

Cost-Benefit Analysis of the Crane Rule (Phase 2)

Washington State Department of Labor and Industries

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1. INTRODUCTION

1.1 The background and history of the rule

Today cranes are widely used in the construction industry and there are numerous types of cranes found on construction sites. While the utilization of cranes greatly improves the efficiency and effectiveness of construction operations, it may also impose great risk and cause tremendous damage to the workers, employers, and the communities involved if safety procedures are not followed. A previous study has found that cranes contribute to as many as one-third of all construction and maintenance fatalities and injuries resulting in permanent disability (MacCollum, 1993). According to another report from the Center for Construction Research and Training (CPWR, 2009), there were a total of 632 crane-related construction worker deaths involving 610 crane incidents from 1992-2006 in the U.S., with an average of 42 deaths per year. More recently, construction crane incidents in 2008 alone caused 58 fatalities and 126 non-fatal injuries. Although it may be unrealistic to prevent each and every one of these incidents, more stringent and effective laws and rules on crane use are needed to protect construction workers and reduce the economic and social losses resulting from construction crane incidents.

The state of Washington is not without tragic crane accidents. Between 1999 and 2010, L&I has recorded 14 deaths in Washington related to cranes or their use. It was the collapse of a crane in Bellevue in 2006 that prompted state lawmakers to direct L&I to develop rules regulating construction cranes operating across the state. In 2007, a stakeholder group comprised of crane owners, construction firms that use cranes, labor leaders and L&I staff from the Division of Occupational Safety and Health (DOSH) was created. The 49 members have met regularly for the past four years. After the stakeholder meetings in July 2007, L&I decided to break the rulemaking procedure into two phases.

The first phase of the rulemaking establishes three major requirements for the use of cranes in construction activities: 1) require crane certifiers to obtain accreditation in order to inspect construction cranes; 2) require all construction cranes capable of lifting 2,000 pounds or more to be inspected and certified by an accredited crane certifier; 3) require crane operators to be certified on the cranes they are operating. This part of the crane rule took effect January 1, 2010.

The second phase of the crane rulemaking will update the requirements that employers must follow with regard to inspection, maintenance and operation of cranes used in the construction industry. These rules are required in order for DOSH's standard to be at least as effective as the Federal Occupational Safety and Health Administration's (OSHA) recently adopted construction crane standard. The second phase will also include qualification requirements for riggers and crane signal persons and it will establish a new standard for the use of self-erecting tower cranes. The rule language was developed in February 2011 and these provisions are expected to be adopted in December 2011 and take effect February 1, 2012.

1.2 Comparison of the current and proposed rules

Most crane accidents can be prevented by following proper operational procedures and keeping up with necessary maintenance and inspections. The new crane and derrick rule in the state of Washington was designed to align with OSHA's new standard and up-to-date American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME) standards B-30.1 through B-30.6. The proposed rule updates and specifies safe industry work practices in an effort to prevent accidents that could cause severe injuries or deaths during the use of cranes and derricks in construction. This proposed rule also incorporates technological advances in the designs of cranes and derricks, addresses related hazards in the uses of these machines, and establishes qualifications requirements necessary for employees to safely operate them. The Washington Administrative Procedure Act (APA) requires the department to conduct a cost-benefit analysis for new requirements beyond those required by (1) federal standards; (2) nationally recognized standards; (3) all other applicable Washington statutes. In order to do this, we need to identify the rule components containing new requirements that have nontrivial and quantifiable economic impacts on businesses and are not in current OSHA or ASME standards or relevant state statutes. These provisions are outlined as follows:

1). Establishing the qualification requirements for riggers

Under OSHA's new standard, qualified riggers are required whenever workers are within the fall zone and hooking, unhooking, or guiding a load, or doing the initial connection of a load to a component or structure. Additionally, employers must use qualified riggers during hoisting activities for assembly and disassembly work. However, the federal rule does not establish specific qualification requirements for riggers when performing these jobs, nor does it address

the qualification period. In response to stakeholders' requests, the proposed crane rule requires an employee to pass a written test and a practical test in order to be a qualified rigger. This qualification must be renewed every five years. At a minimum, this renewal must include a documented written exam. Employers must also use either a third party qualified evaluator or their own qualified evaluator to assess and ensure that a rigger is qualified.

2). Establishing the qualification requirements for crane signal persons

Under OSHA's new standard, a qualified signal person must be provided in each of the following situations:

(a) The point of operation, meaning the load travel or the area near or at load placement, is not in full view of the operator.

(b) When the crane is traveling, the view in the direction of travel is obstructed.

(c) Due to site-specific safety concerns, either the operator or the person handling the load determines that it is necessary.

The new federal rule also requires that a signal person must pass an oral or written test and a practical test in order to be qualified and employers must use either a third party qualified evaluator or their own qualified evaluator to assess and ensure that a rigger is qualified. However it does not address the renewal requirement. In response to stakeholders' requests, the proposed crane rule requires that the qualification for a signal person be renewed every five years. At a minimum, this renewal must include a documented written or practical exam.

3). Establishing general and operation requirements for self-erecting tower cranes

The self-erecting tower crane is a relatively new type of crane in the construction industry. The design, operation and use of a self-erecting tower crane are different from those of a traditional tower crane, so distinct requirements need to be established and followed. So far there is no federal regulation or national consensus standard in place for self-erecting tower cranes, although the ANSI is drafting the new standard for the use of self-erecting tower cranes and this standard is expected to be published in 2012. With the increased use of self-erecting tower cranes on small construction sites in Washington State over the past few years, an effective regulation is warranted to ensure the safe operation of these machines and to protect workers from being injured. The proposed rule creates a separate section (WAC 296-155-541) for self-

erecting tower cranes and includes requirements for general use, maintenance and operation of these cranes. Most of these requirements are also addressed in manufacturer's specification, and they are not considered as increased requirements from the current rule stating that the employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Many other provisions will only impose minor costs on the affected businesses. However, there are two major requirements that may impose significant costs on the businesses involved and they are listed as follows:

Requirement 1: When cranes are erected and after each reconfiguration, before placing the crane in service, all functional motions, motion limiting devices, brakes, and indicating devices must be tested for operation.

Requirement 2: Conditions that adversely affect the crane at the time of erection, reconfiguration, or dismantling must be a limiting factor that could require suspending the operation. These conditions include but are not limited to:

- (a) Support conditions;
- (b) Wind velocity or gusting winds;
- (c) Heavy rain;
- (d) Fog;
- (e) Extreme cold or heat;
- (f) Ice;
- (g) Artificial lighting.

All the other changes to the current rule are intended to address OSHA's regulations or current ASME standards, or to accommodate stakeholders' request to enhance safety. These provisions are either not considered as increased requirements, or they only impose minor costs on the businesses involved.

2. ASSESSING COSTS

2.1 Survey methodology

To estimate the economic impact of the proposed phase 2 crane rule on the affected businesses, L&I developed a survey in April 2011. L&I designed this survey in collaboration

with the DOSH crane technical team, Assistant Attorney General for DOSH, L&I internal survey review committee and other relevant parties. The survey was used to gauge all the probable new compliance costs that businesses would incur if the proposed portion of the crane rule was adopted and to determine whether there exists a disproportionate cost impact on affected small businesses.

