# Incorporating Safety in Construction Contracts- The Experience from the Construction Industry of Pakistan

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## Abstract

Construction accidents and the associated damage they cause to employees, property, equipment, and morale have generated negative effects on the industry's profitability and productivity. One of several approaches to help address the poor safety performance is to hold the contracting parties 'contractually responsible' for their safety performance. The purpose of this study is to assess local industry awareness and perceptions of relevant contractual provisions in Pakistan. The intent is to identify practices and procedures currently used in the industry to fulfill the safety requirements in the contract documentation. Another objective is to benchmark the importance, usage, and effectiveness of selected contractual provisions that have the potential to help improve construction safety scenario in the local construction industry. After referring to national and international contract guidelines, a questionnaire was developed with selected safety clauses that will help accomplish the stated objectives. Local construction contractors were approached for the questionnaire survey. The gathered data was analyzed via descriptive and inferential statistical techniques. The data analysis led to the conclusion that, according to a majority of respondents, up to 10% of a company's contract disputes are related to construction safety; at a cost of up to 20% of contract value for resolution. Safety training is normally prescribed in the contracts, and written contractor safety programs are required. Most of the respondents were of the view that safety training should be made compulsory. However, an overall feeling amongst the respondents about the current state of "safety incorporation" in contracts in Pakistan's construction sector is 'poor'.

## Keywords

Construction Accidents, Contractual Safety Provisions, Developing Country

## 1. Introduction

Due to its distinctive characteristics, unexpected site circumstances, variety of human behavior, and risky processes, the construction business has high rates of fatalities and injuries (Ho et al., 2000). The same notion is also corroborated by the data for wounded workers from Noman et al., (2021). The values represent the percentage of total employed persons suffering occupational injuries in the respective industry sector. Refer to Table 1 below.

**Table 1:** Index-based industry divisions of injured workers in Pakistan. (Source: Noman et al., (2021))

| Industry Sectors | 2001-02 | 2003-04 | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2012-13 | 2013-14 | 2014-15 | 2017-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Manufacturing | 14.5 | 14.61 | 17.1 | 15.21 | 12.72 | 13.96 | 12.8 | 15.8 | 13.32 | 14.2 | 15.9 | 16.9 |
| Construction | 12.54 | 10.65 | 13.21 | 14.55 | 14.93 | 14.54 | 14.25 | 13 | 15.24 | 14.1 | 16.3 | 17.3 |
| All Others Combined | 10.42 | 10.68 | 9.95 | 10.03 | 10.31 | 10.21 | 10.42 | 10.17 | 10.22 | 10.24 | 9.69 | 9.40 |

A study in Pakistan found that the major injuries experienced by contracting firms on their project sites, as reported by the survey respondents, are listed below, in order of decreasing frequency (the percentages in parenthesis indicate the weighted average percentages of the injuries based on a combined proportion of the percentage of the injury's occurrence and percentage of companies facing the injury). 1. Injury from falls (55%) 2. Accidental injuries (53%) 3. Raw material and waste-related injuries (36%) 4. Heat illness (33%). 5. Head trauma (25%) 6. Injury to the eyes (6%) 7. Cases of burning (9%) Farooqui et al., (2007).

According to most of the contractors surveyed in a study by Farooqui et al. (2007), developing safety policies and manuals (69%), including general safety guidelines in the body of the contract (64%), establishing physical controls and rules (61%), and integrating safety into project schedules are the mechanisms that best contribute to implementing and improving safety on projects. Zahoor et al. (2016) also support the notion of addressing construction safety and assert that Occupational Safety and Health training is the most overlooked component among the causes of poor safety performance, followed by the omission of safety from contracts.

One of the primary issues with construction safety is the lack of unambiguous contractual safety responsibilities. Assigning appropriate contractual safety obligations prior to contract execution is therefore in the best interest of all project participants. Abdul Nabi et al., (2020). The overall safety performance of projects will improve with the clear assignment of safety obligations in contracts, which will also reduce claims, disagreements, and disputes linked to safety injuries in the construction industry. Abdul Nabi et al., (2020). In fact, one of the four frequently occurring reasons for claims in the construction business is safety-related difficulties (LaBarre and El-adaway 2014).

This research attempts to benchmark the perception of the local construction industry regarding the importance; usage and effectiveness of contractual safety provisions as a means to improve construction safety scenario in the local industry.

## 2. Literature Review

It cannot be stressed enough that it is in the best interest of all project participants to assign appropriate contractual safety duties and rights before the contract is executed. To reduce safety-related conflicts, claims, and disputes, precise contractual wording and effective contract management methods are essential Abdul Nabi et al,. (2020).

