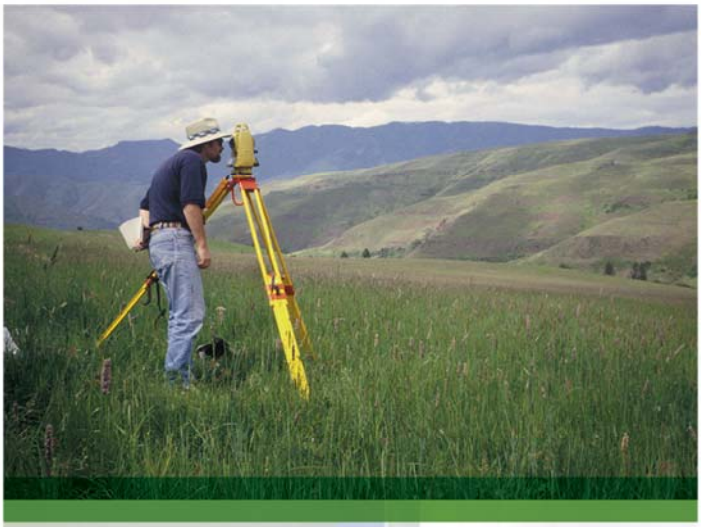
Idaho Occupation Study

IDAHO DEPT. OF LABOR

Licensed Engineers and Land Surveyors



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Study of Licensed Engineers and Land Surveyors

C.L. "BUTCH" OTTER, GOVERNOR
KENNETH D. EDMUNDS, DIRECTOR

Communications and Research
Georgia Smith, Deputy Director

Report prepared by
Christopher Cecil-Cantrell, Senior Research Analyst

Acknowledgements:

Idaho Department of Labor
Bob Uhlenkott, Chief Research Officer
Salvador Vazquez, Research Analyst Supervisor
Jessica Beaver-Nelson, Senior Research Analyst
Jean Cullen, Project Coordinator

Idaho Board of Licensure of Professional Engineers and Professional Land Surveyors
Keith Simila, P.E., Executive Director
Jim Szatkowski, P.E., Deputy Director
Jennifer Rowe, Administrative Assistant

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For more information, contact
Jessica Beaver-Nelson at (208) 332-3570 ext. 4415 or by email at
mailto:jessica.beaver-nelson@labor.idaho.gov

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Executive Summary

The labor market for professional engineers and land surveyors is made complicated by a number of factors. Engineers may be either personally licensed or licensed under a corporation. Both are captured by current tools used to evaluate the market, introducing what is best described as “negative” bias into any comparisons. Engineers may be licensed in multiple states but records of services delivered in different locations will be recorded in the state where the employer is based. While these discourage simple inference, the process itself of becoming a licensed engineer further restricts analysis. Engineers must graduate before beginning a four-year internship which upon completion permits an individual to apply for a professional license. For land surveyors, the internship is six years long, but may begin before graduation. No certainty exists that any prospective engineer or land surveyor will attempt to secure a license.

This document aims to quantify and begin isolating the elements for the engineering and land surveyor labor market with findings as f1ollows:

An estimate of the percentage of individually licensed engineers and land surveyors in Idaho.

Finding: A total of 23.5 percent for all engineers, and 10.5 percent for land surveyors (pg. 3).

An estimate of earnings associated with various disciplines.

Finding: Average $91.6k for all disciplines, civil engineers average $94,500 and electrical engineers average $109,100 annually (pg. 3).

A comparison of Occupational Employment and Wages Survey estimates to the actual engineer population.

Finding: Individually licensed engineers are outnumbered about four to one with respect to corporate licenses, and depending on discipline, earn as much as $20,000 more annually (pg. 3).

An exploration of the mobilization of engineering graduates as they seek employment.

Finding: About two-thirds of graduates remain in Idaho for employment where about 12 percent of graduates procure full licensure (pg. 6).

Evaluate the potential to measure regional supply and demand for education and workforce gaps for licensed land surveyors.

Finding: Not measurable at this time. Projections for needs are complicated by up to six years of internship requirement for license procurement. Land surveyors from out of state do help supplement the demand but the supply is limited to a growth of one to two licensed land surveyors per year (pg. 9).

Purpose

The purpose of this study was to investigate the job market for licensed engineers. With the development of the Educational Analytics System of Idaho (EASI), previously known as the State Longitudinal Data System (SLDS), we were able to integrate education and labor data over time to examine the long-term behavior of a given population, in this case engineers, who have had exposure to the Idaho Board of Licensure of Professional Engineers and Land Surveyors.

This study attempted to assess a number of topics involving Idaho engineers:

- Estimate the percentage of licensed Idaho professional engineers and land surveyors among the total number of all engineers and surveyors (counting all exempt industry and federal government employees);
- Estimate the earnings associated with various engineering disciplines and land surveyors in Idaho;
- Compare the universe of Idaho licensed engineers with sampled estimates derived by the U.S. Bureau of Labor Statistics programs;
- Determine how the engineers educated in Idaho's public and private universities mobilize for employment upon graduation and estimate the number with degrees from Idaho universities; and
- Evaluate the potential to measure regional supply and demand for education and workforce gaps for land surveyors.

Methodology and Background

Using the complete roster of licensed engineers, as acquired from the Idaho Board of Licensure of Professional Engineers and Land Surveyors (IBLPELS), license holders and Idaho wage records were compiled. These data were further enriched with educational data via the National Student Clearinghouse and the EASI.

The population consists of all engineers who were licensed through the IBLPELS and were able to be identified and verified through multiple data systems. Individuals who met the specified qualifications were limited to those who completed the engineering intern exams and procured full licensure. The licensure process requires an intern exam before taking an internship, four years for most disciplines and six years for land surveyors; upon completion of the internship, the license may be awarded. Full licenses awarded by other states may be accepted in place of this process granting immediate licensure by comity.