2.1.1 Sampling frame

The proposed crane rule applies to all construction and general businesses that own or use cranes and derricks for construction activities. The development of the sampling strategy for the cost survey for the proposed rule requires the identification of the set of businesses that will most likely be affected by the proposed rule changes. To sample the establishments that best represent the underlying population, L&I first obtained a list of crane owners from its crane certification database. Next, L&I identified 24 industrial subsectors¹ that most likely would lease cranes from rental companies to perform construction work. Based on these 6-digit NAICS codes, the department extracted the most recent business information data from its administrative data warehouse. By doing this, L&I obtained the population of crane lessees in the construction industry. Together, these two lists constitute the targeted business population that would likely be affected by the proposed rule.

2.1.2 Sample size

In determining the appropriate sample size that was needed to obtain valid cost estimates related to the compliance with the proposed phase 2 crane and derrick rule, several factors including the desired confidence level, uncertainty in the cost estimates, and the expected response rate were considered.

First, the conventional level of 95% confidence and $\pm 5\%$ uncertainty were chosen in order to ensure rigorous and statistically valid estimates. Next, approximately 22,000 unique business accounts were pulled from the crane owner list and the crane lessee list as described in 2.1.1 and these businesses comprise the entire population. L&I also weighed in the fact that past rulemaking-related surveys often had a low response rate.

¹ To control the survey cost, we only consider crane lessees that are in the construction industry. In reality, there may be some businesses in the general industry that would also use cranes to perform construction work.

The final determination of the sample size for this survey was based on the following factors: (1) the population is approximately 22,000 active employers who will most likely be affected by the proposed rule changes, (2) the desirable confidence level is 95% (with +/- 5% sampling error), and (3) the response rate for a similar survey has been relatively low. The department finally chose a sample size of 3,639 to sufficiently yield statistically significant cost estimates, assuming a 10% response rate and conventional levels for statistical validity.

2.1.3 Sampling method

In order to obtain reliable estimates of compliance costs on the affected businesses, an appropriate sampling method needs to be developed. L&I adopted proportionate stratified random sampling by subsectors for crane lessees and crane owners that don't rent cranes as their main revenue. This method allows the department to create strata at the subsector level that pattern the underlying population, thereby helping to reduce sampling variability. To implement this method, L&I determined the sample size needed for each 6-digit NAICS code by multiplying its proportion of the sampling frame by the overall desired sample size (See Table A2 in the Appendix). L&I also randomly selected a certain number of samples from the crane owner list. The final mailing list was obtained by combining the selected samples from the above steps and removing the duplicate records.

2.1.4 Survey development and response rate

The survey was first designed by the regulatory economist in March 2011. The draft was then reviewed by the crane technical team and the AAG from DOSH. Per L&I internal policy, the survey was also submitted to the survey committee for their review. The survey was updated and finalized based on feedbacks from all the parties involved in April 2011, and it was sent out on May 6, 2011. The survey respondents were required to complete the survey and return it to L&I by the end of May 2011.

Between May 6 and May 31, 2011, L&I received 788 completed surveys from the businesses out of the 3,639 surveys sent. Hence, the response rate for those presumed to have been contacted was 21.7%. Six hundred and thirty five respondents reported that they did not have employees performing as riggers or signal persons, nor did they use any self-erecting tower crane. The remaining 153 employers indicated that at least one section applied to them. There may have been some unsuccessful deliveries due to possible errors in the preparation or the

delivery process, so the actual response rate is likely to be higher. Given the short timeframe available to conduct the survey and the fact that no follow-up contacts were made, the response rate is higher than expected.

2.2 Survey contents

The majority of this proposed crane rule is intended to clarify the most current OSHA crane standard or national industrial consensus standard and is not considered as increased requirements to the businesses involved. These components of the rule are not addressed by the survey questions. After comparing the proposed rule with the existing standards and discussing the findings with the AAG and technical team, L&I identified three major requirements that are above current standards and which will probably impose more than minor compliance costs on the businesses involved.

The survey was organized as follows: the first section of the survey was designed to obtain the background information of each employer including the number of employees, the primary business operations, and the work activities involved; the second through the last sections were designed to estimate the probable new compliance costs relating to each increased requirement. Specifically, the survey plans for the three major estimates required were as follows:

(1) Estimate the compliance costs relating to riggers qualification requirements

The survey will first ask the respondents if they hire any employees to perform the tasks that would require qualified riggers under the proposed rule and if yes, how many of these employees they employ and how many of them are already qualified. The survey next asks them to estimate the costs of providing necessary training, mandatory written and practical tests, along with the evaluation services from a qualified evaluator. The estimated total costs from each respondent will be used to derive the aggregated annual costs of this provision on the affected businesses as a whole.

(2) Estimate the compliance costs relating to crane signal persons qualification requirements

The survey will first ask the respondents if they hire any workers designated as signal persons and if yes, how many of these employees they employ and how many of them are already qualified. The survey then ask them to estimate the costs of providing necessary training, mandatory oral or written test and practical test, along with the evaluation services from a

qualified evaluator. The estimated total costs from each respondent will be used to derive the aggregated annual compliance costs of this provision on the entire affected businesses.

(3) Estimate the costs of new requirements employers should comply with when they use self-erecting tower cranes to perform construction work

The survey will first ask the respondents if they use any self-erecting tower cranes to perform construction work. If yes, it will next ask them approximately how many crane jobs they complete with the use of the self-erecting tower cranes in a typical year. Finally, it will ask them whether they are already in compliance with these two requirements and if not, how much the estimated cost would be for each requirement respectively. The total costs from each respondent the question applies to will be used to derive the aggregated annual costs of this provision on the entire affected businesses.

2.3 Quantifiable costs

The approach to estimating monetized compliance costs is essentially the same for the first two rule components in the survey. First, the average cost is derived from the survey as a unit cost. This cost is then multiplied by the estimated total number of affected riggers/signal persons to obtain the total compliance cost of the rule component in question on the businesses as a whole. For the data in the last section, L&I first calculates the average cost of each new requirement and multiplies this with the estimated number of crane jobs that would cause this cost to yield the total annual cost on the affected businesses as a whole. Finally, the total costs from each section are summed up to yield the aggregated probable costs as a result of the proposed rule. To make the estimate of total costs as flexible and inclusive as possible, the department also use the third quartile of the estimated cost from the survey as the upper bound compliance cost, along with the lower bound cost derived from other data sources, such as the standard training fees for riggers and/or signal persons from the training providers endorsed by the National Commission for the Certification of Crane Operators (NCCCO). The lower bound costs would likely give us more realistic estimates as most employers will choose one of these training providers for the required training and testing as well as other necessary services.

2.3.1 Cost relating to riggers qualification requirements

Section 2 in the survey asked respondents whether they have employees performing the tasks that require qualified riggers and if yes, how much the total cost would be if the proposed new qualification requirements were adopted. One hundred and forty two respondents provided their responses indicating they were subject to this requirement (“YES” to question 2a). Table 1 shows the costs estimated by these respondents. Assuming the hourly wage paid to a rigger is \$24.73², the average total cost is \$893 for the training fee and additional 8 hours of travel time, \$622 for the testing and additional 8 hours of travel time, and \$414 for the evaluation service from a qualified evaluator. Since the proposed rule requires that a rigger qualification cannot exceed a five-year period and at a minimum, the renewal must include a documented written exam, a rigger needs to be qualified initially after the rule takes effect and this qualification needs to be renewed twice over an 11-year time span. If we assume that 20% of riggers need to be retrained before retaking the written exam for each renewal, the total average cost would be \$904 each time. In total, the annual average cost per rigger is \$285, while the median cost is \$208 and the third quartile amounts to \$332 in an 11-year time span.