The Pakistan Engineering Council (PEC) is the mandated professional organization that sets the regulations for engineering projects in the country. It has incorporated the following OH&S clauses in its contract documents (cited from Zahoor et al., 2015).

a. Safety, security, and protection of the environment: It is clause 19.1 of Part-I (General conditions of contract) of PEC standard form of bidding documents (PEC, 2007, p.90).
b. Safety precautions: It is clause 19.3 of part-II (Particular conditions of contract) of the PEC standard form of bidding documents (PEC, 2007, p.152).

The PEC documents include safety in the following manner:

- Health and safety: Due precautions shall be taken by the contractor, and at his own cost, to ensure the safety of his staff and labor at all times throughout the period of the contract. The contractor shall further ensure that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.
- Records of safety and health: The contractor shall maintain such records and make such reports concerning the safety, health, and welfare of persons and damages to property as the Engineer may from time to time prescribe.
- Employer's responsibilities: If under clause 31 the employer shall carry out work on the Site with his own workmen he shall, in respect of such work:
    a. Have full regard for the safety of all persons entitled to be upon the Site and
    b. Keep the site in an orderly state appropriate to the avoidance of danger to such persons.

  If under clause 31 the employer shall employ other contractors on the site, he shall require them to have the same regard for safety and avoidance of danger.
- Safety, security, and protection of the environment: The contractor shall, throughout the execution and completion of the works and the remedying of any defects therein:
    a. Have full regard for the safety of all persons entitled to be upon the site and keep the site (so far as the same is under control) and the works (so far as the same are not completed or occupied by the employer) in an orderly state appropriate to the avoidance of danger to such persons,
    b. Provide and maintain at his own cost all lights, guards, fencing, warning signs, and watching, when and where necessary or required by the engineer or by any duly constituted authority, for the protection of the works or for the safety and convenience of the public or others, and
    c. Take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise, or other causes arising as a consequence of his methods of operation.

Similarly, for India, Sivaprakash and Kanchana's (2018) study presents an overview of the different statutory regulations for construction safety in India, with a focus on the BOCW Act, Central Rules, and State Rules. Provisions are given for overhead protection (rule 41), electrical hazards (rule 47), stability of structures (rule 49), test & periodical examination of lifting appliances (rule 56) and lifting gear (rule 70), operator's cabin (rule 63), transport and earth moving equipment (rule 88 to 95), concrete work (rule 96 to 107), demolition (rule 108 to 118), demolition of walls, partition, etc. (rule 110), inspection (rule 116), warnings signs and barricades (rule 117), mechanical method of demolition (rule 118), construction, repair & maintenance of steep roof (rule 169 – 171), ladders & step ladders (rule 172 to 174), catch platform & hoardings, chutes, safety belts & nets (rule 175 to 180), safety belt, safety net (rule 178 to 180), safety officer (rule 209), hazardous process (rule 225), notifiable occupational diseases (rule 230), hazardous processes (Schedule IX).

Ndekugri et al., (2022) argue that the New Engineering Contract (NEC) body of contracts, the conditions of the contract make only three specific references to H&S: the contractor's obligation under clauses 20.1 and 27.4 to act in accordance with the H&S requirements stated in the scope, the contractor's duty under clause 31.2 to show on each program submitted 'provisions for health and safety requirements' and contract termination provisions in clauses 90.1 and 91.3. Other related safety measures are addressed under clauses 91.1 and 91.3, Clause 10.2.

Fédération Internationale des Ingénieurs – Conseils or The International Federation of Consulting Engineers (FIDIC, 1987) addresses safety as follows:

- The contractor shall, throughout the execution and completion of the Works and the remedying of the defects therein:
    a. Have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons,
    b. Provide and maintain at his own cost all the lights, guards, fencing, warning signs and watching when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and
    c. Take all reasonable steps to protect the environment on and off the Site and so avoid damage or nuisance to person or to property or the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

Finally, the relevant safety provisions from the AIA Document A201 (2007) are as follows.

a. 3.3.1: "The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the job site safety thereof and, except as stated below, shall be fully and solely responsible for the job site safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences, or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect."
b. 5.3: "… the Contractor shall require each Subcontractor… to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor… assumes toward the Owner and Architect."
c. 10.1: "The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract."
d. 10.2.1: "The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to… employees on the Work and other persons who may be affected thereby."
e. 10.2.2: "The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss."
f. 10.2.3: "The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting 14danger signs and other

warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities."