Wage records maintained and collected by the Idaho Department of Labor were matched to the individual engineers and enhanced with wage records from Wage Record Interchange System 2 (WRIS2), an interstate data sharing program designed to enable aggregate reporting on wages across state lines. Due to limitations of WRIS2, wage information for licensed engineers outside Idaho was restricted to the most recent consecutive eight quarters, in this case beginning the last quarter of 2013. To ensure the most accurate interpretation of the data, the eight quarters were further restricted to the year 2014, as the records for 2014 were the most complete to compensate for a degree of seasonality for engineering disciplines. In addition, several states were not participating in the WRIS2 program at the time. It is important to note engineers licensed between 2007 and 2009 were not included in the wage record identification because the identification for these individuals could not be completed nor verified with the available information.

Finally, to determine the origin university for the engineers, the data was exchanged via the EASI and processed through the National Student Clearinghouse. The related data was joined with the engineer data to identify the graduating university and blended with the wage data to determine where Idaho graduates found employment.

In order to maintain the confidentiality of the engineers, no identifying information has been included in this publication. Masking techniques were used to remove records of small frequency that could be considered a potential risk of identification of personally identifiable information.

The Findings

Table 1. Comparison of wages for licensed engineers to the estimated statistics for the entire occupation code population.*

		Licensed Engineers			Occupational Employment Statistics		
		Employed in Idaho	Annualized Wages	Trimmed Wages**	Estimated Wage	Employed Estimate	Estimated Percentage Licensed
Chemical Engineers	Idaho	27	$134.5k	$128.9k	$110.1k	80	41.3%
	Comity	6	$92.2k	$105.5k			
Civil Engineers	Idaho	436	$96.1k	$94.5k	$74.3k	1680	41.9%
	Comity	268	$88.9k	$94.8k			
Electrical Engineers	Idaho	108	$132.8k	$109.1k	$87.8k	1330	10.9%
	Comity	37	$114.3k	$105.5k			
Engineers, All Others	Idaho	27	$180.4k	$122.8k	$104.5k	530	6.2%
	Comity	6	$97.2k	$113.3k			
Environmental Engineers	Idaho	30	$96.0k	$101.5k	$90.4k	370	10.0%
	Comity	7	$182.5k	$89.1k			
Mechanical Engineers	Idaho	189	$99.0k	$102.4k	$81.8k	910	25.4%
	Comity	42	$87.9k	$100.5k			
Surveyors	Idaho	15	$53.4k	$76.0k	$63.8k	240	10.8%
	Comity	11	$61.1k	$64.3k			
				Total Estimated Percent:			23.5%

**Idaho licenses are originally licensed in Idaho; Comity licenses were first issued in other states or countries.*

***Wages for individuals below $30k per year and over $200k per year omitted.*

The initial research questions are answered with descriptive statistics. Table 1 presents two separate sets of data side by side to provide a snapshot of 2014 wages. The intent is to generate a more complete image of the relationships between employment rates, wages and the labor markets for each of the engineering disciplines listed in the table.

The first two columns identify the engineering discipline and the method by which the license was obtained, whether by taking the exam in Idaho or awarded by comity for a license in another state. The following columns display the number of identifiable engineers who actively earned wages in Idaho in 2014, as recorded in labor wage records. The following two columns show the wages gained by engineers in Idaho - the first, unaltered, and the second holding the trimmed wages, excluding probable executive salaries greater than $200,000 a year and part time or unrelated industry wages less than $30,000 annually. The next two columns are Occupational Employment Survey (OES) estimates for individuals fulfilling employment needs under the definition of the Standard Occupational Classification Code and the associated wages. Finally, the estimated percentage of engineers in those occupations with personal licenses is indicated in the last column to address the first of the research questions. Aggregated across disciplines and license type, the estimated proportion of all engineers who are personally licensed is 23.5 percent.

Observations from Table 1 indicate that the population trimmed wage average for licensed engineers performing duties relevant to the license differ between native and comity engineers, although this difference is not significant ($-0.5 < t < 0.5$ in all cases). The wages for Idaho engineers tend to exceed the OES estimate by at least double the $8,000 margin of error and comity licenses to a lesser degree, notable exceptions being chemical engineers, electrical engineers and land surveyors. Therefore, procurement of a license would, in general, be advantageous to someone in an engineering career path.

Not every individual performing relevant job duties of a given engineering discipline will have an individual license; many of these individuals are covered under a lead engineer who reviews and approves work or under a

corporate license, which may cover any number of engineers. Unfortunately, at this time, it is not possible to identify the individuals who perform relevant duties under the occupation code who are not personally licensed. While not immediately apparent, licensed engineers were also captured by the OES estimate and may overestimate the annual income for corporately licensed engineers. Since the differences between wages under a personal license are higher, there is a potential that the higher wages will be captured in the OES estimate. This would inflate the average for corporately licensed engineers and indicates that the OES estimates for engineering salaries may be pessimistic for licensed individuals.