An alternative approach to estimating the costs with regard to riggers qualification requirements is based on the training and exam fees that qualified training providers charge for these services. This approach would give us a lower bound and probably more reliable estimate on the compliance costs the affected businesses would incur. In an effort to facilitate selection of an appropriate vendor for employers, The NCCCO has prepared a list of firms and organizations that offer preparatory training for rigger qualification exams. Table A4 contains selected providers that have specific information available on their websites about the cost for qualified riggers training. The costs vary between \$125 for both riggers/signal persons training and \$660 for riggers only, with the average of \$299 per rigger. The durations of training classes range from 4 hours to 3 days, with the average of 9 hours. The total training cost amounts to \$719, which is very close to the estimated median cost from the survey. However, the exam fee is much lower and most of time, the evaluation service is included in the training they provide. Altogether, the annual cost for a rigger to be qualified is \$142. Given the fact that many unions also provide training programs that comply with riggers qualification requirement to workers for

² This value was derived from the average weekly wage for all construction workers released by Washington Employment Security Department Quarterly Census of Employment and Wages, 3rd quarter report, 2010.

much lower costs or even for free and a number of respondents have indicated so, the actual total cost for this provision is likely to be even lower.

Table 1. Cost relating to riggers qualification requirements

Data Source	Estimated costs from the survey			Cost charged by training providers
	Mean	Median	3 rd quartile	Mean
Training hours	16 hrs	8 hrs	17 hrs	9 hrs
Total training cost (including 8 additional hours for travel time) ³	\$893	\$695	\$917	\$719
Exam fee	\$424	\$300	\$600	\$190
Total exam cost (including 8 additional hours for travel time)	\$622	\$498	\$798	\$388
Evaluation cost	\$414	\$250	\$500	Included in the training fee
Total cost for initial qualification	\$1,929	\$1,443	\$2,215	\$1,107
Total cost for the first renewal in the 6 th year ⁴	\$904	\$638	\$1,082	\$338
Total cost for the second renewal in the 11 th year	\$904	\$638	\$1,082	\$338
Annual cost in 11-year period⁵	\$285	\$208	\$332	\$142

To estimate the total number of workers in the state of Washington who would need to be qualified riggers, L&I used the detailed annual data at the state level on the number of establishments, employees, and total payroll hours for each NAICS code within the construction industry from 2008 County Business Patterns, which was released by U.S. Census Bureau. L&I also used the data on the value of construction work in Washington State from the 2007 U.S.

³ We use \$299 as the fixed training fee.

⁴ This cost is the sum of the evaluation fee, 50% of total exam cost and 20% of total training cost.

⁵ We use 5% as the discount rate to annualize these costs.

Economic Census. In addition, L&I made the following assumptions in estimating the total number of affected riggers:

1. L&I assumes that the proportion of businesses performing work that requires a crane for each NAICS code in Washington is the same as that at national level, which was estimated in the economic impact analysis for OSHA's new crane rule.

2. L&I assumes that among all the construction businesses that do work using cranes, 10% of them own their own cranes and the remaining 90% of them do not own but lease cranes from crane-rental companies or other companies that own cranes. This assumption is reasonable given that the vast majority of construction companies would likely lease cranes rather than having their own ones.

3. L&I estimates that on average, about 5 crane jobs would be performed every year by each crane owned by construction companies and 5 crane jobs by each establishment that lease cranes. While rented cranes are likely to be used more often, self-owned cranes are expected to be operated less frequently. Overall, the estimate of the total number of crane jobs per year is expected to be reliable as this estimate accounts for about 3.5% of the 860,000 total annual U.S. crane jobs (OSHA, 2008), which is very close to Washington's proportion of the U.S. total in terms of other measures such as the number of establishments, the number of employees and the value of construction work.

4. L&I estimates that on average there is one rigger and one signal person associated with each crane owned by construction companies. L&I uses a 20:1 ratio of crane jobs to riggers/signal persons for crane lessees since these companies do not own cranes and are expected to have fewer riggers and signal persons.

Based on these assumptions and using the state data from U.S. Census Bureau, L&I finally estimates the total number of riggers in the construction industry in Washington at 2,734 (See table A1 in the appendix). According to the proposed rule, qualified riggers are required under certain conditions. If we assume 70%⁶ of all the riggers would receive qualifications after the rule is adopted, the average annual cost per rigger is multiplied by the estimated 1,914 riggers to

⁶ This percent number was discussed and estimated by the DOSH crane technical experts.

arrive at a total annual cost of \$545,490. The upper bound and lower bound total costs are \$635,448 and \$271,788 respectively.

2.3.2 Cost relating to crane signal persons qualification requirements

Section 3 in the survey asked respondents whether they have employees performing the tasks that require qualified signal persons and if yes, how much the total cost would be if the proposed qualification requirements were adopted. One hundred and thirty two respondents provided their responses indicating they were subject to this new requirement (“YES” to question 3a). Table 2 shows the costs estimated by these respondents. Assuming the hourly wage paid to a signal person is \$24.73, the average total cost is \$770 for the training fee and additional 8 hours of travel time, \$562 for the testing and additional 8 hours of travel time, and \$391 for the evaluation service from a qualified evaluator. Since OSHA’s new crane rule has already required signal persons to be qualified, the only requirement in this proposed rule beyond federal standard is that it requires a signal person qualification to be renewed every five years. Therefore, the new compliance cost attributed to this rule is the renewal cost. As a signal person’s qualification needs to be renewed twice over an 11-year time span, the annual total cost per signal person is \$100 on average, while the median cost is \$74 and the third quartile amounts to \$120.

Same as for the riggers qualification requirement, the cost data from the training providers give us a lower bound and probably more reliable estimate on the compliance costs the affected businesses would incur with regard to signal persons qualification. Table A5 contains selected providers that have specific information available on their websites about the cost for qualified signal persons training. The training costs vary between \$125 for both riggers/signal persons trainings and \$660 for signal persons only, with the average of \$275 per signaler. The durations of training classes range from 3 hours to 2 days, with the average of 8 hours and the total training cost at \$671. However, the exam fee is much lower and most of time, the evaluation service is included in the training they provide. Altogether, the annual cost for a signal person to meet the renewal requirement is \$40.

Using the same procedure mentioned above for riggers, L&I derive the estimate on the total number of signal persons in construction industry in Washington (See table A1 in the appendix). According to the proposed rule, qualified signal persons are required under certain conditions. If

we assume 75%⁷ of all signal persons would receive qualifications after the rule is adopted, the average annual cost per signal person due to this rule is multiplied by the estimated 2,051 signal persons to arrive at a total annual cost of \$205,100. The upper bound and lower bound total costs are \$246,120 and \$82,040 respectively.

Table 2. Cost relating to signal persons qualification requirements

Data Source	Estimated costs from the survey			Cost charged by training providers
Cost Item	Mean	Median	3 rd quartile	Mean
Training hours	12 hrs	6 hrs	10 hrs	8 hrs
Total training cost (including 8 additional hours for travel time) ⁸	\$770	\$621	\$720	\$671
Exam fee	\$364	\$275	\$500	\$190
Total exam cost (including 8 additional hours for travel time)	\$562	\$473	\$698	\$388
Evaluation cost	\$391	\$250	\$500	Included in the training fee
Total cost for the first renewal in the 6 th year	\$826	\$611	\$993	\$328
Total cost for the second renewal in the 11 th year	\$826	\$611	\$993	\$328
Annual cost in 11-year period	\$100	\$74	\$120	\$40

2.3.3 Cost relating to the use of self-erecting tower cranes to perform construction work

As of February 2011, there were a total of 24 certified tower cranes in Washington State⁹. A breakdown of statistics by crane owners indicated that only 4 of these cranes were certified self-erecting tower cranes. The population of this type of cranes is likely still very small even including those that have not yet certified by the department. Section 4 in the survey asked

⁷ This percent number was discussed and estimated by the DOSH crane technical experts.