## 3. Research Methodology

The methodology for this study is presented in Fig.1.

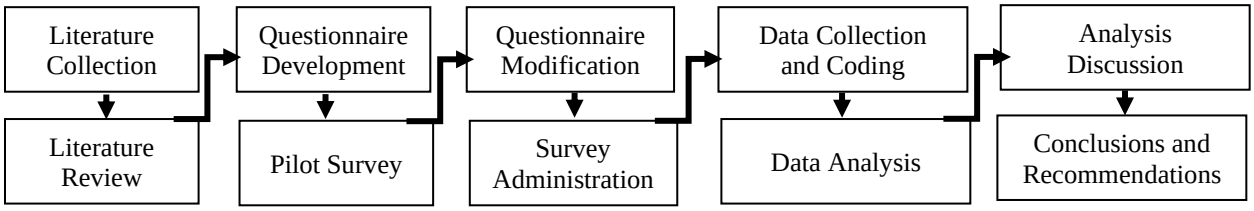


**Fig.1.** Research Methodology

Fig 1 is elaborated as follows:

- Literature Collection: The literature was collected using the keywords such as construction safety, contractual safety provisions, and construction safety performance of the local construction sector. In addition, model contract forms from PEC, FIDIC, AIA, and NEC were also consulted.
- Literature Review: Relevant portions of the collected secondary data were brought forward to extract literature that helped to establish existing safety provisions in model contracts, recent construction safety performance of local construction contractors, and also the importance of contractual safety provisions for improving the safety scenario in the local AEC sector.
- Questionnaire Development: The literature review process translated into the development of a questionnaire for the local industry stakeholders. Section 4 elaborates on the structure of the questionnaire in greater detail, especially in light of the data analysis and discussion.
- Pilot Survey: The pilot survey was administered to identify shortcomings in the survey instrument. The feedback received from the process was incorporated to improve it effectiveness and technical quality.
- Survey Administration: The survey administration was carried out using Google Forms and also via semi-structured interviews. The target audience was identified using personal contacts and also through graduate-level students studying at NED University of Engineering and Technology during Fall 2022. These students were part-time graduate students pursuing a higher degree in construction management. Their professional association was with local construction contractors, which made a suitable choice for survey respondents.
- Data Collection and Coding: The collected responses were recorded in MS Excel and all references to the respondent (if any) were deleted. The data analysis and respective figures and tables were generated using MS Excel. ANOVA analysis was carried out using RStudio.
- Data Analysis and Discussion: The data analysis and discussion are elaborated in Section 4.
- Conclusions and Recommendations: Pertinent conclusions and recommendations were drafted based on the insights obtained from data analysis.

## 4. Data Analysis and Discussion

The data analysis and discussion follow the structure of the survey instrument which had the following sections.

- Demographics of Survey Respondents.
- Questions to elicit information about the current status of contractual safety in the local construction industry
- Likert scale-based questions that required the respondents to rate the Importance (5=Not Important to 1=Very Important), Usage (5=Never Used to 1=Always Used), and Effectiveness (5=Not Effective to 1=Very Effective) respectively of selected contractual provisions that may help to improve the construction safety scenario in the local construction industry (refer Fig.1a and Fig 1b). A summary of descriptive statistics for the three analysis aspects of selected contractual provisions is presented in Table 2. The ranking of Selected Contractual Provisions is based on the three parameters (refer Table 3). Results of ANOVA analysis for the three aspects Importance, Usage, and Effectiveness respectively are presented in the following tables: Table 4 (One-way ANOVA for Usage~Importance Model); Table 5 (One-way ANOVA for Usage~Effectiveness Model); Table 6 (Two-way ANOVA for Usage~Importance+Effectiveness Model); Table 7 (Two-way ANOVA for Interaction Model); Table 8 (Performance of All Models and Selection of Best Fit Model). The last part of the questionnaire required the respondents to rate the significance (5=not at all significant to 1=

extremely significant) of barriers that impede the widespread adoption of contractual construction safety approaches in the local industry-Refer Fig 4.

**4.1 Demographic Analysis**

The demographic analysis of the survey respondents shows the following break up of experience and organizational positions.

- < 05 years (45%); 05-10 years (10%); 10-15 years (20%); > 20 years (05%); > 30 years (05%); > 40 years (10%); did not respond (05%).
- Owner/CEO (15%); Manager-Civil/PM (20%); Technical Advisor/Project Coordinator (10%); Planning Engineer (10%); Project Engineer/Site Engineer (45%).