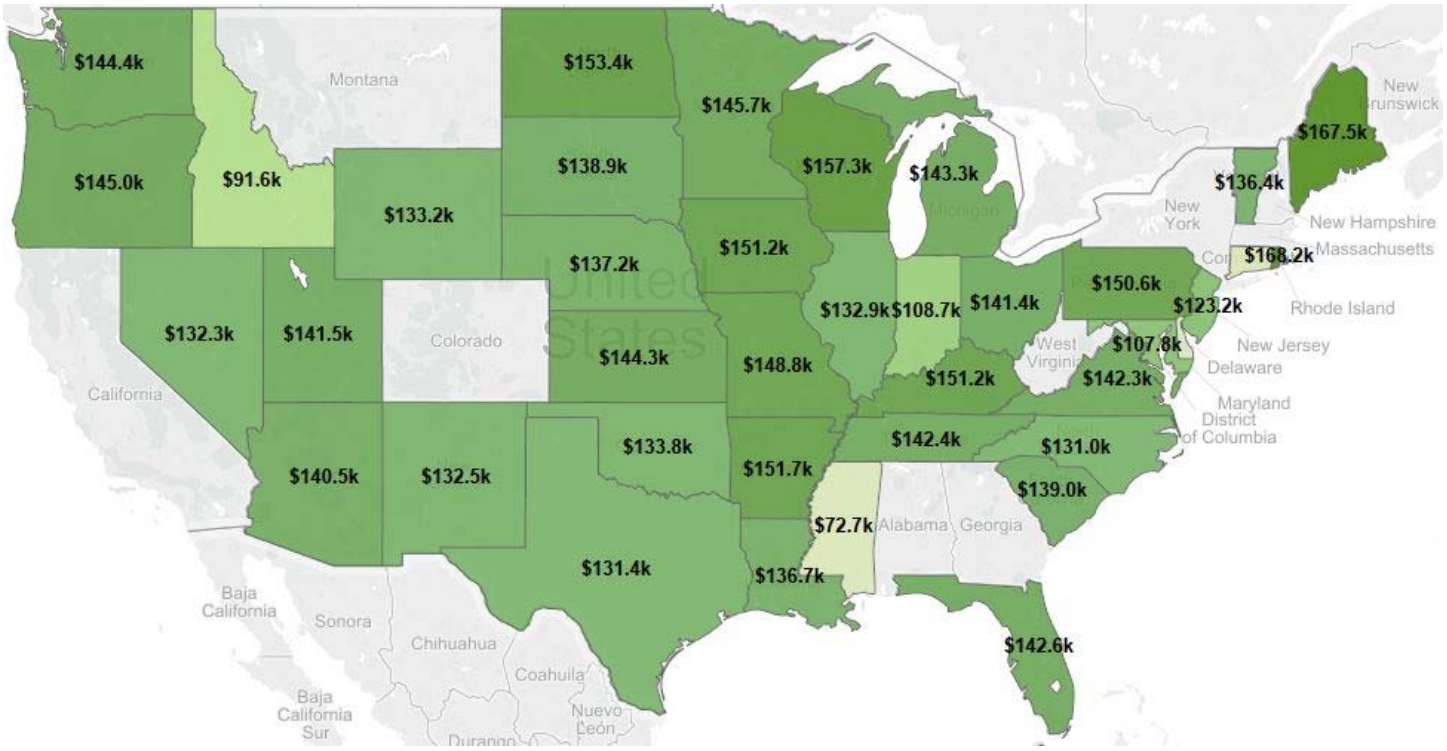
Unemployment insurance records were used to show the distribution of various engineering disciplines across several industries. Table 2 indicates in which industries a certain discipline of engineer is most likely to be employed. Most engineers across disciplines find employment in the professional, scientific and technical services industry field. Industries with few or no engineers have been omitted.

Table 2. Engineer Proportions by Industry.

INDUSTRY/SECTOR	CHEMICAL ENGINEERS	CIVIL ENGINEERS	ELECTRICAL ENGINEERS	ENGINEERS, ALL OTHER	ENVIRONMENTAL ENGINEERS	MECHANICAL ENGINEERS	SURVEYORS
EDUCATIONAL SERVICES	6.98%		8.47%	10.87%	9.09%	13.78%	6.56%
MANUFACTURING	32.56%		10.05%	15.22%	6.82%	21.79%	
MINING				10.87%			
PROFESSIONAL, SCIENTIFIC AND TECHNICAL SERVICES	48.84%	58.86%	48.15%	52.17%	52.27%	51.92%	73.77%
PUBLIC ADMINISTRATION	6.98%	22.23%		6.52%	27.27%		18.03%
UTILITIES			26.98%				

The following maps provide comparisons of wages for Idaho engineers to those in other states. The first map displays the trimmed average wages, and the second map shows the OES wage estimates for all engineers either individually or corporately licensed. Conclusions drawn from these maps incorporate data from both sources as a matter of practicality and sensibility.

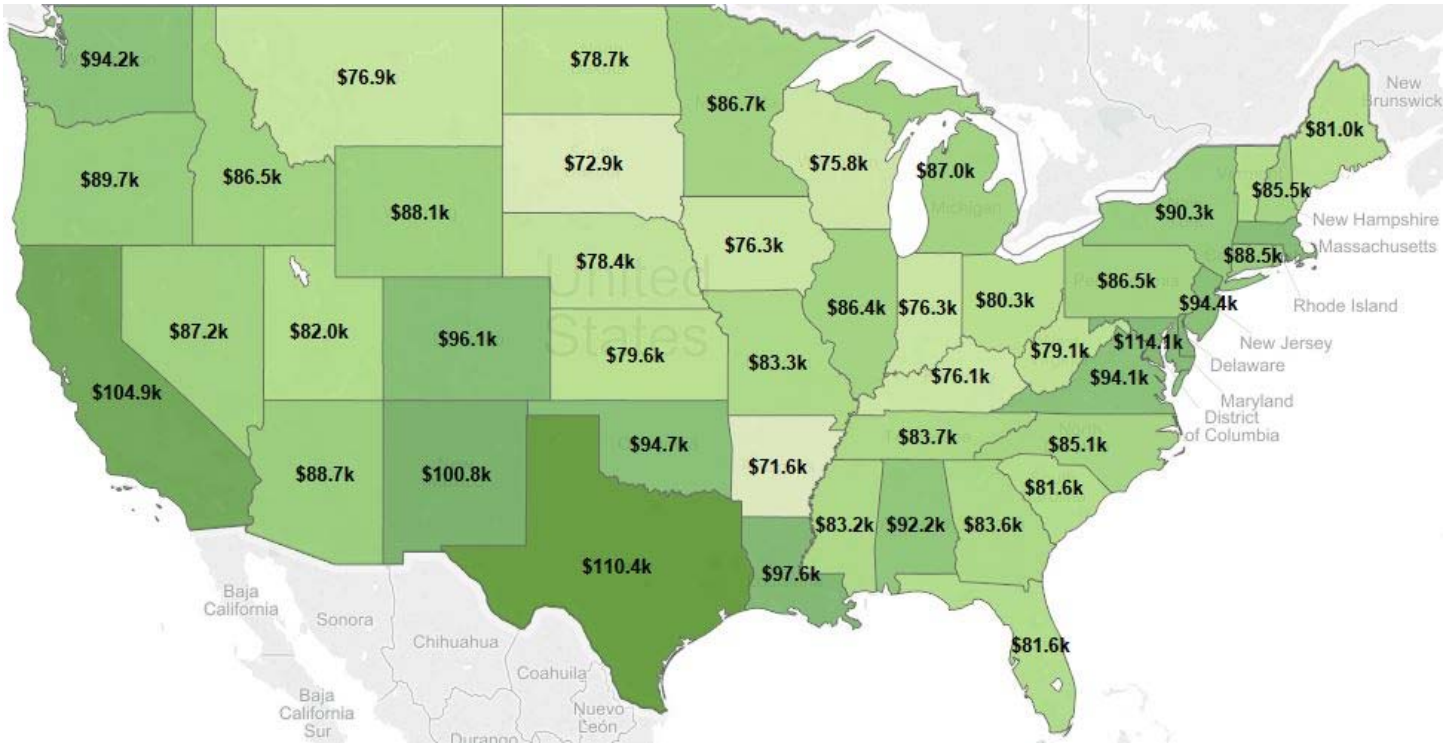
Figure 1. Actual Wages for Professional Engineers Originating in Idaho 2014 – WRIS2 and Unemployment Wage Records