⁸ We use \$275 as the fixed training fee.

⁹ Crane certification database, Washington Department of Labor and Industries. 2011.

respondents whether they use any self-erecting tower cranes to perform construction work and if yes, how much the total cost would be if the proposed increased requirements relating to this type of machine were adopted. Only 9 respondents indicated they use self-erecting tower cranes to perform construction work (“YES” to question 4a). Based on their feedback, they complete about 23 total crane jobs using self-erecting tower cranes in a year and the average amount of time needed to meet requirement 1 is 4 hours. As these employers account for approximately 1.1% (9 out of 788 completed surveys), this percentage, along with the average crane jobs these employers perform, is applied to the total population to arrive the estimate of the total crane jobs relating to the use of self-erecting tower cranes at 643 and the total cost of requirement 1 to be \$93,440¹⁰. As for requirement 2, L&I estimates that 1% of the time, one of the listed events would occur and result in the suspension of operation. Using the average cost of \$14,100 per suspension from the survey, this yields the total cost of requirement 2 to be \$90,663. Altogether, the total cost of these requirements is approximately \$184,103¹¹ for the affected businesses.

3. ASSESSING BENEFITS

In order to estimate the probable benefits that can be attributed to the proposed crane rule, L&I uses multiple sources including the existing relevant studies, the BLS workplace injury data and workers’ compensation claim data from the department’s administrative database. It is worth noting that we did not attempt to monetize the pain and suffering experienced by injured workers and their families, nor did we try to quantify the benefits of the improved clarity and understandability of the proposed rule. In addition, there might be some costs associated with crane accidents that do not result in an employee injury. Therefore, our approach tends to underestimate the real social benefits resulting from the proposed crane rule.

3.1 Quantifiable benefits

3.1.1 Benefit of preventing injuries

One major benefit of the proposed rule is that it is expected to help reduce the number of crane-related injuries on construction worksites. As many of these injuries are severe,

¹⁰ We use \$36.33 as the hourly wage for a competent person to test these devices.

¹¹ Given the small number of observations from the survey, this cost estimate is likely not accurate.

sometimes even catastrophic, the benefit of avoiding these incidents could be substantial for construction workers, employers, regulatory agencies, and society in general.

All of the three major requirements of the proposed rule that are above current OSHA rules or ASME standards will help prevent future crane accidents. Correct rigging is essential to ensure safe crane operations and lack of rigger training has been identified as one of major causes of crane-related accidents (Howard, 2001). When a rigging failure occurs, it can be catastrophic in terms of injury, property damage and equipment replacement costs. While using a qualified rigger in itself cannot guarantee the prevention of any accident, it is anticipated that this practice will reduce the number of crane incidents. Signaling is also a key part of crane operations and using a qualified signal person would also be expected to help reduce crane accident rates. In addition, the proposed rule establishes a number of safety standards for the use of self-erecting tower cranes in response to stakeholders' safety concerns arising from growth in use of this new type of crane.

To best gauge the number of accidents that could be prevented due to the adoption of these provisions, existing relevant studies have been reviewed and data from many different sources have been utilized as the basis for our estimation. One study was conducted by Yow et al. in 2000 to examine the cause of crane-related accidents reported to California Division of Occupational Safety and Health between 1997 and 1999. They found that 34 out of a total of 158 accidents were caused mainly by unsecured load and 32 were due to lack of communication. These two factors together represented 41.8% of total crane accidents and the use of qualified riggers and signal persons are anticipated to successfully prevent most of these accidents. About one-fourth of all the crane-related nonfatal injuries each year at U.S. Department of Energy facilities occurred when workers were performing rigging or maintenance activities (USDOE, 1993). Another research study investigating all crane-related claims between 1999 and 2008 in BC, Canada found that 44% of victims are trade helpers and laborers in construction sector (Nelson, 2010). From a different perspective, Hauser and his research team (Hauser et al, 1998) examined all accidents involving cranes on the Outer Continental Shelf between 1995 and 1998 and observed that 12 out of 34 incidents can be attributed to human errors associated with crane operators, riggers, signal persons and other personnel involved in the crane activity. Further, they revealed that riggers appear to be at a much greater risk of injury and death than any other personnel during crane operations. Taking all these research findings into consideration, L&I

estimates the percent of total crane injuries that would be prevented if the proposed rule were in place at 30%, with 25% and 35% as the lower bound and upper bound respectively.

To collect the information on the average number of nonfatal crane related injuries in Washington each year, L&I searched the injury reports involving cranes in the construction industry in 1999-2009 in its internal data warehouse. By filtering the claims using the source of injury or illness code and the NAICS code (“343” for cranes and “23” for construction industries), L&I identified 223 nonfatal state-funded crane-related claims. Using the percentages that L&I has estimated above and including the self-insured claims¹², approximately 59 to 82 nonfatal injuries would be prevented as a result of compliance with the proposed provisions in an 11-year time span. Finally, L&I adopts OSHA’s estimated average cost of \$62,500 for nonfatal crane-related injuries (OSHA, 2010) and concludes that the total monetized benefit of avoiding these injuries amounts to \$397,727 annually, with a possible range from \$335,227 to \$465,909.

3.1.2 Benefit of saving lives

Another anticipated benefit of the proposed crane rule is that it will help reduce the number of crane fatalities. This is particularly obvious compared to many other types of construction accidents as more often, crane accidents cause devastating results in terms of the fatalities. For example, a rigger who used polyester slings improperly to raise a large crane component aloft caused the collapse of a crane in New York in 2008 and seven people were killed, including six construction workers on the site (New York City Department of Buildings, 2009). This is a tragedy that could have been avoided if the rigger had received proper training and possessed sufficient knowledge and skills to be qualified for his job. According to recent BLS data (BLS, 2008), there were 26 and 35 fatal accidents in the private construction industry in 2006 and 2007 respectively in which cranes played a primary or secondary role. Over a longer period of time, from 1992 to 2006, 632 crane related fatalities were logged in all industries, with an average of 42 fatalities each year, while the last 4 years of that time period showed a much higher average of 75 crane-related fatalities. Table 3 demonstrates that the most recent three years have seen the number of crane-related fatalities still hovering at a stubbornly high level, with an average of 71 deaths per year (BLS, 2010). More aggressively, OSHA estimated that 89 crane-related fatalities

¹² Assuming the total number of self-insured crane-related claims is 5% of that of state-funded claims.

occur per year in construction work and that its new rule would have saved about 220 lives if it were adopted in 2000 instead of 2010 (OSHA, 2010).

Table 3. Number of crane-related fatalities by source of injury

Number of fatalities			
Year	Primary source	Secondary source	Total fatalities
2009	23	29	52
2008	45	48	93
2007	30	37	67
2006	28	45	73
2005	43	39	82
2004	39	47	86
2003	34	25	59

Source: annual CFOI data 2003-2009, Bureau of Labor Statistics, U.S. Department of Labor.