**4.2 Closed-Ended Questions' Analysis**

The following summarizes the results of the close-ended questions as follows:

- Percentage of company's contract disputes related to safety issues [questionnaire option (percentage response)]: 0-20% (75%); 20-40% (20%); 40-60% (0%); 60-80% (0%); above 80% (5%)
- Time (%) spend on resolving contractual safety issue(s) [questionnaire option (percentage response)]: 0-10% (55%); 11-20% (25%); 21-30% (20%); above 30% (0%)
- Cost (% of Total contract value) incurred (on every project) resolving contract safety issues [questionnaire option (percentage response)]: 0-10% (35%); 11-20%(55%); 21-30% (05%); above 30% (05%)
- Specify safety training for the worker in contracts [questionnaire option (percentage response)]: Yes always (65%); Yes, but only when a client demands (25%); No (05%); Consider unimportant (05%).
- Designate an employee as a project safety coordinator? [questionnaire option (percentage response)]: Yes (70%); No (30%)
- Submit written contractor safety programs with the contract before work begins [questionnaire option (percentage response)]: Yes always (45%); Yes, but only when a client demands (35%); No (20%); Consider unimportant (0%).
- Ways to incorporate safety more effectively on sites through contracts [questionnaire option (percentage response)]: Include proper risk assessment in contracts (30%); Follow international safety standards strictly (10%); the client should be accountable for proper safety insurance in contracts (20%); Worker's training for safety measures should become compulsory (40%).
- Current state of "safety incorporation" in contracts in Pakistan's Construction Sector? [questionnaire option (percentage response)]: Excellent (10%); Good (25%); Average (25%); Poor (40%).

The data analysis suggests that for the majority of respondents, about 20% of the disputes between the contracting parties on their projects are related to construction safety. There is a majority response that suggests that about 10% of the time is spent on resolving contractual safety issues, which account for about 20% of the cost to be incurred. Usually, there is a requirement for workers' safety training. Most respondents believed that workers' safety training should become mandatory in contracts. Towards the end, many respondents perceived the current state of 'contractual safety' provisions to be in a 'poor' state in the local construction industry.

**4.3 Analysis of Importance-Usage- Effectiveness of selected contractual provisions and barriers impeding their adoption.**

Fig.1a. to Fig. 1b. presents the analysis of the Importance-Usage- Effectiveness of selected contractual provisions. The top and bottom tier of the Likert Scale is presented in Figure 1a and Figure 1b respectively. Fig 2. depicts the perceived significance of barriers.

As per Fig.1a and Fig 1b, contractual provisions related to the safety of site work have been rated as 'very important' followed by 'Availability of Site Engineer' and 'Insurance of work'. There is a general opinion of 'lesser importance' towards the contractual provisions related to environmental safety and labor safety measures on-site. Contractual provisions related to the Safety of site work, care of works, and Insurance of Works have been found to be 'always used'. As seen in Fig.1a and Fig 1b, the environmental safety and labor safety measures on-site are also found to be rarely used. Despite the lower perceived usage and importance of selected contractual provisions, Fig.1a and Fig 1b presents an interesting insight where almost all respondents are found to be of the view that all selected contractual provisions are effective in improving construction safety performance.

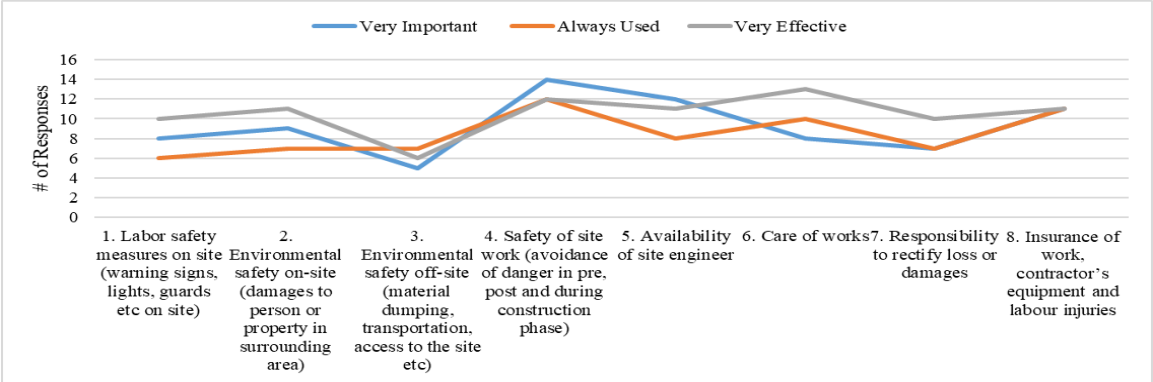


**Fig.1a.** Top Tier of Importance-Usage-Performance
(Very Important VS Always Used VS Very Effective)

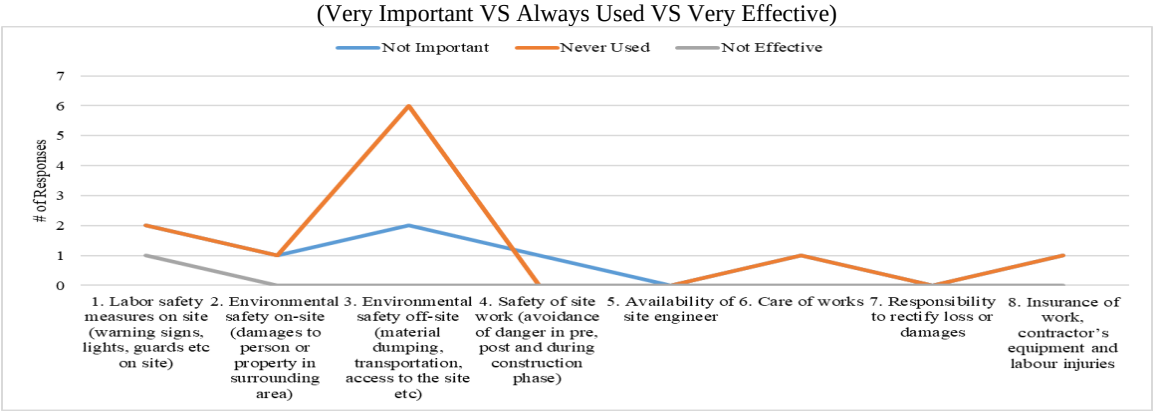


**Fig.1b.** Bottom Tier of Importance-Usage-Performance
(Not Important VS Never Used VS Not Effective)

Fig. 2 summarizes the responses to the question that asked the respondents to rate the significance of barriers that impede the wide adoption of contractual safety provisions in the local construction industry. A majority of respondents rated cost constraints as extremely significant, followed by poor safety assessment during the bidding stage and resource constraints.

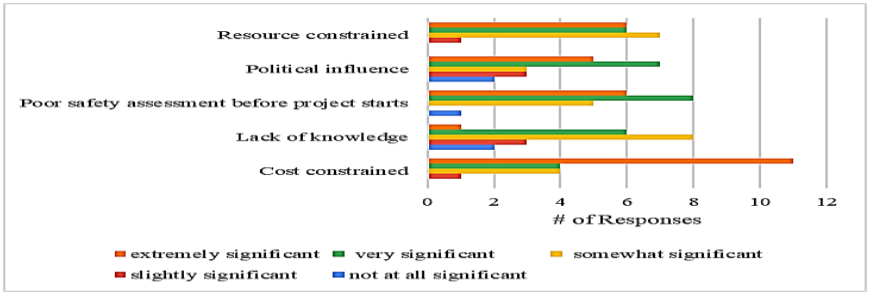


**Fig.2.** Barriers Impeding Adoption of Contractual Safety

Table 2 presents the descriptive statistics for the responses obtained. There is a relatively low degree of divergence among the respondents for all selected contractual provisions. The mean values of the three parameters for all selected contractual provisions have been found to be in the region of 'excellent to good'.

**Table 2.** Descriptive Statistics

| Contractual Safety Provisions | Importance Mean (SD) | Usage Mean (SD) | Effectiveness Mean (SD) |
|---|---|---|---|
| Labor safety measures on site (warning signs, lights, guards, etc, on site) | 2 (1.2) | 2.3 (1.3) | 2.3 (1.1) |
| Environmental safety on-site (damages to person or property in surrounding area). | 2.05 (1.2) | 2.1 (1.1) | 2.1 (1.0) |
| Environmental safety off-site (material dumping, transportation, access to the site etc). | 2.4 (1.3) | 2.95 (1.7) | 2.95 (1.1) |

| | | | |
|---|---|---|---|
| Safety of site work (avoidance of danger in pre, post and during construction phase). | 1.7 (1.2) | 1.85 (1.2) | 1.85 (1.0) |
| Availability of site engineer. | 1.7 (0.98) | 1.85 (0.88) | 1.85 (1.0) |
| Care of works. | 2.05 (1.2) | 1.85 (1.1) | 1.85 (1.0) |
| Responsibility to rectify loss or damages. | 2.05 (1.0) | 2.15 (1.1) | 2.15 (1.1) |
| Insurance of work, contractor's equipment and labor injuries. | 1.9 (1.3) | 1.9 (1.3) | 1.9 (1.1) |

Table 3 presents the ranking of contractual provisions based on the Weighted Average Response from the survey. The ranking criteria looked at the minimum values (in the order) Usage-Importance-Effectiveness. The minimum value was selected because 1 represented the best level for each parameter (Usage-Importance-Effectiveness).

**Table 3:** Ranking of Selected Contractual Provisions

| Ranking of Selected Contractual Provisions | Usage | Importance | Effectiveness |
|---|---|---|---|
| Environmental safety off-site (material dumping, transportation, access to the site, etc.) | 4.067 | 4.800 | 5.000 |
| Labor safety measures on site (warning signs, lights, guards, etc on site). | 4.933 | 5.333 | 5.600 |
| Responsibility to rectify loss or damages. | 5.133 | 5.267 | 5.400 |
| Environmental safety on-site (damages to person or property in the surrounding area). | 5.200 | 5.267 | 5.533 |
| Insurance of work, contractor's equipment, and labor injuries. | 5.467 | 5.467 | 5.533 |
| Care of works. | 5.533 | 5.267 | 5.800 |
| Availability of site engineer. | 5.533 | 5.733 | 5.667 |
| Safety of site work (avoidance of danger in pre, post and during the construction phase). | 5.533 | 5.733 | 5.800 |

### 4.4 ANOVA Analysis

The results of the One-way ANOVA analysis are presented as follows.

**Table 4:** One-way ANOVA for Usage~Importance Model

| Parameters | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
|---|---|---|---|---|---|
| Importance | 1 | 1.2676 | 1.2676 | 15.5 | 0.00765 ** |
| Residuals | 6 | 0.4908 | 0.0818 | | |

The p-value of the importance parameter is low ($p < \alpha=0.05$), so it appears that the importance of contractual provisions has a statistically significant impact on their usage.

**Table 5:** One-way ANOVA for Usage~Effectiveness Model

| Parameters | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
|---|---|---|---|---|---|
| Effectiveness | 1 | 1.4391 | 1.4391 | 27.04 | 0.00201 |
| Residuals | 6 | 0.3193 | 0.0532 | | |

The p-value of the effectiveness parameter is low ($p < \alpha=0.05$), so it appears that the effectiveness of contractual provisions has a statistically significant impact on their usage.

The results of the Two way ANOVA are as follows.

**Table 6:** Two-way ANOVA for Usage~Importance+Effectiveness Model

| Parameters | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
|---|---|---|---|---|---|
| Importance | 1 | 1.2676 | 1.2676 | 26.075 | 0.00375 ** |
| Effectiveness | 1 | 0.2477 | 0.2477 | 5.095 | 0.07360 |
| Residuals | 5 | 0.2431 | 0.0486 | | |

Adding Effectiveness or Importance to the model seems to have made the model better: it reduced the residual variance (the residual sum of squares went from 0.4908 to 0.2431 or 0.3193 to 0.2431), and Importance is statistically significant (p-values < 0.05); whereas Effectiveness has not been found statistically significant (p-values > 0.05);

The results of the Two-way ANOVA for the Interaction Model are shown in Table 8 below. In Table 8 above, the Importance: Effectiveness variable has a low sum-of-squares value and a high p-value, which means there is not much

variation that can be explained by the interaction between Importance and Effectiveness. The last step in the ANOVA analysis is the selection of best model. The performance of all models is summarized in Table 9 below.

**Table 7:** Two-way ANOVA for Interaction Model

| Parameters | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
|---|---|---|---|---|---|
| Importance | 1 | 1.2676 | 1.2676 | 31.553 | 0.00494 ** |
| Effectiveness | 1 | 0.2477 | 0.2477 | 6.166 | 0.06798 |
| Importance: Effectiveness | 1 | 0.0824 | 0.0824 | 2.051 | 0.22541 |
| Residuals | 4 | 0.1607 | 0.0402 | | |

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

An estimate of prediction error and, hence, of the relative quality of statistical models for a certain set of data is the Akaike information criterion (AIC). AIC calculates the relative quality of each model in a set of data models by comparing it to all the other models. AIC therefore offers a model selection method. (Stoica & Selen, 2004; McElreath, 2020; