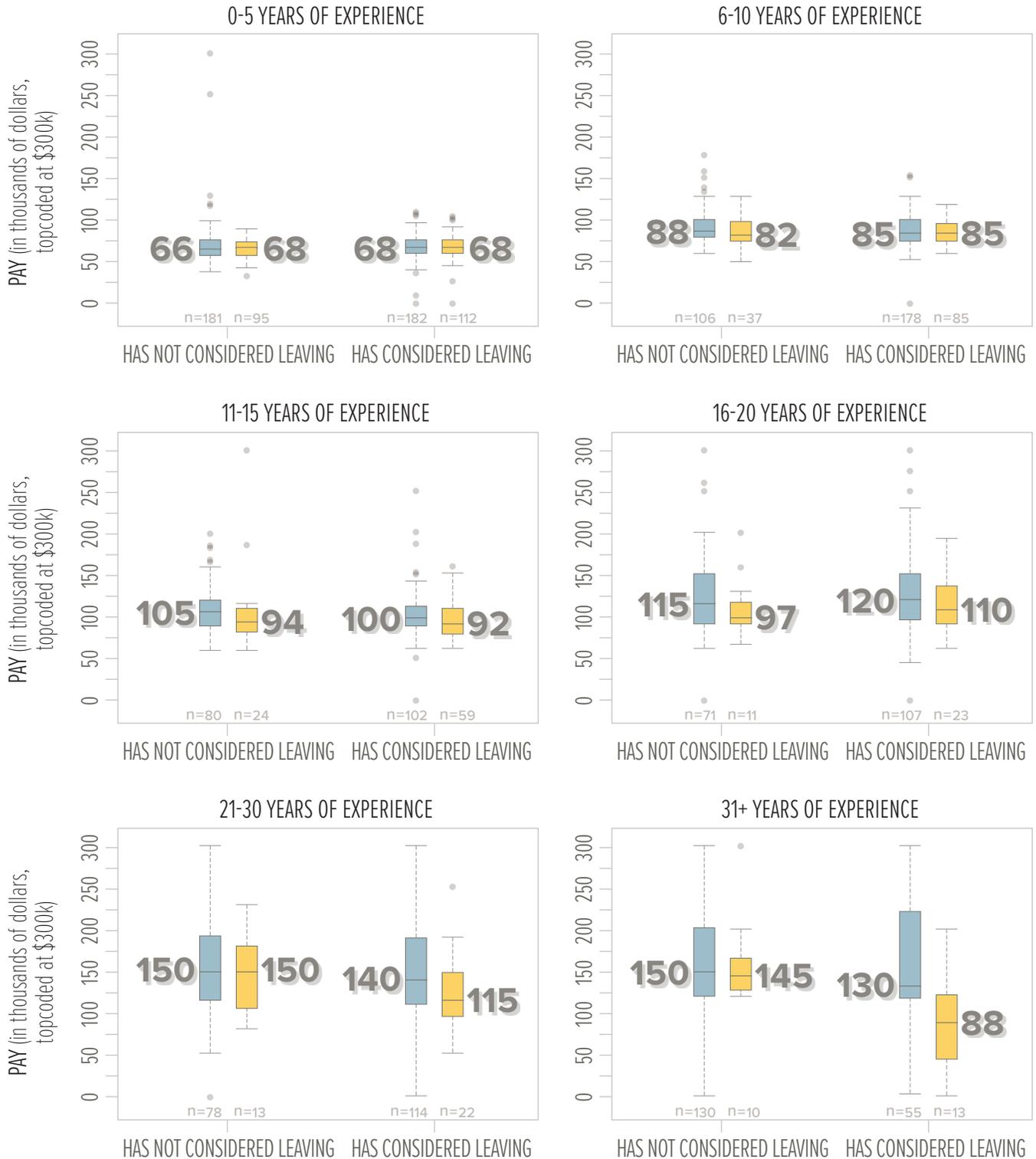
Figure 4.1 shows income ranges for respondent subgroups defined by their answer to the question “Since you started working as a structural engineer, have you ever considered leaving the profession?” broken down by gender and years of experience.

At each level of experience, women were more likely to have considered leaving the profession, with the largest gaps at 11-15 years (71% of women vs. 56% of men) and at over 30 years (57% of women vs. 30% of men).

In the first four experience categories, there is no clear difference in pay patterns between the “yes” responses and the “no” responses. While it is clear that women are more likely to consider leaving the profession, there is no clear correlation between compensation and considering leaving the profession. Among respondents with more than 20 years of experience, women who had considered leaving the profession reported lower median pay than women who had not.

FIGURE 4.1 INCOME AND CONSIDERING LEAVING PROFESSION

■ = men ■ = women



4.2 INCOME AND OVERALL CAREER SATISFACTION

Figure 4.2 shows income ranges as a function of overall career satisfaction and gender. The respondents rated their career satisfaction on a five-point satisfaction scale ranging from “very satisfied” to “very dissatisfied.”

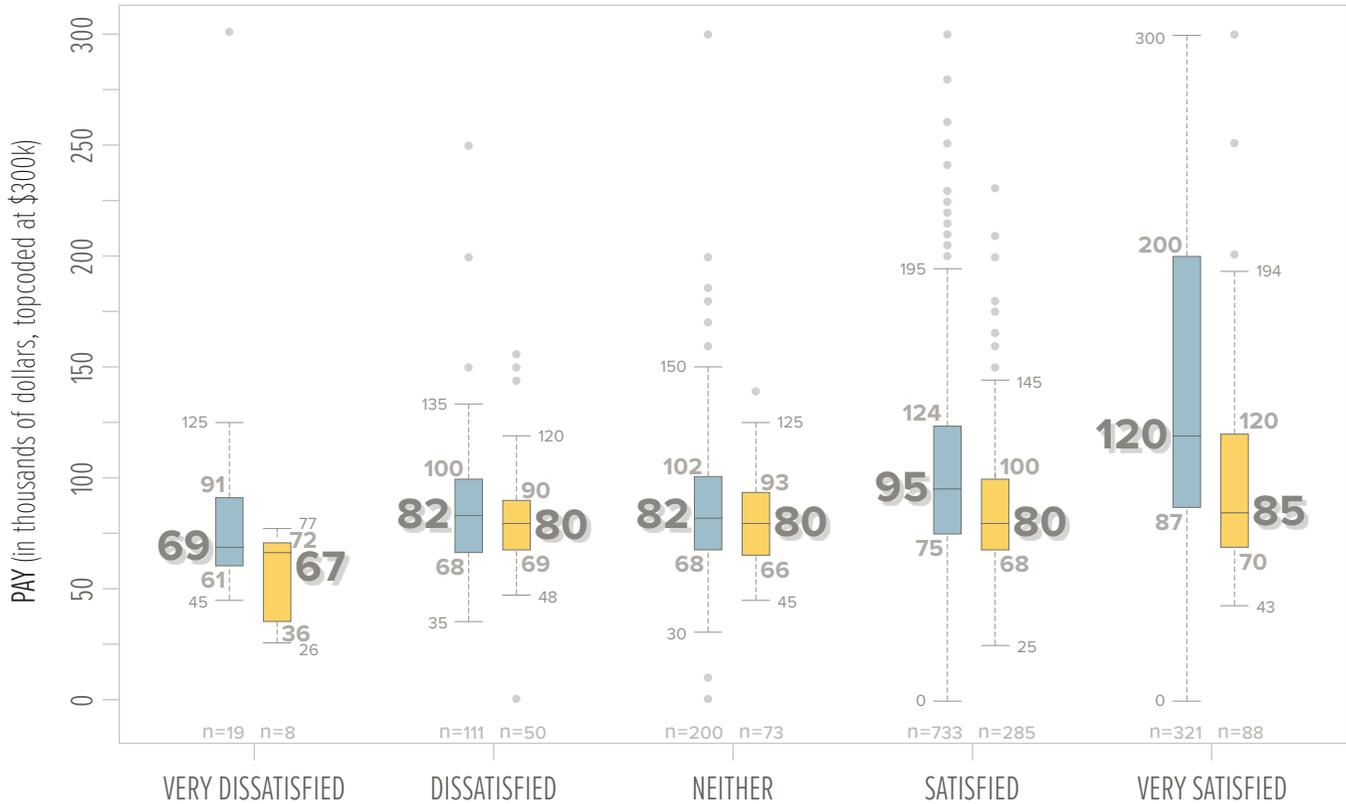
For male respondents, there is a correlation between median pay and level of satisfaction. Moving from “very dissatisfied” to “very satisfied,” men’s median pay increased from \$69,000 to \$120,000.