**The blank states in the map indicate wage records from these states were not available. In addition, there is some restriction in the ability to report, as records are delayed during a state level verification and collection process. WRIS2 is restricted to the eight most recent quarters of wages.*

***These wages do not include the majority of the engineers in the state as shown and only reflects the wages of engineers who have been licensed to work in Idaho.*

Figure 2. National OES Estimates of Wages for Professional Engineers*



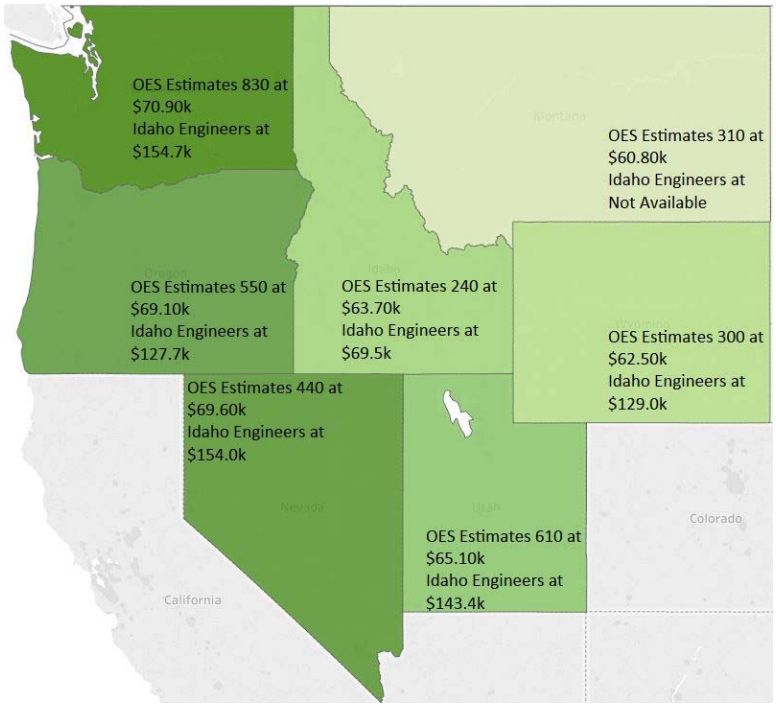
**These values represent wages weighted for the estimated number employed under various disciplines based on OES.*

Strictly, there is not enough evidence to compare the salaries of licensed engineers between states at this time; wages are available for all licensed Idaho engineers, but only a small portion of Idaho engineers were employed in other states during 2014, barring valid statistical inference. However, there are noticeable differences between the wages presented on both maps — wages as much as double the OES estimates presented in Figure 2. OES estimates are obtained in the same fashion for each state. Depending on state laws governing engineering licensure, we could expect similar salary differences between the OES estimate and real wages. However, because of the nature of the data, the OES estimates vary and as previously discussed, may underestimate the wages of personally licensed engineers. Based on the Idaho data, the estimate falls 5 percent below the population average trimmed wage. It cannot be expected that this difference is uniform across the nation, and there is not enough evidence to calculate a confidence interval for other states. However this raises the question why the wages for engineers originating in Idaho are higher in other states. Possible reasons include influences from engineer mobility, skill level and more extensive work history. With greater mobility, an engineer is able to examine a broader spectrum of jobs, looking beyond home town and into other states or countries, in all likelihood finding something with a higher wage because of the volume of possible jobs. An applicant's strong grasp of concept, application and a fundamental skill level is important to succeed in the interview and advance to the hiring list. Extensive work history and experience is highly desirable and may help an engineer attain a higher wage. Work history with a prominent firm bears even more weight during wage negotiation. Some sentiments exist regarding Idaho's low wages for engineers, but Idaho ranks 25th nationally for the wages paid to professional engineers based on the OES estimates. While Idaho doesn't lead the pack, it does indicate that Idaho offers competitive wages for engineers.

A common practice among engineering firms is licensure among multiple states. This introduces a level of complication; work performed in a given state is recorded in the state of the wage distribution agency of the particular firm. An agency headquartered in one state may have operations in several states, affording wage differentials and have a high enough profile to attract the most experienced and talented engineers. For this study, the impact of this phenomenon is worth noting—engineers who are paid in other states but are licensed to work in Idaho will contribute to Idaho infrastructure and development while Idaho engineers who are paid in Idaho and do work in other states will contribute to the local economy more directly due to cost of living. Alternatively, an engineer may be licensed in Idaho, employed for wage in Utah, and perform duties in Oregon with no impact or relation to Idaho other than licensure. This will have some impact on the wages described, primarily other states, however, the size of the effect is not measurable.

Figure 3 illustrates employment and wages of land surveyors. The state frequency of surveyors is not high, but the role of land surveyors is vital for economic development and growth. Figure 3 has been restricted to Idaho and neighboring states. Each state is listed with the OES estimated number of individuals employed as land surveyors with the expected salary followed by the OES expected wages for one in that capacity within that state. The third value is the estimated salary for Idaho land surveyors employed in that state.