As for the State of Washington, 14 deaths related to cranes or their use were recorded between January 1999 and February 2010 (Washington Department of Labor and Industries, 2010), which is equivalent to more than 1 crane fatality each year.

Several existing studies have examined the cause and the type of crane fatalities. A study by Suruda et al. found that among all the 502 crane-related fatalities between 1984 and 1994, 7% of them were due to rigging failure. Other causes of crane incidents such as struck by moving load can be, at least in part, attributed to the lack of communication between signal persons and operators. Current studies on fatalities by construction trade in crane-related accidents also help predict the number of fatalities that can be prevented as a result of the adoption of this proposed rule, as we know most rigging and signaling work is performed by construction laborers. One study concluded that more construction laborers were killed in crane-related incidents than any

other trade. They accounted for 30% (191 out of 632 fatalities) of total crane-related deaths in 1992-2006 (CPWR, 2009). Another study showed that 33% of victims of crane fatalities are construction laborers, which is 5% higher than crane operators (Bains, 2010). Requiring qualified riggers and qualified signal persons can help prevent these accidents from occurring. In addition, the proposed rule creates a new subsection and clarifies the fall protection requirements while using the crane, which is expected to help reduce the number of fatalities caused by falling from the cranes. The new standards on the use of self-erecting tower cranes and all the other proposed rule changes intended to improve the clarity and understandability of the crane rule will also contribute to the reduction in the number of fatalities. Conservatively, L&I estimates that 1 to 2 fatalities could have been prevented as a result of the compliance with the proposed rule as a whole in the period between 1999 and early 2010. This translates into a saving of \$8.7 million to \$17.4 million in that period¹³. That being said, the annual saving is approximately \$0.79 million to \$1.58 million for the affected businesses.

3.1.3 Benefit of avoiding indirect costs associated with crane-related incidents

The estimated cost we have adopted in deriving the total benefit of preventing injuries in 3.1.1 is the direct cost of crane-related injuries. It does not take many other losses associated with the injuries into account. On the other hand, numerous studies have shown that the resultant hidden costs are very sizeable, especially for an accident involving cranes. These costs are commonly referred to as indirect costs and may include, but are not limited to, the costs attributed to loss of productivity of the injured worker; loss of productivity of the other workers; time lost by supervisors and managers; cost of transportation to the nearest medical-treatment facilities; reduced employee morale and heightened fear of accidents; the additional recruitment and training efforts for replacement workers and additional administrative costs for dealing with the injuries. Among all of these costs, employee morale is a less tangible factor than other documentable factors. However, it is widely acknowledged that few factors affect productivity more than employee morale and few things are more detrimental to employee morale than seeing a co-worker injured.

The estimates of indirect-to-direct cost ratio range from 10% to 2000% in current literature. The exact magnitude of this ratio depends on the industry in which the injury occurs, the injury

¹³ We use OSHA's estimated value of \$8.7 million for a statistical life (OSHA, 2010)

severity, the date when the injury happens, and the inclusiveness of the researcher's investigation of indirect costs. This issue has received ample attention and the construction industry has been in focus for the past couple of years. For example, Hinze and Appelgate (1991) examined construction-worker injuries and concluded in their study that the ratio of indirect-to-direct costs for medical-only injuries was 4.2, but it could be as large as 20.3 for restricted activity or lost-workday injuries. Another earlier research study pertaining to the construction sector identified that the magnitude of this ratio varies by claim costs with a range of 1.1 to 9.2 (Levitt, Parker and Samuelson, 1981). In its previous cost-benefit analyses of the heat-related illness and ergonomics standard rules, L&I conducted an extensive literature review and selected 4.1 as the median ratio of indirect to direct costs of workplace injuries. Given the fact that the cost of property damages has been factored into our estimated direct cost, this analysis uses a conservative ratio of 0.5 to derive the indirect benefit of avoiding crane injuries. Based on this assumption, the annual saving from the indirect costs ranges from \$167,614 to \$232,955 if the proposed provisions were adopted.

3.2 Qualitative benefits

This section of the report is intended to advise the public on how probable qualitative benefits need to be identified and weighed in along with the probable quantitative benefits estimated above. Monetizing subjective values associated with this proposed rule is very difficult and, in some cases, impracticable. However, these benefits need to be addressed properly because they could be tremendous and deeply felt by all the involved parties. The clarification of the current requirements is one of these unquantifiable benefits. Another major component of these benefits is the avoidance of the pain and suffering felt by families and friends of victims of crane accidents.

3.2.1 Benefit of clarifying safe workplace requirements

One tangible benefit of the rules as proposed is that they provide greater clarity so that employers and employees involved in crane operations have a better understanding of what is required and when it is required to ensure safe crane use. Specifically, the proposed rule clarifies the requirements in OSHA's recently adopted crane rule and the most updated national standards. It also explicitly delineates many requirements that are part of manufacturer's specifications but are not always clearly stated to employers. By doing this, employees exposed

to hazards are more likely to receive appropriate and sufficient protections and employers are less likely to be cited and fined for violations of standards that they may not have fully understood. Ultimately, this will save businesses from the cost of appeals and legal fees and will benefit the department as well.

3.2.2 Benefit of avoiding negative impacts on the victims' families or friends

When a serious accident occurs, it does not only affect the employer and the workers, but also anyone else who has a connection with them. This may be in the form of the dependents' and friends' pain and suffering, dread, emotional distress, and other physical and mental losses and should not be ignored, although difficult to monetize.

4. LEAST BURDENSOME ALTERNATIVE ANALYSIS

The department considered several alternatives for these proposed provisions and has determined that the draft proposed language is the least burdensome approach available while still accomplishing the intent of the rule. The following sections outline some more burdensome alternatives that the department considered during the rulemaking process but ultimately did not include in the proposed rule.

4.1 No grace period for riggers qualification requirement

L&I had considered not creating a grace period for riggers qualification requirement. After more consideration and discussion with the stakeholders, L&I determined that the 6-month grace period would provide necessary and sufficient time for riggers to be qualified. In the meantime, this would still meet the timeline requirement for implementation of the new crane rule.

4.2 More frequent qualification renewals for riggers and signal persons

L&I had considered creating two-year or three-year renewal requirement for both riggers and signal persons qualifications. After more consideration and discussion with the stakeholders, L&I determined that this requirement would impose unnecessary burden on the affected businesses and decided that renewing these qualifications every five years was sufficient. In the meantime, this time frame is in line with the renewal requirement for crane operator certification.

4.3 More comprehensive testing requirement for qualification renewals

At one time, L&I had considered requiring both written and practical exams for the renewal of riggers and signal persons qualifications. After more consideration and discussion, L&I eventually required only one exam for these renewals and is confident that this requirement is sufficient.

4.4 More costly approach to evaluate qualifications of riggers and signal persons

L&I had considered requiring a third-party qualified evaluator to assess and ensure that a rigger or signal person is qualified. After more consideration and discussion with the stakeholders, L&I determined that this requirement would impose unnecessary burden on the affected businesses and decided that using employer's own qualified evaluator would be another option that also fulfills this objective.

4.5 No grace period for crane certifier accreditation and crane certification requirements for digger derricks that don't meet the exemption criteria of the current rule

L&I had considered not creating a grace period for crane certifier accreditation and crane certification requirements for digger derricks that don't meet the exemption criteria of the current rule. After more consideration and discussion with the stakeholders, L&I determined that the 6-month grace period would provide necessary and sufficient time for digger derrick owners and users.