For female respondents, the correlation between median pay and career satisfaction is less clear. The pay at each level of satisfaction did not increase steadily as it did for men. Median pay was \$67,000 for the lowest level of satisfaction, \$80,000 for each of the next three intermediate levels of satisfaction, and \$85,000 among the most satisfied.

If the 75th percentile is considered, there is a clearer correlation between pay and career satisfaction for both men and women. The 75th percentile pay increased steadily with each level of satisfaction.

FIGURE 4.2 INCOME AND OVERALL CAREER SATISFACTION

■ = men ■ = women



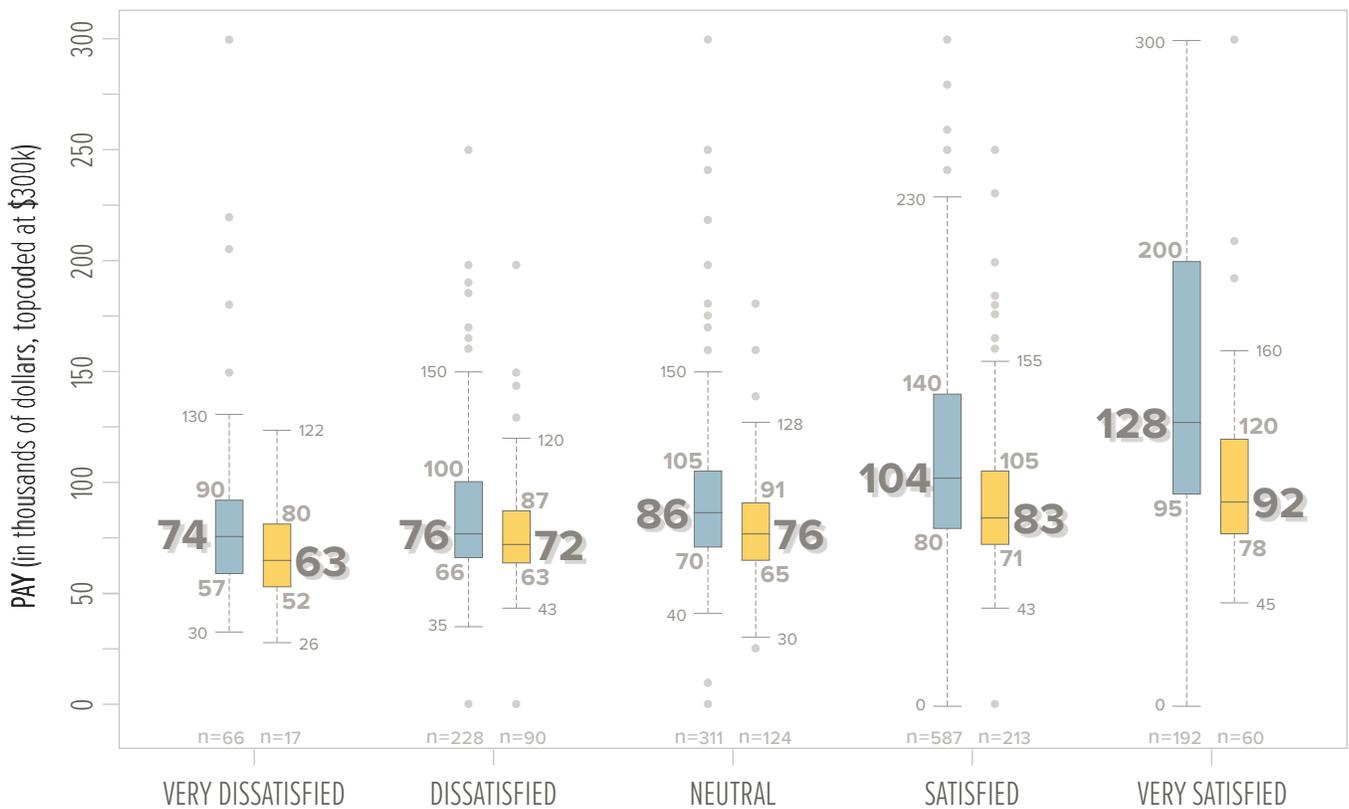
4.3 INCOME AND SATISFACTION WITH PAY

Figure 4.3 shows income ranges for respondents grouped according to their satisfaction with pay and then broken down by gender. The respondents rated their satisfaction with pay based on a five-point satisfaction scale ranging from “very satisfied” to “very dissatisfied.”

Unlike the previous figure of income and overall career satisfaction, there is a clear correlation between income and satisfaction with pay, for women and men alike, and for each pay quartile: the 25th percentile, median, the 75th percentile, and the upper bound. The level of satisfaction with pay increased as pay increased.

FIGURE 4.3 INCOME AND SATISFACTION WITH PAY

■ = men ■ = women



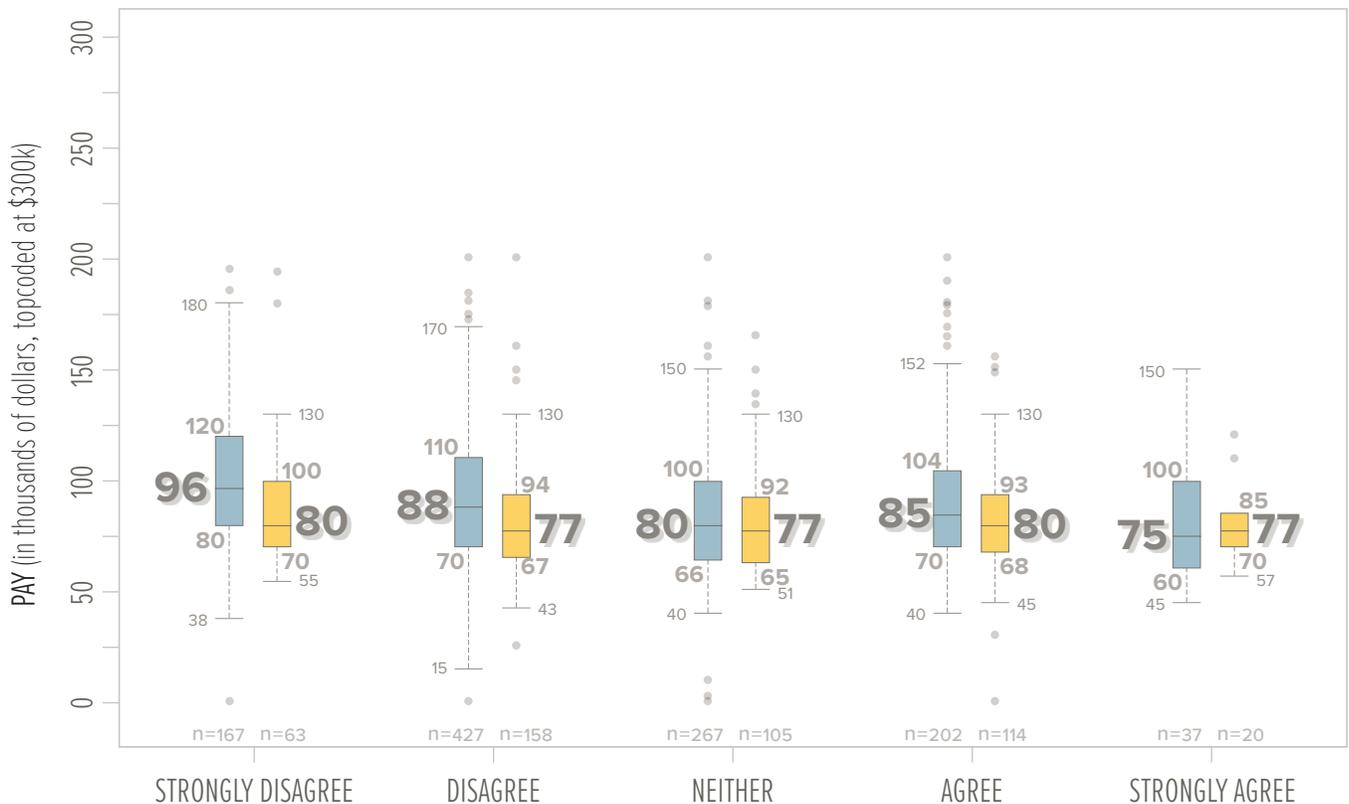
4.4 INCOME AND DIFFICULTY DISCUSSING ADVANCEMENT

Figure 4.4 shows income ranges as a function of respondents' difficulty discussing advancement and of gender. The respondents rated their difficulty discussing advancement on a five-point scale of agreement with the following statement: "I have difficulty discussing advancement with my superiors."