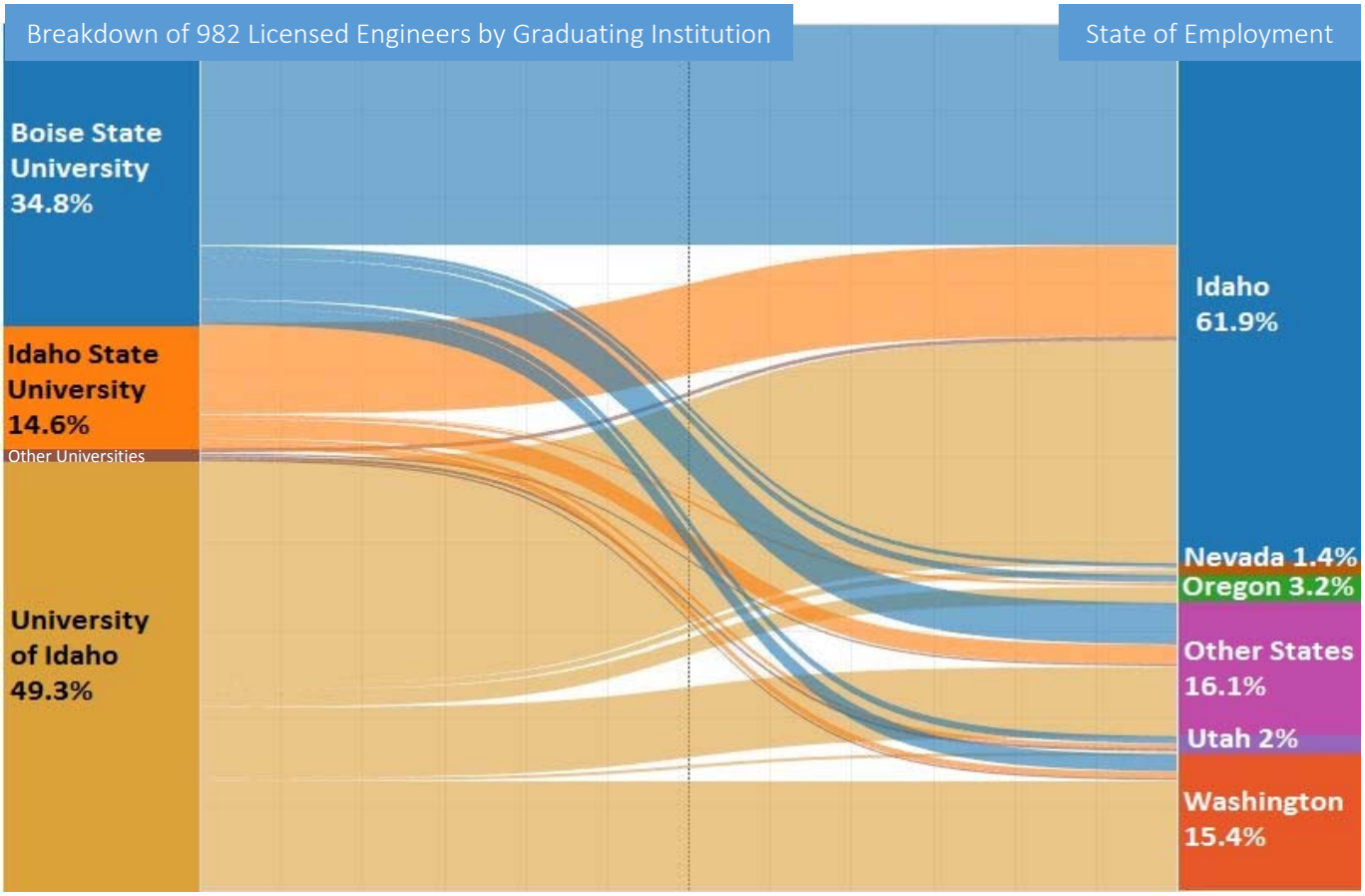
Figure 3. Land Surveyor OES Estimates and UI Records.



The difference depicted in Figure 3 has similar explanations analogous to professional engineers as noted previously. Despite lower Idaho wages among land surveyors, more comity licenses enter Idaho for employment than native licenses. This may indicate that other states have a surplus of land surveyors with strong competition where the excess finds employment in Idaho. Meeting an increasing demand may not be possible with native talent alone as will later be discussed.

Education

Figure 4. Sankey Diagram Illustrating the Flow of Licensed Engineers Graduating from 2010-2014 to Final Employment.



*Weighted to evaluate both comity and native licenses

Educational data is depicted by diagrams showing the pipeline of engineers entering the workforce. Figure 4 illustrates the originating university - where engineer interns or engineers earned their degrees - on the left to the right where the graduates have found employment. The size of the bar represents the portion of the institution's 2010-2014 graduates to the final state where the student was employed. The thickness of the curve indicates how many of any population of a university's engineering graduates moved to a given state. Only engineers who received credentials from IBLPELS and were able to be cross-referenced with the National Student Clearinghouse are included in this image.

The diagram indicates that most of the engineering graduates from Idaho universities remain in Idaho for employment after graduation (61.9 percent). However, 15.4 percent of graduates move to Washington for employment, over two-thirds of whom originate from the University of Idaho. This was not unexpected due to the geographic proximity of the University of Idaho to Washington and places like Pullman which has a large engineering firm. About 6.6 percent of graduates migrate to other neighboring states and the remaining 16.1 percent find employment elsewhere.

The IBLPELS database does not document the institution from which each of their licensees graduates. The capability to identify the originating university of an engineer dates back to 2010; the earliest EASI holds postsecondary records for all of Idaho's students and graduates. Before using EASI to identify graduates and their degree-awarding institutions, the Idaho Department of Labor received 25,766 records corresponding to 21,608 distinct individuals from IBLPELS. Duplicity of records existed for those registrants with multiple licenses, and each duplicated record may have also reflected updates to names if any changed from the original registration. To

provide this dataset to EASI for matching, Labor researchers stripped off social security numbers and only provided demographic information, including names and aliases, for each individual.