5. CONCLUSIONS

Cranes are critical machines that contribute to the work efficiency of most construction projects nowadays, but due to their size and power as well as the complex design and operation, they also pose great safety hazards to the workers around them. A very important factor in crane safety, in addition to many others, is the skills and capability of related crane personnel such as riggers and signal persons. In addition, a feasible standard which originates from safe industrial practice is very much needed for the use of self-erecting tower cranes, a relatively new but fast-growing type of crane family. These issues were addressed and solutions to them have been developed as part of this rulemaking. In compliance with the Administrative Procedures Act

(APA), chapter 34.05 RCW, the department has reviewed the proposed provisions and estimated the probable costs and benefits associated with them.

While there always exists some degree of uncertainty in anticipating what the costs and benefits of this proposed rule would be, L&I concludes through the use of the survey and other statistical techniques that the total increased compliance cost ranges from \$537,931 to \$1,065,671. To estimate the benefits of the proposed rule as accurately as possible, L&I conducted an in-depth analysis of the internal claim data and an extensive review of current literature and existing studies on this subject matter, as well as an active consultation with DOSH technical staff and other experts. The department finally comes to the conclusion that the aggregated benefit of these proposed provisions is from \$1.29 million to \$2.28 million. Therefore, the net benefit is estimated at \$452,807, with a range from \$228,079 up to \$1.74 million each year.

Based on these results, L&I concludes that the probable benefits of the proposed rule changes outweigh the probable costs.

6. LIMITATIONS

Due to time and resource constraints, there are some limitations in this analysis, which can be summarized as follows:

6.1 Exclusion of construction activities in general industry

While we included the majority of affected businesses in our analysis, we did not consider cases in which cranes are used by general industry to perform construction work into our consideration. This would affect our estimates on the total costs and benefits associated with the proposed provisions, but the effect should be limited and the related costs and benefits would offset each other to some extent. The limitation of the resources available to the department and the urgency of adopting this rule prevented us from conducting a more extensive analysis that includes both construction industry and general industry.

6.2 Assumptions that are difficult to prove due to lack of data in the state level

In order to derive the final estimates on the total compliance cost and benefit, L&I has made several assumptions. For example, due to the lack of information in state level data, L&I

adopted the assumption that OSHA had made on the proportion of U.S. construction businesses that perform work requiring a crane for each 6-digit subsector. While the construction industry in Washington may have a different level of involvement with crane uses than it does nationwide, this assumption is needed and is acceptable.

6.3 Non-response bias

Although the number of completed surveys is larger than needed to ensure statistical validity, the number of respondents who are related to each survey section varies and it is likely there is some non-response bias, especially for the survey questions with low response rate. That is, some employers may be more inclined not to respond than others. For example, it is almost always the case that those with strong opinions about the survey topic or with more interest in the outcome are more likely to respond. In this survey, it is very obvious that small businesses have more serious non-response bias than relatively larger businesses as the proportion of small businesses out of total businesses that have completed the survey is much smaller than their proportion in the population of entire affected businesses.

6.4 Inclination to overestimate costs

In a similar manner, respondents naturally have an incentive to inflate their cost estimates, which may undermine the quality of the cost data we gathered. This incentive stems from the discontent that prevails among construction businesses with the safety regulations, especially in tough economic times like those we are currently experiencing.

6.5 Missing or infeasible data

A small number of respondents indicated that a certain question applied to them, but they didn't provide numerical values of the costs. A few of them simply did not answer the question when they were asked to estimate the costs. Others described the costs as "a lot", "huge", "don't know", etc. These missing or infeasible data reduced the total number of "quantitatively useable" surveys on which this analysis is based.

6.6 Unknown actual effectiveness of the proposed rule

Another limitation of the present analysis is that it does not account for the actual effectiveness of the proposed rule measured by the number of injuries and fatalities that would be prevented due to the new standards. While it is necessary to estimate a certain level of

effectiveness of the rules, it is always difficult to know in advance what components of the proposed rule will likely be effective and to what extent. While these have been estimated as accurately as possible, there may still be some possibility that the actual effectiveness is far from what we expected.

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8. APPENDIX

Table A1. Industrial profile of affected establishments in Washington State

NAICS/ Industry	Total businesses	Percent of affected businesses	# of affected businesses	# of Cranes	# of crane jobs	# of affected riggers	# of affected signalers
Crane rental							
238990 All other specialty trade contractors	805	3.71%	30	90	.....	.....	.....
532412 Const./Min./ for machine & equipment rental & leasing	125	94.00%	118	611	.....	.....	.....
Crane owners in the Construction industry							
236115 New single-family general construction	2,874	5.00%	144	431	2156	431	431
236116 New multifamily housing construction	112	5.00%	6	17	84	17	17
236117 New housing operative builders	1,093	5.00%	55	164	820	164	164
236118 Residential remodelers	3,369	1.00%	34	101	505	101	101
236210 Industrial building construction	80	10.00%	8	24	120	24	24
236220 Commercial and institutional building construction	1020	10.00%	102	306	1530	306	306
237110 Water and sewer line and related structures construction	394	10.00%	39	118	591	118	118
237120 Oil and gas pipeline and related construction	30	10.00%	3	9	45	9	9
237130 Power and communication line and related construction	138	5.00%	7	21	104	21	21
237310 Highway, street, and bridge construction	335	1.00%	3	10	50	10	10
237990 Other heavy and civil engineering construction	144	5.00%	7	22	108	22	22
238110 Poured concrete foundation and structure contractors	892	0.50%	4	13	67	13	13
238120 Structural steel and precast concrete contractors	89	10.00%	9	27	134	27	27

NAICS/ Industry	Total businesses	Percent of affected businesses	# of affected businesses	# of Cranes	# of crane jobs	# of affected riggers	# of affected signalmen
238130 Framing contractors	867	7.50%	65	195	975	195	195
238140 Masonry contractors	537	0.50%	3	8	40	8	8
238150 Glass and glazing contractors	135	1.00%	1	4	20	4	4
238160 Roofing contractors	708	1.00%	7	21	106	21	21
238170 Siding contractors	449	0.50%	2	7	34	7	7
238190 Other foundation, structure, and bld. exterior contractors	132	0.50%	1	2	10	2	2
238210 Electrical contr. and other wiring installation contractors	2,086	0.10%	2	6	31	6	6
238220 Plumbing, heating, and air-conditioning contractors	1,995	0.10%	2	6	30	6	6
238290 Other building equipment contractors	138	1.00%	1	4	21	4	4
238320 Painting and wall covering contractors	1,594	0.10%	2	5	24	5	5
238910 Site preparation contractors	1,383	1.00%	14	41	207	41	41
Subtotal			521	1,562	7,812	1,562	1,562
Crane Lessees in the Construction industry							
236115 New single-family general construction	2,874	45.00%	1293	.....	6467	323	323
236116 New multifamily housing construction	112	45.00%	50	.....	252	13	13
236117 New housing operative builders	1,093	45.00%	492	.....	2459	123	123
236118 Residential remodelers	3,369	9.00%	303	.....	1516	76	76
236210 Industrial building construction	80	90.00%	72	.....	360	18	18
236220 Commercial and institutional building construction	1020	90.00%	918	.....	4590	230	230
237110 Water and sewer line and related structures construction	394	90.00%	355	.....	1773	89	89
237120 Oil and gas pipeline and related construction	30	90.00%	27	.....	135	7	7