Looking at median pay for men, there is a weak correlation between lower income and greater difficulty with discussing advancement. Among women, pay was more or less the same whether or not they reported difficulty discussing advancement.

FIGURE 4.4 INCOME AND DIFFICULTY DISCUSSING ADVANCEMENT

■ = men ■ = women



4.5 INCOME AND MENTORSHIP

Approximately 55% of both men and women reported having a professional mentor. For women, the pay ranges were almost identical for those who had a mentor and those who did not have a mentor, as shown in Figure 4.5. For men, respondents who had a mentor were paid more than respondents who did not have a mentor: \$8,000 more based on median pay, and \$19,000 more based on 75th percentile pay. While the purpose of this report is to study current trends in pay, the 2016 survey report examined more fully the non-monetary benefits of having a mentor.

When broken down by years of experience, as shown in Figure 4.6, a similar trend persists. At lower experience levels, there appears to be negligible difference between pay for respondents with and without mentors. At greater experience levels, however, female respondents continued to indicate negligible differences in pay, while male respondents indicated an increase in pay corresponding to the presence of a mentor. In the highest experience category, both men and women with mentors were paid more than those without mentors.

FIGURE 4.5 INCOME AND MENTORSHIP

■ = men ■ = women

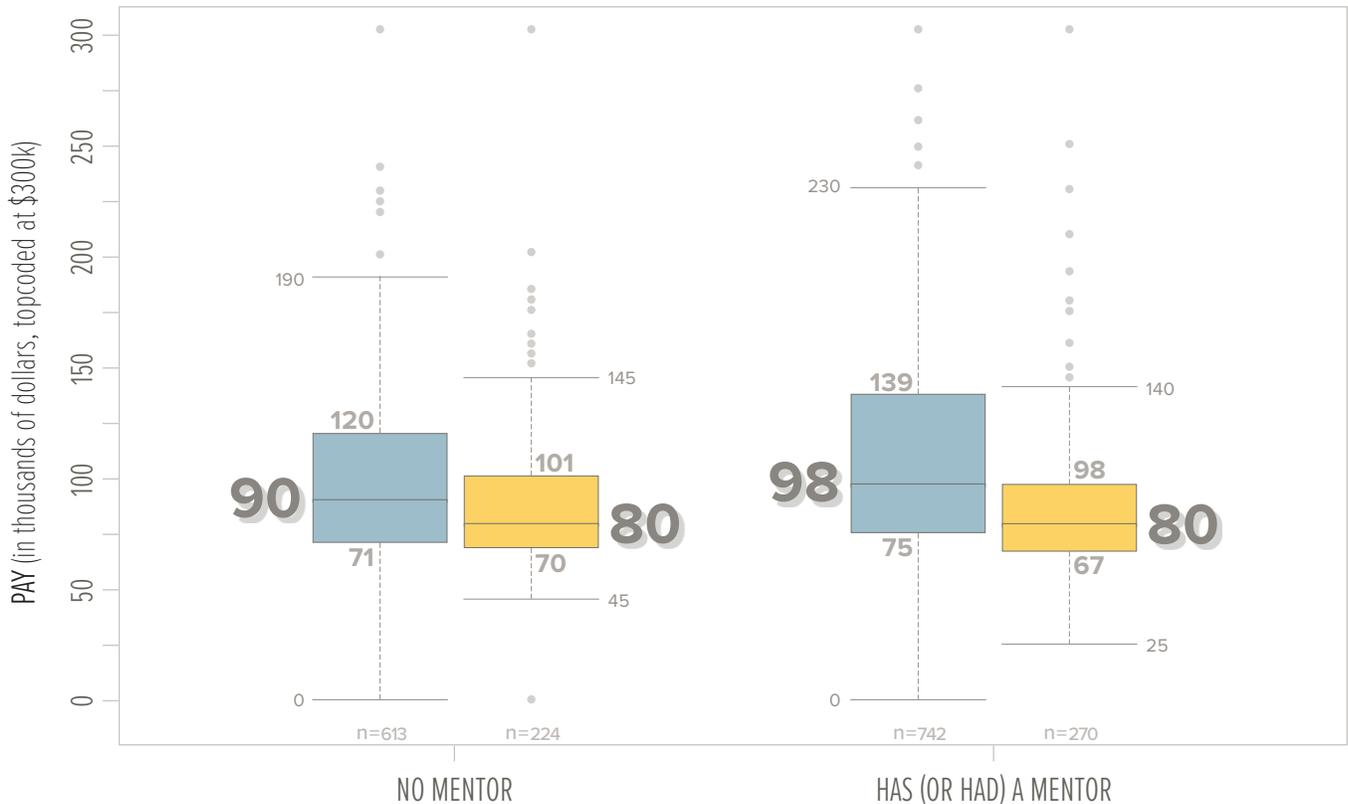
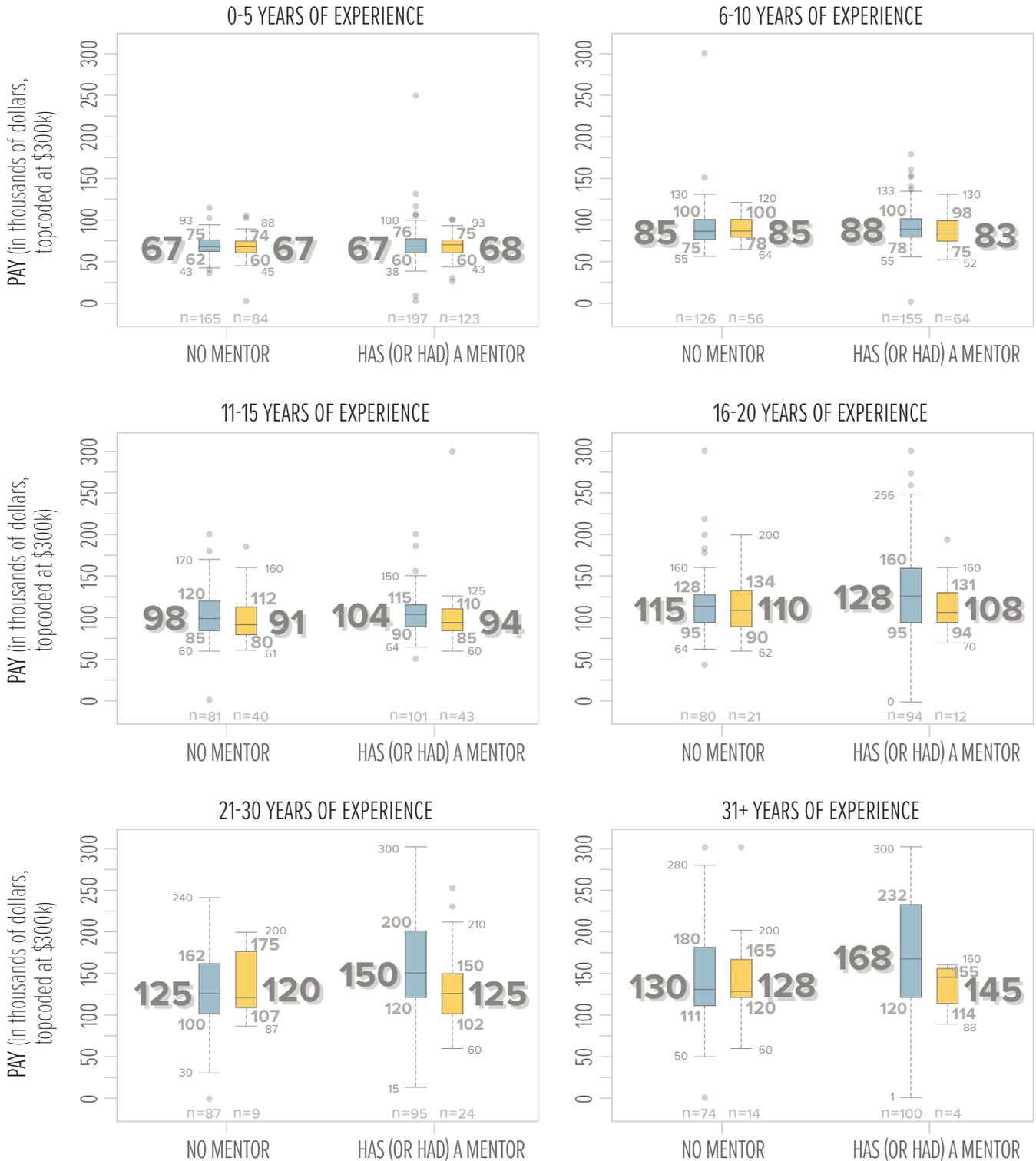