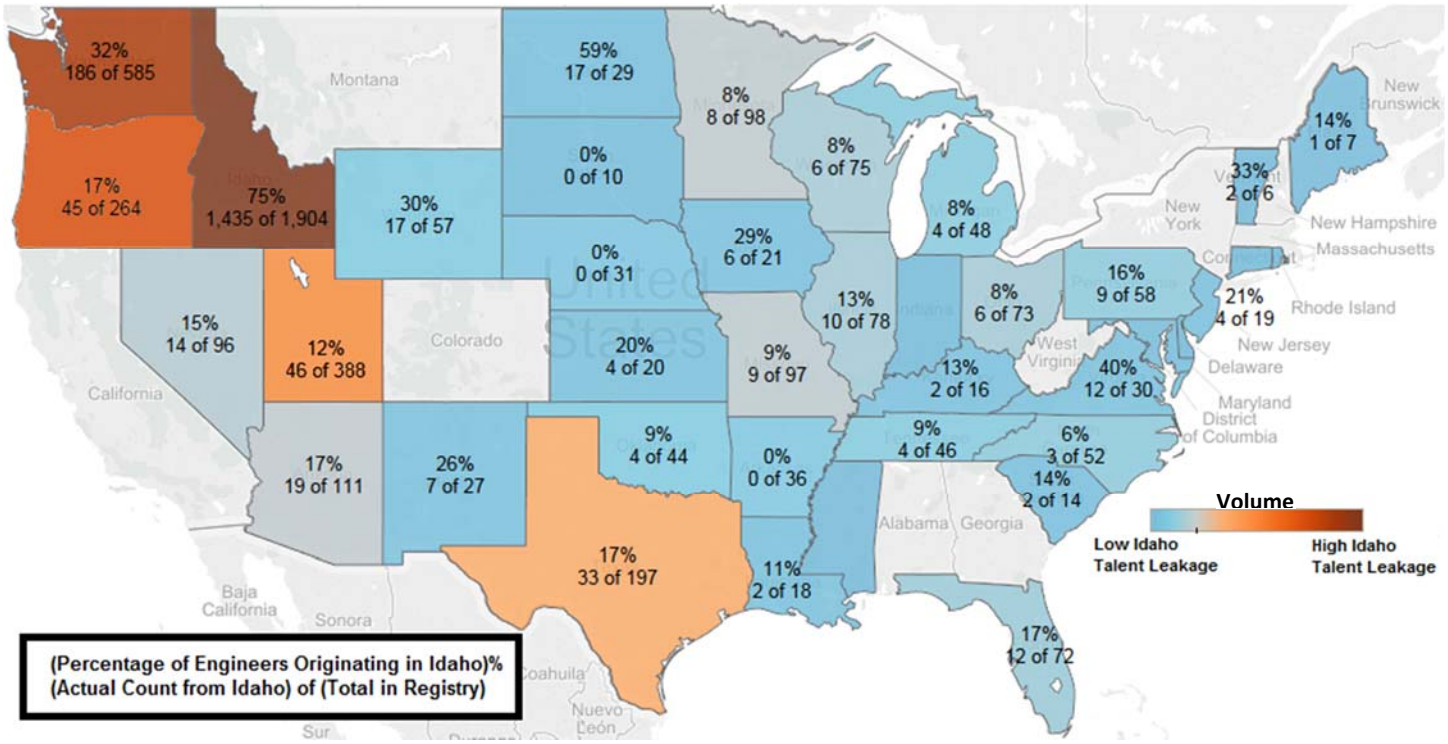
For individuals who had graduated from one of Idaho's educational institutions prior to 2010, the EASI had to query the National Student Clearing House (NSCH). The EASI does not have authority to query NSCH for records that are not related to Idaho's educational system. From the matched dataset, EASI determined 1,521 or 7 percent of licensed engineers were Idaho graduates. Findings from the matched dataset indicated that most licensees graduated between 2010 and 2014, but there were some licensees who graduated before 2010.

It is important to note that educational record matching is done based on first name, last name, gender and dates of birth, thus matches for individuals who have graduated from an institution may be missed given some individuals may change their names multiple times throughout life. Assuming that females may change their names more often than males due to marriage or other circumstances, matching educational records of females may have less success than males. Additionally, the ratio of male to female licensed engineers across the entire IBLPELS population is 12.7 males to one female, while licensed engineers exclusively matched to Idaho educational institutions rendered a ratio of 6.4 males to one female. This indicates that there is a stronger rate of female to male licensed engineers from Idaho's educational institutions than the ratio of female to male licensed engineers across the entire IBLPELS population.

In total, 982 engineering and land surveyor interns have graduated since 2010 as of March 31, 2016. Of these interns, 102 have completed the internship and possess licenses under specialized disciplines, 90 have remained in Idaho to compose 4.7 percent of the current engineering population and the other 12 are working in other states. Of the remaining 880 interns, 150 have left Idaho to pursue employment and may have procured a personal license under the licensing board of another state. The 730 interns still in Idaho are either employed under corporate licenses or do not currently use engineering expertise in the workforce. Based on this, an estimated 12 percent of engineers and land surveyors obtain full licensure.

The original research questions did not examine out-migration of Idaho professional engineers, but the potential exists to begin looking at this process. This would be done by reviewing the number of engineers originating in Idaho compared with engineers granted licenses by comity and determining where the engineers were employed in 2014. The percentage would be weighted by the actual number of engineers who have found employment in a given state. A fundamental concept in Figure 5 is the origin of the license; engineers from Idaho but employed in other states hold comity licenses and are not considered to be talent cultured in Idaho. However, these licenses supplement industry and development in Idaho. For example, the proportion of license types originating in North Dakota shows a large proportion of the talent from Idaho also originated in Idaho, but in actual numbers, there are not many Idaho-originating engineers employed there. On the other hand, Texas has a relatively low proportion of engineers who trained in Idaho, but the total number of engineers coming from Idaho is quite large in comparison to most other states, double what is seen in North Dakota.

Figure 5. Distribution of Idaho Talent Weighted by the Proportion of Comity Licensed Engineers



When engineers originally licensed in Idaho have left to work in another state, it is considered talent leakage. Any license awarded outside of Idaho is granted under comity and is not considered Idaho talent. Figure 5 illustrates the distribution of Idaho talent across the nation in conjunction with talent leakage. This information is somewhat limited due to participation levels for some states in WRIS2. Idaho has a high concentration of native talent with 75 percent of Idaho engineers taking exams in Idaho and continuing to work in Idaho. Talent appears to have spread to the surrounding states of Washington, Oregon and Utah as well as Texas. Utah is an excellent example of talent leakage. Of the 388 engineers with exposure to IBLPELS, 46 originally had Idaho licenses. Annually, this amounts to about 17.4 engineers "leaking" from Idaho with an average 6.2 of those engineers leaving Idaho each year for Washington, but Idaho also "recovers" about 15.6 engineers annually for a net loss of 1.8 engineers per year. Measuring leakage would be a long-term process to fully assess precisely how and why engineers move, especially as Idaho is in a period of economic growth that is more robust than the current national average. In total, there has been a net loss of about 50 engineers over the past 30 years.

Age Distribution

Ages of engineers by discipline and their ages when they were licensed revealed some trends and insight into the supply of engineers.