NAICS/ Industry	Total businesses	Percent of affected businesses	# of affected businesses	# of Cranes	# of crane jobs	# of affected riggers	# of affected signalmen
237130 Power and communication line and related construction	138	45.00%	62	.....	311	16	16
237310 Highway, street, and bridge construction	335	9.00%	30	.....	151	8	8
237990 Other heavy and civil engineering construction	144	45.00%	65	.....	324	16	16
238110 Poured concrete foundation and structure contractors	892	4.50%	40	.....	201	10	10
238120 Structural steel and precast concrete contractors	89	90.00%	80	.....	401	20	20
238130 Framing contractors	867	67.50%	585	.....	2926	146	146
238140 Masonry contractors	537	4.50%	24	.....	121	6	6
238150 Glass and glazing contractors	135	9.00%	12	.....	61	3	3
238160 Roofing contractors	708	9.00%	64	.....	319	16	16
238170 Siding contractors	449	4.50%	20	.....	101	5	5
238190 Other foundation, structure, and bld. exterior contractors	132	4.50%	6	.....	30	1	1
238210 Electrical contr. and other wiring installation contractors	2,086	0.90%	19	.....	94	5	5
238220 Plumbing, heating, and air-conditioning contractors	1,995	0.90%	18	.....	90	4	4
238290 Other building equipment contractors	138	9.00%	12	.....	62	3	3
238320 Painting and wall covering contractors	1,594	0.90%	14	.....	72	4	4
238910 Site preparation contractors	1,383	9.00%	124	.....	622	31	31
Subtotal			4,687		23,435	1,172	1,172
Grand total			5,355		31,247	2,734	2,734

Note: this table is created based on data from 2008 County Business Patterns and 2007 Economic Census for Washington State.

Table A2. Stratified random samples of crane lessees and owners that don't rent cranes as their main revenue

NAICS Code	Total businesses	Affected businesses	Percent of total affected bus.	Proportionate sample size
236115	2,874	1437	27.59%	828
236116	112	56	1.08%	32
236117	1,093	547	10.49%	315
236118	3,369	337	6.47%	194
236210	80	80	1.54%	46
236220	1020	1020	19.59%	588
237110	394	394	7.57%	227
237120	30	30	0.58%	17
237130	138	69	1.32%	40
237310	335	34	0.64%	19
237990	144	72	1.38%	41
238110	892	45	0.86%	26
238120	89	89	1.71%	51
238130	867	650	12.49%	375
238140	537	27	0.52%	15
238150	135	14	0.26%	8
238160	708	71	1.36%	41
238170	449	22	0.43%	13
238190	132	7	0.13%	4
238210	2,086	21	0.40%	12
238220	1,995	20	0.38%	11
238290	138	14	0.26%	8
238320	1,594	16	0.31%	9
238910	1,383	138	2.66%	80
Subtotal	20,594	5208	100%	3000

Table A3. Key survey response information

Sampling frame	22,000
Sample size	3,639
Returned total	798
Incomplete total	10
Completed total	788
Related to one or more sections in the survey	153

Table A4. Training cost for riggers qualifications

Training providers	Length of training class	Cost of training class per rigger
AGC Washington	8 hours	\$199
Safety Equipped Inc	5-6 hours	Unknown
AGC Oregon	4 hours	\$208
Southwest Industrial Rigging	4 hours	\$198
Tower Crane School of Phoenix, LLC	10 hours	\$560
American Crane Training & Consulting	Unknown	\$395
Crane Inspection & Certification Bureau	1 day	Unknown
Crane Tech	8 hours	\$295
AGC Wisconsin	0.5 day	\$63
Crane Wise Certifications LLC	2 days	\$660
Associated Training Services	4-6 hours	Unknown
TSC Training Academy	Unknown	\$200
Municipal Electric Utility in Wisconsin	Unknown	\$65
Morrow Equipment company	1.5 days	\$448
Crawford Custom Consulting Inc	2 days for training and exams	Unknown
Crane Coach	2-3 days	Unknown
Lifting & Handling Specialist Vocational Training & Certification	12 hours (three 4-hour sessions)	\$295

Note: 1. If only the grand total cost for both riggers and signal persons trainings is available, we split the cost into two categories.

2. If the training cost includes test fees, we subtracted \$190, the standard test fees by NCCCO, from the training cost.

Table A5. Training cost for signal persons qualifications

Training providers	Length of training class	Cost of training class/ testing service
AGC Washington	4 hours	\$125
Safety Equipped Inc	3-4 hours	Unknown
AGC Oregon	8 hours	\$208
Southwest Industrial Rigging	4 hours	\$198
Tower Crane School of Phoenix, LLC	10 hours	\$560
Crane Inspection & Certification Bureau	1 day	Unknown
Crane Tech	8 hours	\$295
AGC Wisconsin	4 hours	\$63
Crane Wise Certifications LLC	2 days	\$660
Associated Training Services	4-6 hours	Unknown
TSC Training Academy	Unknown	\$150
Municipal Electric Utility in Wisconsin	Unknown	\$65
Morrow Equipment company	1.5 days	\$448
Crawford Custom Consulting Inc	2 days for training and exams	Unknown
Crane Coach	1 day	Unknown
Lifting & Handling Specialist Vocational Training & Certification	12 hours (three 4-hour sessions)	\$250

Note: 1. If only the grand total cost for both riggers and signal persons trainings is available, we split the cost into two categories.

2. If the training cost includes test fees, we subtracted \$190, the fixed exam fee by NCCCO, from the training cost.

Table A6. Cost-benefit analysis table for the crane rule (phase 2)

Impact	Cost	Benefit	Quantified Value (\$)
Riggers qualification requirements	X		Lower bound: \$271,788 Estimate: \$545,490 Upper bound: \$635,448
Crane signal persons qualification requirements	X		Lower bound: \$82,040 Estimate: \$205,100 Upper bound: \$246,120
The requirements relating to the use self-erecting tower cranes in construction work	X		\$184,103
Total estimated compliance costs to businesses			Lower bound: \$537,931 Estimate: \$934,693 Upper bound: \$1,065,671
Prevention of injuries		X	Lower bound: \$335,227 Estimate: \$397,727 Upper bound: \$465,909
Prevention of fatalities		X	Lower bound: \$790,909 Upper bound: \$1,581,818
Avoiding indirect cost		X	Lower bound: \$167,614 Estimate: \$198,864 Upper bound: \$232,955
Total estimated benefits			Lower bound: \$1,293,750 Estimate: \$1,387,500 Upper bound: \$2,280,682
Net benefits			Estimate: \$452,807 Range: [\$228,079; \$1,742,751]

Survey Instrument



Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

2011 Crane Rulemaking (Phase 2) Survey

Responses to this survey are anonymous and confidential

May 3, 2011

Dear Business Owner/Safety Manager:

The purpose of this survey is to determine any new costs your business may incur due to the increased requirements in the proposed crane rule (Phase 2). Your answers will also help us determine how the proposed rule could impact businesses of different types and sizes.

- Each section will ask you questions that will help us determine how these rules might affect your business.
- You may not need to fill out all sections. For example, if your company uses cranes but you do not employ employees as riggers, you can skip Section 2.
- The department specifically asked the labor organizations and the business associations in the state to select representatives to participate and attend meetings to assist the department with developing this proposal. To read the draft rules on the L&I website go to: www.Lni.wa.gov/Safety/Rules/WhatsNew/Proposed/ and click on Construction, Safety Standards for Chapter 296-155 WAC Cranes (Phase 2).