FIGURE 4.6 INCOME AND MENTORSHIP

■ = men ■ = women



CHAPTER FIVE

5.0 A MULTIFACTOR MODEL OF PAY

5.1 METHODS OF VARIABLE SELECTION

In order to develop a statistical model, the variables that are most relevant in predicting the pay of structural engineers must be identified. Statisticians have numerous techniques for identifying relevant predictors among the often-large number of variables available from survey responses. The methods of variable selection used with the SE3 data to identify these predictors are as follows:

- Bayesian model averaging (BMA)
- Best subset regression (BSR)
- Ridge regression
- LASSO regression
- Elastic-net regression (a hybrid of LASSO and ridge regression)
- OLS regression with forward selection
- OLS regression with stepwise selection

These methods vary in their details, but their common objective is to avoid “overfitting” the data. Because of the random nature of every survey sample, some of the correlation observed among the variables is, in fact, random. Avoiding overfitting means trying to prevent those random correlations from influencing the outcome of the search for the best predictors. If the chosen model predicts pay for a new sample (e.g., a “holdout” sample, or a portion of the sample that was not used to estimate the model) just as well as it predicts pay in the sample used to develop the model, then the model has not been overfit.

Cross-validation (among other things) was used to avoid overfitting the SE3 model. This involves estimating the model on one portion of the data and then evaluating it in the remainder of the data and doing this repeatedly, with different portions of the data being reserved as the testing (validation) data. Based on this, the analysts concluded that it was reasonable to say that the final SE3 model was not overfit.

After analyzing the data using these methodologies, a consistent subset of variables that contributes the most to explaining the observed variation in the survey respondents’ pay was found across the competing methods. This means that the patterns found in the SE3 data are strong and that the most relevant variables for predicting pay are not closely tied to which methodology of variable selection is chosen.

The final statistical model chosen for this study was identified using the Bayesian model averaging method, which identified 13 predictors to best predict the observed variations in the survey respondents’ pay. These 13 predictors were also the top predictors identified by other methodologies. Of the variables initially considered the most promising (position, years of experience, firm size, degrees achieved, licensure, hours worked, region, dependents, having considered leaving the profession, difficulty discussing advancement, and mentorship), only six are among the top 13 predictors: position, years of experience, firm size, hours worked, region, and dependents.

5.2 THE INITIAL MODEL OF PAY

The initial statistical model’s adjusted R-squared value is 56%, which means that the model can account for 56% of the observed variation in the respondents’ salary using the 13 identified predictors. While this is considered to be a respectable performance for a salary model based on survey data, this also indicates that there are other important predictors of pay that are not captured in the model. For example, these could include a respondent’s technical ability, connections, personality, or appearance.

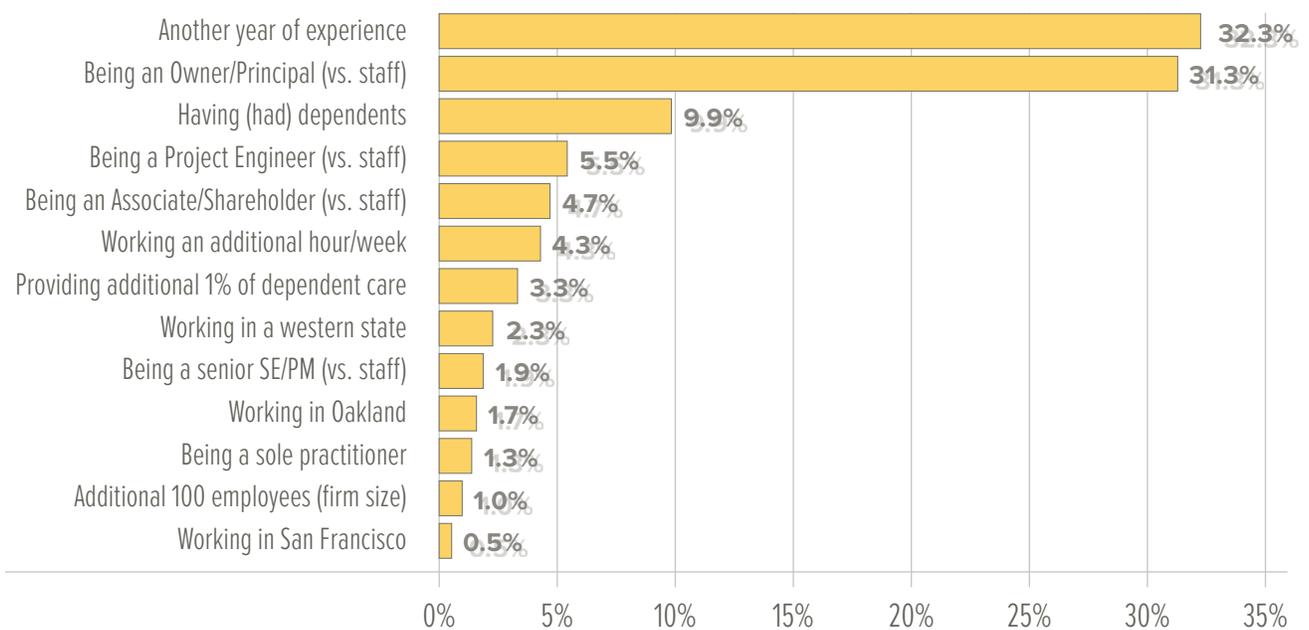
The 13 predictors are listed below, ranked by their relative contribution to the model's overall predictive ability. Figure 5.1 shows the numerical value of each predictor's relative contribution to the model's overall predictive ability.

1. Another year of experience
2. Being a principal/owner/CEO/founder*
3. Having (or having previously had) dependents
4. Being a project engineer*
5. Being an associate/shareholder*
6. Working an additional hour per week
7. Providing an additional 1% of dependent care
8. Working in a western state**
9. Being a senior structural engineer and/or project manager*
10. Working in Oakland, CA
11. Being a sole practitioner
12. Working at a company with an additional 100 employees (firm size)
13. Working in San Francisco, CA

*A staff/entry-level engineer was treated as the reference position level.

**As defined by the US Department of Labor Bureau of Labor Statistics (refer to Section 2.8)

FIGURE 5.1 RANKED FACTORS THAT INFLUENCE PAY



Each predictor's contribution has been normalized so that the percentages add up to 100%. It is important to note that a predictor's relative contribution is not synonymous with its dollar impact on pay prediction. For example, being a sole practitioner accounts for only 1.3% of the model's overall explanatory power; however, being a sole practitioner has a large impact on predicted pay, as described further in Section 5.3 and Section 6.4. Instead, being a sole practitioner has a relatively low contribution because there is a relatively small population of sole practitioners in the SE3 data set. Refer to Section 2.2 for the breakdown of respondents by position.

It is clear from Figure 5.1 that a respondent's years of experience and position are the two factors that account for most of the observed variation in pay among respondents.

Figure 5.1 also demonstrates that some of the factors that initially appeared to be strongly associated with variations in pay in the bivariate analyses did not end up in the top 13 predictors. One example is licensure, which is discussed in Section 3.6. Figure 3.7 depicts a much higher median salary of \$114,000 for SE-licensed engineers, versus \$87,000 for PE-licensed engineers and \$64,000 for engineers with an EIT. From a bivariate analysis of just pay and licensure, it appears that earning an SE license has a high positive impact on salary. However, multivariate analysis demonstrates that having an SE license is not an important predictor of pay. SE licensure is likely a by-product of other, more fundamental determinants of pay. For example, engineers who have earned their SE license tend to be in higher positions and have more years of experience, which are the top two predictors of pay. In other words, there is no *additional* predictive value in knowing whether a respondent has an SE license. (Additionally, as discussed in Section 3.6, SE licensure is neither offered nor required in many states. SE licensure is offered in California, where nearly half of the respondents were from.)

Regarding regional influences, note that all of the regions and cities indicated in Section 3.8 were included in the model. Of those eight regions and seven cities, only the West region and cities of Oakland and San Francisco ended up being in the top 13 predictors. Note however, that if these region variables were removed from the model, its explanatory power (R-squared value) would drop only a very little and the other model coefficients would not be materially impacted.

5.3 THE INTERACTION OF GENDER WITH OTHER FACTORS

Despite gender pay gaps favoring men in nearly all bivariate analyses noted in Chapters 3 and 4, none of the variable selection methods identify gender as a statistically significant predictor of pay. This means that, in the SE3 survey data, gender, by itself, is not as reliable a predictor as any of the 13 factors in Figure 5.1. However, gender may interact in important ways with some or all of those 13 factors.

Once the initial statistical model, with its top predictors for all respondents, was determined, each of the predictors was then explicitly tested for its interaction with gender. It is important to explore gender-based interaction terms for predictors, because otherwise there is an implicit assumption that each predictor is gender neutral in its impact on pay.

In order to determine the impact of gender on each factor, two approaches were implemented. The first methodology was to implement the initial model separately for the male and female respondents in the SE3 data set. If a predictor were gender neutral, then its estimated contribution would be similar in models of men's pay and in models of women's pay.

The second methodology was to augment the 13-variable statistical model by interacting gender with each of the factors, so that there was a set of 13 predictors and a set of 13 gender-interacted terms, for a total of 26 predictors. If a predictor were gender neutral, the predictor would remain statistically significant, but its gender-interaction term would be statistically insignificant.

Both methodologies resulted in the same conclusion: 11 of the 13 top predictors appear to be gender neutral. The two that do not are being a sole practitioner and being a principal/owner/CEO/founder. When these two factors were modeled as gender-specific predictors, i.e., separated out into male and female sole practitioners and male and female principals/owners/CEOs/founders, the statistical model's adjusted R-squared value rose from 56% to 60%, a modest but meaningful improvement in the model's ability to account for the observed variation in the respondents' salary.

5.4 THE FINAL MODEL OF PAY

Based on the additional analysis of the 13 initial factors that includes gender interactions, the final statistical model has 15 top predictors. Ranked in order of their dollar impact on pay (and also shown in Figure 5.2), the 15 top predictors are as follows:

1. Being a male principal/owner/CEO/founder*
2. Being a female principal/owner/CEO/founder*
3. Being a male sole practitioner*
4. Being an associate/shareholder*
5. Working in Oakland, CA
6. Being a senior structural engineer and/or project manager*
7. Having (or having previously had) dependents
8. Working in a western state**
9. Working in San Francisco, CA
10. Being a project engineer*
11. Another year of experience
12. Working at a company with an additional 100 employees (firm size)
13. Working an additional five hours per week
14. Providing an additional 10% of dependent care
15. Being a female sole practitioner*

*A staff/entry-level engineer was treated as the reference position level.

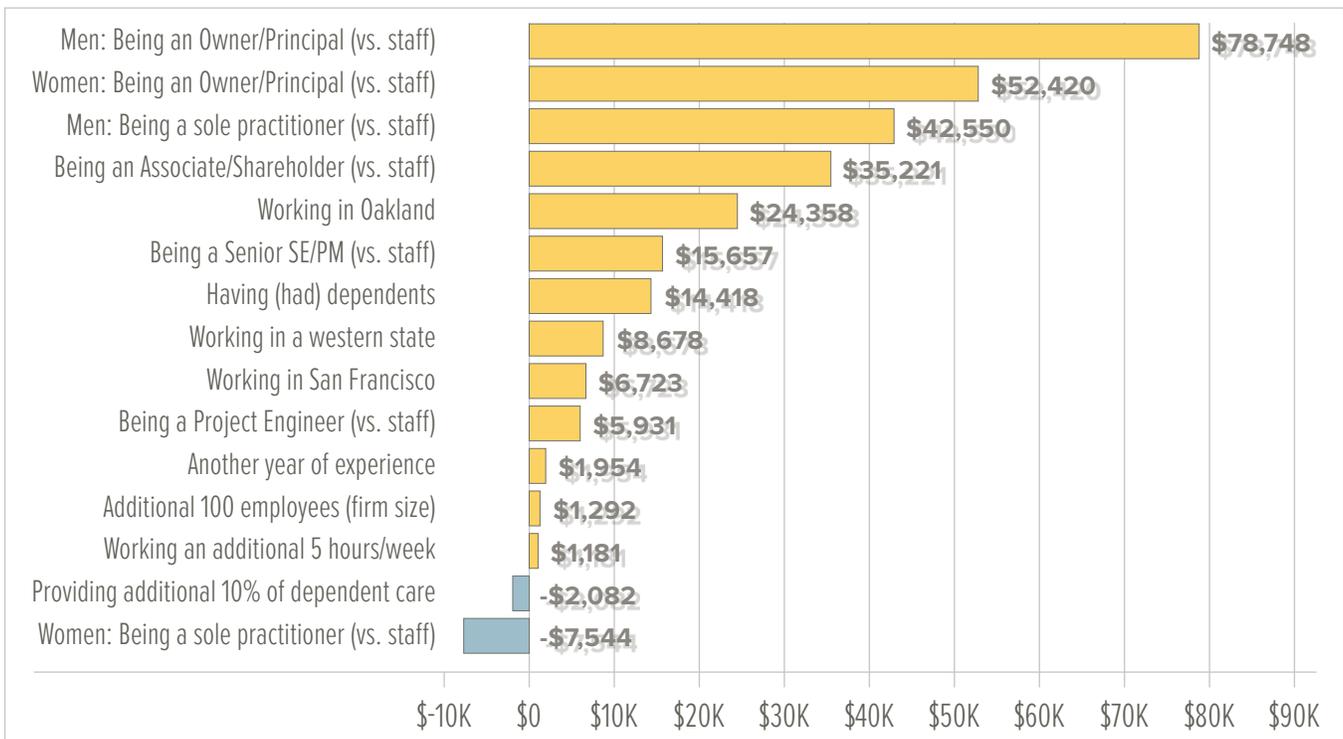
**As defined by the US Department of Labor Bureau of Labor Statistics (refer to Section 2.8)

Figure 5.2 illustrates the estimated dollar impact of each predictor on a respondent's salary, all other factors being equal. Suppose, for example, that Respondent A is a project engineer with five years of experience, Respondent B is a staff/entry-level engineer with five years of experience, and Respondent C is a staff/entry-level engineer with three years of experience. Suppose, too, that all other factors are equal, i.e., that all three have never had dependents, do not live in a western state, and work the same number of hours in a company of the same size. The final statistical model would predict that Respondent A earns \$5,931 more in annual salary than Respondent B, because a project engineer is estimated to earn more than an entry-level engineer, even though they both have the same number of years of experience. Similarly, the model would predict that Respondent B earns \$3,908 more in annual salary than Respondent C, because each additional year of experience within a position is estimated to increase salary by \$1,954 on average. And finally, Respondent A would be predicted to earn \$9,839 more than Respondent C, because Respondent A has a higher position and two more years of experience.