Figure 6. Histograms for Engineer Ages—License Acquisition

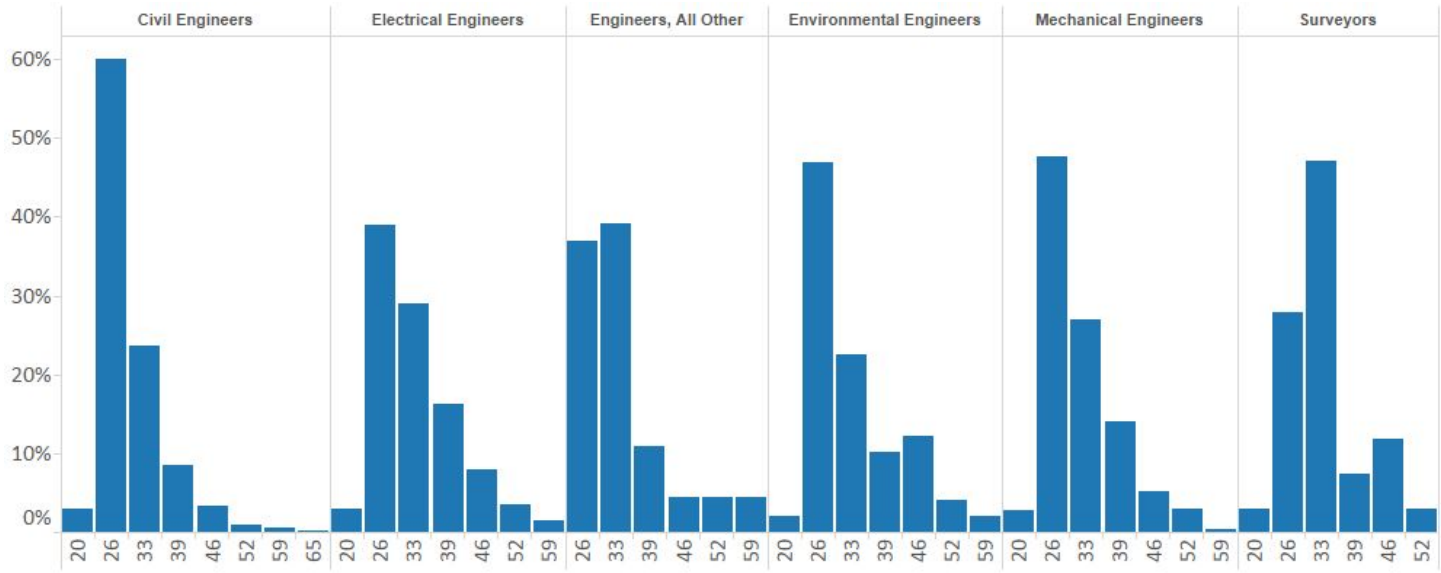


Figure7. Histograms for Engineer Ages—Current Workforce Age

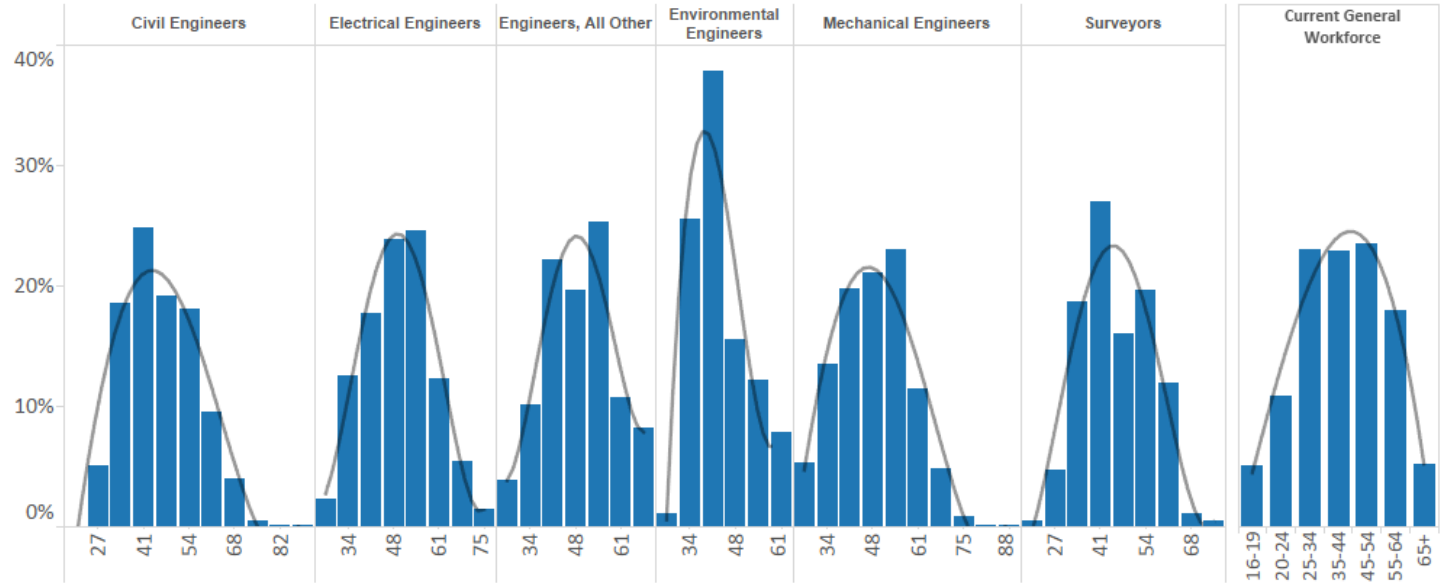
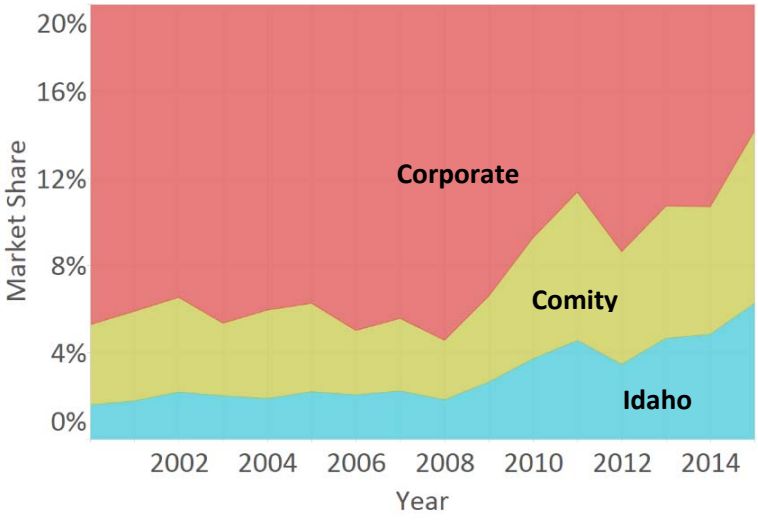


Figure 6 shows the typical acquisition age for most disciplines falls between the ages of late 20s to early 30s, although some occur in ages of 40s to 50s. In Figure 7, the current age distribution for active licenses appears to be relatively healthy with most engineers in the 40- to 50-year-old age range. The average license lifespan is 30 years, and a typical retirement occurs around age 60. Most actively working engineers are in the middle of their careers – in the span of 40 to 50 years between when they were licensed to when they retire – so the market appears to be relatively stable and not overpopulated by older workers approaching retirement or more inexperienced engineers entering the workforce.

However, over one-third of the employed land surveyors are older than 50. Since most engineering licenses are retired or are allowed to expire by age 60, there may be some concern regarding the supply of land surveyors in the future.

The final research question concerns the current and future needs for engineers and land surveyors. Such an analysis is difficult due to time delays between the internship and formal license award along with attempting to fill the current need and providing a six-year projected need to support economic and logistic growth. A starting point is to look at the OES estimates for the number employed in any given year for land surveyors, a high-demand field which has recently been described as under staffed in Idaho. The employment estimate in Idaho has fluctuated quite strongly in the past 10 years - anywhere between 220 and 500. For licensed land surveyors during this timeframe, the number employed in Idaho has been steadily increasing. The flexible number of available positions and the nature of corporate licensing restrict projecting regional supply and demand. In Figure 8 the estimated total of positions is used to evaluate the growth of personally held licenses. The upper portion represents positions filled under corporate licenses, the lowest represents Idaho originating land surveyors and the central portion represents comity licenses. Together, all licensed land surveyors make up about 14 percent of the supply.

Figure 8. Land Surveyor—Labor Market Share Graph*



**The remaining 80% of the surveyor market is covered under corporate licensure.*

The number of surveyors individually licensed increases each year, but the question remains as to whether or not Idaho is producing enough land surveyors to meet the labor demand. Currently, there are 10 individuals on the intern career path who may be eligible for a professional license within the next six years; at most two may enter the workforce in the next 6 years. The market fluctuation may change by several dozen at any time preventing modeling predictions. Fortunately, Idaho is able to attract land surveyor talent from neighboring states to help meet the increasing demand.

While projecting the labor market for land surveyors and other engineering disciplines was one of the goals for this research project, the ability to model the demand is complicated by complex market forces not covered under the scope of this initial research. The hope is to develop methods in the future as more complete data becomes available. Unfortunately, without the ability to project demand for individually licensed engineers, developing a model to examine non-degree seeking technological occupations will be equally impeded.

Conclusion

Engineering labor market information is complex. In general, only 23.5 percent of individuals performing engineering services are personally licensed in Idaho. Many more are licensed at a corporate level, captured in the OES data, revealing that personally licensed engineers tend to earn more annually than their unlicensed counterparts. Data was available indicating how engineers originating in Idaho succeed nationally. While previously there has been concern that Idaho wages for engineers were not competitive, these findings indicate that Idaho wages are comparable with neighboring states and occupies the middle ground nationally. Concerning Idaho talent leakage, findings indicate that Idaho retains roughly two-thirds of its engineering talent, whether engineers or interns, with most of the diverted talent leaving Idaho for employment in neighboring states of Washington, Utah or Oregon, consistent with research on other occupations. However, the talent leak may not be as severe as has been purported as individual license holders do not leave Idaho quickly.

Some questions were unable to be quantified at this time, such as a gap analysis for land surveyors, other engineering occupations and the demand for technological occupations that do not ultimately require postsecondary degrees. As the longitudinal data systems mature, more complete data should be available, to develop these models for labor market projections.

Collaboration with the IBLPELS, labor wage data, WRIS2 integration, the State Board of Education and OES have culminated in a comprehensive introductory analysis of Idaho's engineering talent and engineering labor market. These findings will assist the EASI to develop new protocols to more effectively measure Idaho's workforce in the coming years.