Completing the survey

There are four sections in this survey:

Section 1: General questions about your business as a whole

Section 2: Questions to answer if your business employs employees as riggers

Section 3: Questions to answer if your business employs employees as crane signal persons

Section 4: Questions to answer if your business owns or uses self-erecting tower cranes

Please answer the questions the best you can. If you do not have the exact information, use your best estimate, or leave the response blank. In order for your cost data to be included in the economic analysis of this rule, the survey must be filled out and returned in the included postage-paid envelope by **May 31, 2011**.

If you have any questions about the proposed rule, please contact Cindy Ireland.

If you have any questions about the survey, please contact Alex (Yuanlong) Ge.

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2011 Crane Rulemaking (Phase 2) Survey

SECTION 1: GENERAL QUESTIONS ABOUT YOUR BUSINESS

1a. During 2010, what was the maximum number of full-time workers your business employed?

_____ full-time workers (if none, enter 0)

1b. During 2010, how many total hours did your part-time and/or seasonal employees work?

_____ hours (if none, or if you don't employ part-time or seasonal workers, enter 0)

1c. Please check the **one** industry description that most closely identifies your business. If more than one of these descriptions fits your business, select the one that represents the largest part of your business:

<u>Construction</u>
<input type="checkbox"/> New Single-Family Housing Construction
<input type="checkbox"/> New Multifamily Housing Construction
<input type="checkbox"/> New Housing Operative Builders
<input type="checkbox"/> Residential Remodelers
<input type="checkbox"/> Industrial Building Construction
<input type="checkbox"/> Commercial and Institutional Building Construction
<input type="checkbox"/> Water and Sewer Line and Related Structures Construction
<input type="checkbox"/> Oil and Gas Pipeline and Related Structures Construction
<input type="checkbox"/> Power and Communication Line and Related Construction
<input type="checkbox"/> Highway, Street, and Bridge Construction
<input type="checkbox"/> Other Heavy and Civil Engineering Construction
<input type="checkbox"/> Poured Concrete Foundation and Structure Contractors
<input type="checkbox"/> Structural Steel and Precast Concrete Contractors
<input type="checkbox"/> Framing Contractors
<input type="checkbox"/> Masonry Contractors
<input type="checkbox"/> Other Building Equipment Contractors
<input type="checkbox"/> Roofing Contractors
<input type="checkbox"/> Electrical and Other Wiring Installation Contractors
<input type="checkbox"/> Plumbing, Heating, and Air-Conditioning Contractors
<input type="checkbox"/> Other Building Equipment Contractors
<input type="checkbox"/> Site Preparation Contractors
<input type="checkbox"/> All Other Specialty Trade Contractors
<u>Real estate and rental and leasing</u>
<input type="checkbox"/> Machinery and Equipment Rental and Leasing
<u>Others</u>
<input type="checkbox"/> Please specify: _____

2011 Crane Rulemaking (Phase 2) Survey

SECTION 2: RIGGER

Please read the text in the box below before answering the following questions.

Under the proposed rule (WAC 296-155-53400(43)(c)(iii) and WAC 296-155-53402(19)(a)), qualified riggers are required whenever workers are **within the fall zone** and hooking, unhooking, or guiding a load, or doing the initial connection of a load to a component or structure. Additionally, employers must use qualified riggers **during hoisting activities for assembly and disassembly work**.

Proposed qualification requirements (WAC 296-155-53306): Employees must pass a **written test** and a **practical test** in order to be qualified riggers and this qualification must be **renewed every five years**. Employers must use **either a third party qualified evaluator or their own qualified evaluator** to assess and ensure that a rigger is qualified.

2a. Do any of your employees perform these specific tasks? How many?

- Yes: _____ employees.
- No: please go to Section 3: Crane Signal Persons

2b. Are any of your workers performing these jobs already **qualified** riggers as outlined in the box above? How many?

- Yes: _____ **qualified** riggers.
- No.

2c. Please estimate the hours of training your employees will need to be provided to meet the requirements for qualified riggers.

_____ hours per qualified rigger

2d. Please estimate the costs of all the other necessary services your employees will need to be provided to meet the requirements for qualified riggers.

	Cost per qualified rigger
Written Test	\$
Practical Test	\$
Use of a qualified evaluator to assess and document the qualifications of the candidate	\$

SECTION 3: CRANE SIGNAL PERSONS

Please read the text in the box below before answering the following questions.

Under the proposed rule (WAC 296-155-53406(1)), a **qualified signal person** must be provided in each of the following situations:

(a) **The point of operation**, meaning the load travel or the area near or at load placement, **is not in full view** of the operator.

(b) When the crane is traveling, **the view in the direction of travel is obstructed**.

(c) Due to **site-specific safety concerns**, either the operator or the person handling the load determines that it is necessary.

Proposed qualification requirements (WAC 296-155-53302): Employees must pass an **oral or written test** and a **practical test** in order to be qualified signal persons and this qualification must be **renewed every five years**. Employers must use **either a third party qualified evaluator or their own qualified evaluator** to assess and ensure that a signal person is qualified.

3a. Are any of your workers designated as signal persons? How many?

- Yes: _____ employees.
- No: please go to Section 4: General Requirements for Self-erecting Tower Cranes

3b. Are any of your workers designated as signal persons already **qualified** as outlined in the box above? How many?

- Yes: _____ **qualified** signal persons.
- No.

3c. Please estimate the hours of training your employees will need to be provided to meet the requirements for qualified signal persons.

_____ hours per qualified signal person

3d. Please estimate the costs of all the other necessary services your employees will need to be provided to meet the requirements for qualified signal persons.

	Cost per qualified signal person
Oral or Written Test	\$
Practical Test	\$
Use of a qualified evaluator to assess and document the qualifications of the candidate	\$

2011 Crane Rulemaking (Phase 2) Survey

SECTION 4: GENERAL REQUIREMENTS FOR SELF-ERECTING TOWER CRANES

4a. Do you use self-erecting tower cranes to perform any construction work?

- Yes: please read the text in the box below and continue with question 4b through 4f.
- No: Your survey is complete-please return it in the postage-paid envelope by May 31, 2011.

Under the proposed rule, there are two major new requirements employers should comply with when using self-erecting tower cranes to perform any construction work:

Requirement 1: When cranes are erected and after each reconfiguration, before placing the crane in service, all functional motions, motion limiting devices, brakes, and indicating devices must be tested for operation.

Requirement 2: Conditions that adversely affect the crane at the time of erection, reconfiguration, or dismantling must be a limiting factor that could require suspending the operation. These conditions include but are not limited to:

- (a) Support conditions;
- (b) Wind velocity or gusting winds;
- (c) Heavy rain;
- (d) Fog;
- (e) Extreme cold or heat;
- (f) Ice;
- (g) Artificial lighting.

4b. Approximately how many crane jobs are completed by your firm using the self-erecting tower cranes each year? _____ crane jobs

4c. Are you already in compliance with Requirement 1 as stated in the box above?

- Yes [**Please go to Question 4e**]
- No: [**Please continue with Question 4d**]

4d. Please estimate the amount of time needed to test all these devices each time self-erecting tower cranes are erected or reconfigured. _____hours _____minutes

4e. Please estimate the number of times that an operation would be suspended due to any of the conditions under Requirement 2 as stated in the box above in a year. _____times per year

4f. Please estimate the cost of suspending the operation due to the occurrence of one of the conditions under Requirement 2. \$_____per suspended operation

Thank you for completing this survey. Please return it in the postage-paid envelope by May 31, 2011.