To calculate estimated salary based on the model, each predictor that applies to a specific person can be added together. Note that the base pay determined by the model, to which all other adjustments are made, is \$32,674. Therefore, for example, if one were an associate/shareholder in Austin, TX, with 15 years of experience at a firm of 25 people and who worked 45 hours/week on average and had no dependents, this person’s estimated salary would be as follows:

Base pay:	\$32,674
Position: associate/shareholder:	\$35,221
Experience: 15 x \$1,954:	\$29,310
Average hours per week:	\$ 1,181
<hr/>	
Total estimated annual pay (including bonuses):	\$98,386

FIGURE 5.2 THE FINAL MODEL OF PAY



5.5 CAREER SATISFACTION, PAY SATISFACTION, AND PAY

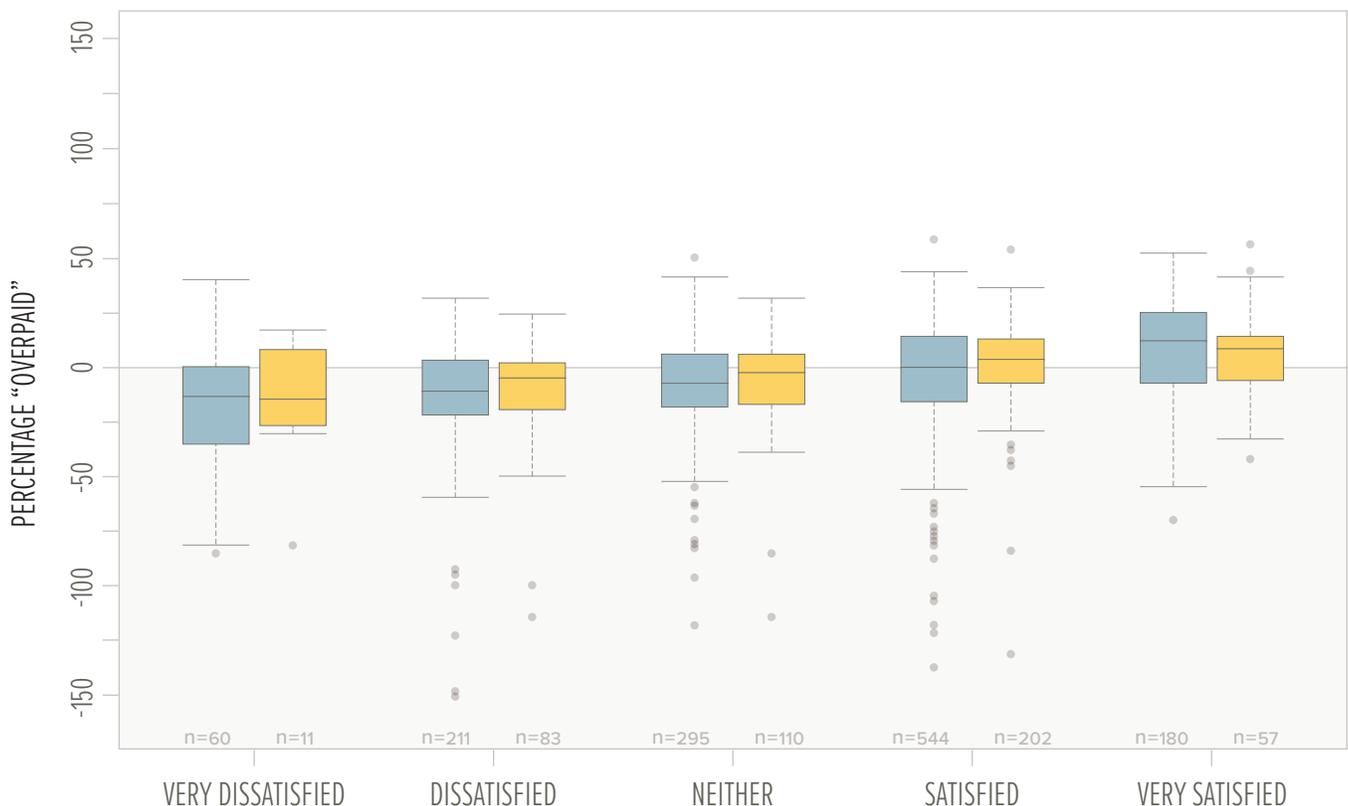
Two factors that were excluded from the model of pay at the outset are a respondent's level of career satisfaction and a respondent's level of pay satisfaction. The rationale for excluding these two factors is that each is more likely to be determined *by*, rather than be a determinant *of*, a respondent's level of pay. In other words, those who consider themselves well paid, other things being equal, may tend to report higher levels of satisfaction with their career and their pay.

Looking at the two satisfaction questions, we find a moderate, positive correlation between career satisfaction and pay satisfaction. That correlation, however, may overstate the extent to which career satisfaction is a function of respondents' pay satisfaction. The correlation could be partly the result of satisfaction with pay and satisfaction with career both being strongly determined by some third factor, such as the position a respondent holds.

A technique to get around the potential interdependence of these two satisfaction measures is to compare the levels of respondent satisfaction versus being "overpaid" or "underpaid" as determined by the final model of pay. If, after adjusting for experience, position, firm size, and all other predictors of pay, a respondent earns *more* than the model predicts, then that respondent can be considered "overpaid" in a statistical sense. Similarly, if a respondent earns less than

FIGURE 5.3 "OVERPAID"/"UNDERPAID" AND SATISFACTION WITH COMPENSATION

■ = men ■ = women



the model predicts, then that respondent can be considered “underpaid.” The percentage by which a respondent is “overpaid” or “underpaid” can be compared against each satisfaction metric to see if they are correlated with pay.

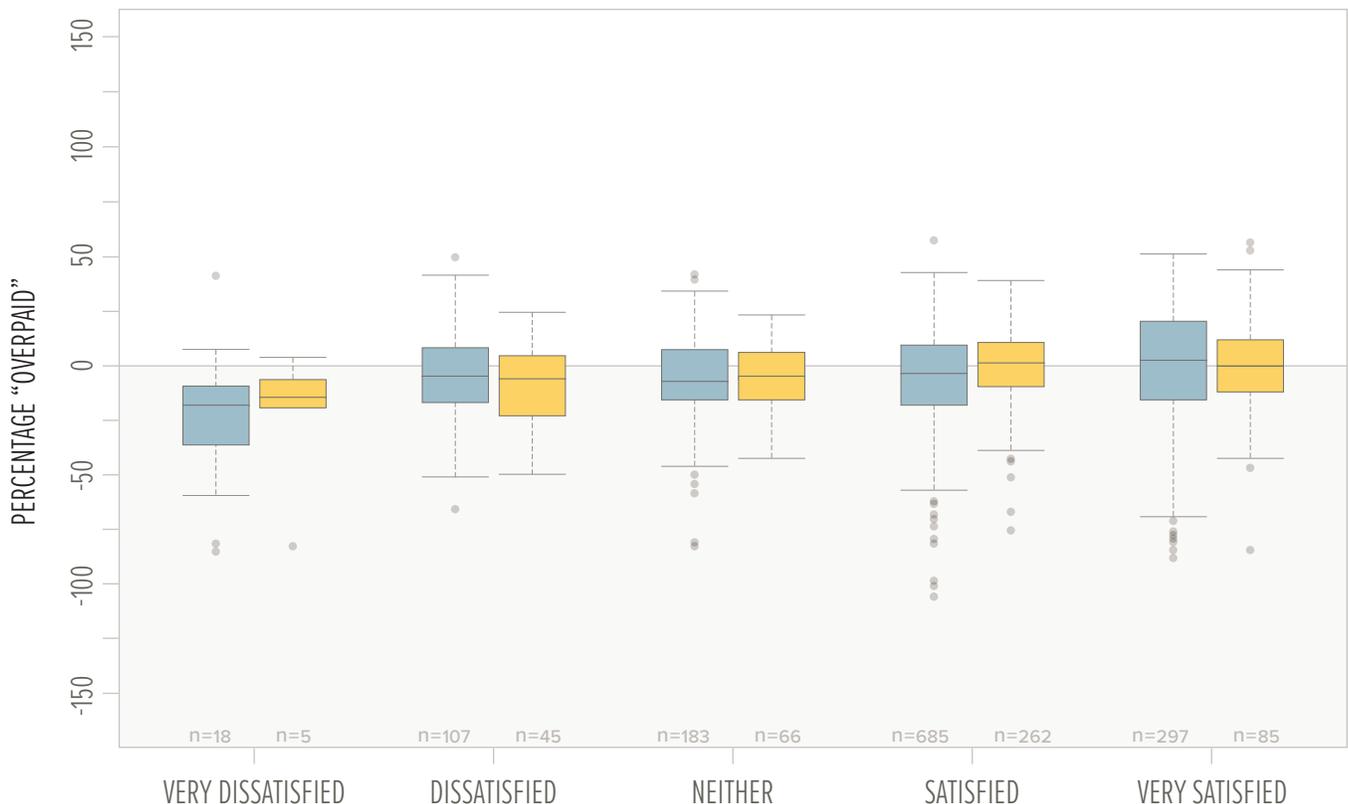
Figure 5.3 shows, by gender, the relationship between the amount by which a respondent is “overpaid” (or “underpaid”) and the respondent’s stated satisfaction with his or her pay. The positive correlation is clear: Respondents who earn more than the model predicts reported, on average, higher satisfaction with their pay.

Figure 5.4 shows the relationship between the respondent’s career satisfaction and the extent to which the respondent is “overpaid” (or “underpaid”). The relationship is less pronounced than in the preceding figure. Among the respondents who were most satisfied with their career progression—the “very satisfied” category—men and women alike were roughly as likely to be “underpaid” as “overpaid.” In the “very dissatisfied” group, however, virtually every respondent was “underpaid.”

These patterns provide evidence that the most dissatisfied workers are also likely to be “underpaid.” Among workers indicating the greatest satisfaction with their career, however, that satisfaction appears to result from other aspects of their jobs, as well as half of the “very satisfied” respondents appear to be “underpaid.”

FIGURE 5.4 “OVERPAID”/“UNDERPAID” AND CAREER SATISFACTION

■ = men ■ = women



CHAPTER SIX

6.0 GENDER PAY GAP

6.1 DESCRIPTION OF ANALYSIS FROM 2016 REPORT

The *SE3 2016 Survey Report* detailed a number of findings regarding the pay of 1,955 respondents who provided information regarding their compensation. One of those findings indicated a pay gap between genders. While accurate, the analysis included in the 2016 report is relatively superficial. One goal of this pay report is to investigate this gender pay gap in further detail and with more statistical rigor, in order to attempt to dig below the surface and identify key determinants of pay.

In the 2016 report, the gender pay gap was analyzed in a number of ways, but each way compared only two variables at a time: pay and one other variable (separated by gender), similar to the comparisons from Chapters 3 and 4 of this report. Initially, the study reviewed the overall pay gap among respondents: the average pay of the 1,401 men who provided compensation data was found to be \$27,500 per year higher than the average pay of the 553 women who provided compensation data.

Noting that this overall discrepancy could likely be explained by a number of factors, the data were then reviewed to compare pay for different groups

of people. The responses were broken down first by years of experience and then position, in order to understand whether male respondents simply had more experience and/or held higher positions, on average, than female respondents. While female responses were more skewed toward fewer years of experience and lower positions, when comparing men and women from equal experience ranges and positions, a notable pay gap was still found to exist for engineers, beginning at approximately mid-career.

The 2016 report notes: “For full-time employees, men with 14-17 years of experience made \$7,900 per year more than women, and men with 18-20 years of experience made \$41,200 per year more than women.” At the peak of the pay gap, men with 30-34 years of experience made \$52,000 per year more, on average, than women in the same range of experience. The sample size for this range was 108 men and 24 women.

Additionally, these same data were reviewed for full-time respondents only, removing the relatively small number of part-time respondents who were more likely to be women. In this data set, the peak pay gap of respondents with 30-34 years of experience was found to be slightly less (\$47,000).

When the data were analyzed by position, a negligible gap was present at the first two positions (staff/entry-level engineer and project engineer). At the upper three positions, the pay gap was found to widen: “A \$9,000 pay gap was present for senior engineers/project managers, a \$12,000 pay gap was present for associates/shareholders, and a \$52,000 pay gap was present for principals/owners.”

The data were also analyzed for a variety of other factors (again, one at a time in comparison with pay), such as location, full-time employment, firm size, and having/not having children. Statistics from these comparisons were not included in the 2016 report, but the findings were noted to include a gender pay gap consistently across each metric studied.

Note that all pay data analyzed for the 2016 report considered *average* (mean) pay. This pay report generally reports *median* pay, as explained in Section 1.3.

6.2 DESCRIPTION OF MORE DETAILED PAY REPORT ANALYSIS

One goal of this detailed study of pay was to perform a rigorous statistical analysis of the gender pay gap that could provide insight regarding multiple factors at one time. The analyses performed for this report used statistical methods to analyze an array of permutations of the data, whereby a variety of factors are held constant while changing only one variable at a time. This allowed the analysts to understand which factors affect pay and which of those factors that affect pay are correlated with gender. This process is described in more detail in Section 5.3.

This is the primary difference between the original 2016 report and this pay report: this report uses regression analyses that allow us to measure each factor’s impact on pay while adjusting for its correlation with other factors. This method offers more complete and nuanced insights into the contributions of multiple factors to an overall gender pay gap than those suggested by correlating pay with only one variable at a time, as was done for the 2016 report.

6.3 SIMILARITIES AND DIFFERENCES IN FINDINGS

The similarities in the findings between the original 2016 report and this pay report are that there is a pay gap between genders and that the gap is most highly concentrated at the upper experience and position levels. This is discussed in further detail in the following section.

The difference, however, is that this pay report shows that the pay gap does not permeate as many variables in quite the same way as was found in the 2016 report. For example, while the 2016 report's analysis showed that a gender pay gap existed at most positions, ranges of years of experience, locations, firm sizes, etc., this pay report notes that, with two exceptions, those factors actually affect the pay of men and women similarly. That is to say that when varied one at a time (holding all else constant), most factors that affect pay do not affect men and women differently. However, it is clear that while some of these factors may *affect* men and women similarly *when present*, that does not mean that the *presence* of these factors, and thus their effects, are necessarily the same for men and women. This nuance is discussed further in Section 6.6.

6.4 TWO FACTORS OF PAY DIRECTLY CORRELATED WITH GENDER

Out of the 13 predictors found to be most relevant to salary (refer to Section 5.2 for more discussion of all predictors), two of these predictors were directly correlated with gender (as described in Section 5.3):

1. Being a sole practitioner
2. Being a principal/owner/CEO/founder (the highest position of five in the survey)

For respondents who were sole practitioners, a gender pay gap of \$50,100 was found to occur, even when other top predictors, like years of experience, location, having/had dependents, etc., were held constant. In other words, based on the data from the 2016 survey, male sole practitioners earned approximately \$50,000 more than female sole practitioners annually, even if they had the same number of years of experience, worked the same number of hours in the same city, provided the same percentage of care to their dependents, etc. This is depicted in Figure 5.2. As previously stated, only respondents who work 40 or more hours per week were included in the final statistical model.

Note that, while the information presented above is accurate regarding the data collected, the sample size for sole practitioners was relatively small (22 women and 57 men). Therefore, while the findings are statistically significant, it is not possible to know whether they accurately reflect the pay of *all* sole practitioners. The 2018 SE3 survey is expected to delve further into this finding to seek further information.

For respondents who were principals/owners, a gender pay gap of about \$26,300 was found to occur in principal/owner/CEO/founder respondents. This is also depicted in Figure 5.2.

6.5 FACTORS THAT AFFECT PAY COMPARABLY FOR BOTH MEN AND WOMEN

Out of the 13 predictors found to be most relevant to salary noted in Section 5.2, 11 of these predictors were found to affect pay comparably for both men and women. Below they are ranked in order of their dollar impact on pay:

1. Being an associate/shareholder
2. Working in Oakland, CA
3. Being a senior structural engineer and/or project manager
4. Having (or having previously had) dependents
5. Working in a western state
6. Working in San Francisco, CA
7. Being a project engineer
8. Another year of experience
9. Working at a company with an additional 100 employees (firm size)
10. Working an additional five hours per week
11. Providing an additional 10% of dependent care

Figure 5.2 shows that, unsurprisingly, respondents earn more with each advance in position: owners/principals/CEOs/founders earn more than associates/shareholders, who earn more than senior structural engineers/project managers, and so on. As the numeric predictors were determined to be linear variables in the model, each additional year of experience increased a respondent's salary by approximately \$2,000, whether the respondent had 5 or 10 years of experience. This can be considered to be the average gradient of pay within a position.

Having, or having previously had, dependents is associated with a pay increase of approximately \$14,500. Working at a larger firm and working additional hours have modest impacts on salary (approximately \$1,300 for each additional 100 employees in the respondent's firm and approximately \$1,200 for each five additional hours worked per week).

Working in the cities of Oakland, CA; San Francisco, CA; or in one of the western states is associated with higher pay; this could be partly due to the higher living costs in these areas. It is interesting to note that despite the geographical proximity of the two Bay Area cities of Oakland and San Francisco, working in Oakland is associated with an additional ~\$24,000 in pay, but working in San Francisco is associated with only ~\$6,500 in additional pay. The reasons for this finding are not able to be determined from the survey data. However, due to the relatively small (though statistically significant) sample sizes from these cities, some anomalous behavior could be in effect. And, as noted in Section 5.2, if these region variables were removed from the model, the other model coefficients would not be materially impacted.

The only gender-neutral factor that had a negative impact on pay was providing an additional 10% of dependent care, which predicted a decrease of approximately \$2,000 per additional 10% of dependent care that a respondent provided.

6.6 SECONDARY EFFECTS ON WOMEN

It is important to note that while the statistical model for this 2016 SE3 data set demonstrates that most of the key determinants of pay affect men and women's pay comparably, it does not rule out the existence of gender bias or other gender-based trends that may play a role in the salaries of structural engineers. Thus, an important distinction must be made between determining pay factors to be "gender neutral" and determining whether gender bias in pay occurs.

The SE3 model shows that most of the factors explored in the 2016 survey, apart from being a sole practitioner and a principal/owner/CEO/founder as discussed in Section 6.4, have a gender-neutral impact on pay for this population. For example, the number of years of experience one has impacts men and women in roughly the same way; unsurprisingly, salary increases with more years of experience. Likewise, providing a larger share of dependent care negatively impacts the salaries of both men and women roughly equally: approximately \$2,082 less in annual salary for each additional 10% of dependent care provided.

The statistical model can tell us that the average increase in pay for each additional year of experience is similar for men and women. But it cannot provide an explanation for *why* female respondents typically had fewer years of experience (see Figure 2.2) or were less likely to be in higher positions (see Figure 2.1) than male respondents. Historically low female representation in the profession or higher female attrition rates may help explain why there are fewer women with many years of experience or high positions, which could then explain correspondingly lower salaries. However, the data from this survey cannot explain the societal or cultural basis of those differences between male and female respondents.

Similarly, while the statistical model suggests that the pay decrease associated with providing a larger share of dependent care is roughly the same for men and women, the survey data cannot explain why female respondents report providing, on average, 65% of dependent care while the average reported by male respondents is 35%. Historically, women have taken on more unpaid family responsibilities than men, and their salaries are therefore disproportionately negatively impacted by caregiving responsibilities. Additionally, while this study shows that salary increases modestly with the average number of hours worked (see Figure 3.11), providing a large share of unpaid family responsibilities may make it hard to work as many paid hours as someone providing a smaller share of unpaid family responsibilities.

For a comprehensive view of how the factors that predict pay are actually skewed toward higher salaries for male engineers, refer to Figure 6.1. Recall that 11 of these 13 factors were shown to be "gender neutral" in their effect on respondents. However, this chart illustrates how, even though these factors may *affect* men and women equally *when present*, they are often more or less *prevalent* in one gender, which has the overall effect of women's pay consistently being less than men's.

In Figure 6.1, the 13 factors that are most important for predicting pay in the SE3 sample are shown in order of importance. The direction of each factor's impact on pay (positive or negative) is shown in the second column. The average value for each factor is shown for men and women in the next two columns. The seven most important predictors of pay all *exacerbate* the gender pay gap; these are shaded in blue. For example, more experience has a positive impact on pay, but the average years of experience is 9.6 for women and 15.0 for men. Similarly, being in an entry-level position is associated with lower pay, and women are almost twice as likely as men to be in that category (23% vs. 13%). Again, having (or having previously had) dependents has a positive impact on pay, but women are only about half as likely as men to have dependents (33% vs. 56%). The factors that, on balance, help to *narrow* the gender gap in pay are shaded in yellow. However, these factors are much less important as predictors of pay, as indicated by their ranks of 8 to 13 on the list. For example, working in Oakland is associated with higher pay, and women are slightly more likely to work in Oakland (5% for women vs. 4% for men).

FIGURE 6.1 IMPACT ON GENDER GAP IN PAY BASED ON PREVALENCE OF PREDICTORS IN SAMPLE

VARIABLE	IMPACT ON PAY	SAMPLE AVERAGES		VARIABLE'S PREDICTIVE IMPORTANCE
		MEN	WOMEN	
SALARY (N THOUSANDS)		\$112	\$89	
Years of experience	+	15.0	9.6	1
Entry level position (Position=1)	-	13%	23%	-
Being a principal/owner (Position=5)**	+	20%	9%	2
Having (had) dependents	+	56%	33%	3
Being a project engineer (Position=2)	-	23%	33%	4
Being an associate/shareholder (Position=4)	+	25%	22%	5
Working an additional hour/week	+	46.2	45.0	6
Providing additional 1% of dependent care	-	20%	21%	7
Working in a western state	+	55%	57%	8
Being a senior SE/PM (Position=3)*	(reference)	18%	13%	9
Working in Oakland	+	4%	5%	10
Being a sole practitioner**	-	2.1%	1.5%	11
Another 100 employees (firm size)	+	3.44	3.70	12
Working in San Francisco	+	14%	17%	13

*Position 3 treated as the reference level for the other four positions.

**Owner/Principal category includes sole practitioner. Being a sole practitioner also enters model as separate predictor.

CHAPTER SEVEN

CONCLUSIONS

Pay is a complex outcome that is influenced by a wide variety of factors. This report reviewed pay data for 13 bivariate correlations (eight demographic variables in Chapter 3 and five subjective variables in Chapter 4), which had limited conclusive power regarding their overall effect on respondent pay.

A more comprehensive view of the influence of these factors on pay was provided by a statistical regression analysis, a methodology that simulates holding multiple variables constant and varying one variable at a time to determine its influence on the target variable (in this case, pay). This analysis revealed that there were 13 primary factors that affected the pay of the 2016 survey respondents. Additionally, the final model of pay includes two gender-based factors, which were added after examining the gender-specific impact of each of the original 13 factors. Thus, the final model of pay and the factors' relative effect on average annual pay are shown below.

The factors affecting pay, ranked by estimated dollar impact on average annual pay, are as follows. Note that the base pay determined by the model, to which all other adjustments shown below are to be made, is \$32,674.

1. Being a male principal/owner/CEO/founder*	\$78,748
2. Being a female principal/owner/CEO/founder*	\$52,420
3. Being a male sole practitioner*	\$42,550
4. Being an associate/shareholder*	\$35,221
5. Working in Oakland, CA	\$24,358
6. Being a senior structural engineer and/or project manager*	\$15,657
7. Having (or having previously had) dependents	\$14,418
8. Working in a western state**	\$ 8,678
9. Working in San Francisco, CA	\$ 6,723
10. Being a project engineer*	\$ 5,931
11. Another year of experience	\$ 1,954
12. Working at a company with an additional 100 employees	\$ 1,292
13. Working an additional five hours per week	\$ 1,181
14. Providing an additional 10% of dependent care	-\$ 2,082
	(pay decrease)
15. Being a female sole practitioner*	-\$ 7,544
	(pay decrease)

*A staff/entry-level engineer was treated as the reference position level.

**As defined by the US Department of Labor Bureau of Labor Statistics (refer to Section 2.8).

The final model of pay describes 11 factors that are “gender neutral” and two factors that affect men and women differently. The two factors that affect men and women differently are being a principal/owner/CEO/founder and being a sole practitioner. In both of these cases, holding all else constant, females in these roles made significantly less than their male counterparts: female principals were found to make, on average, \$26,300 less than male principals, and female sole practitioners were found to make, on average, \$50,100 less than male sole practitioners. For the latter finding, the sample sizes were relatively small and, while statistically significant, may not be indicative of trends for all sole practitioners.

For the 11 factors that were noted to be “gender neutral” in their effect on men and women, it was found that even though these factors may affect men and women equally when present, they are often more or less prevalent in one gender, which has the overall effect of women’s pay consistently being less than men’s. For example, more experience means higher pay,

but the average years of experience for women in the data set is lower than men (9.6 years versus 15.0 years). Additionally, being in an entry-level position means lower pay, and female respondents were almost twice as likely as male respondents to be in an entry-level position.

Overall, the 2016 SE3 survey data provided a statistically robust sample from which to derive a model of pay and better understand the factors that affect pay. The data also provided further insight into the gender pay gap within the structural engineering profession, though much about the causes of these pay differences is still unknown. This is because, even with this detailed study, the nuances of pay are complex and difficult to understand in a meaningful way. Continuing to collect and evaluate data at two-year intervals, the SE3 Committee seeks to further this understanding over the course of many years of study in order to increase our understanding of these concepts over time.



SE3[≡]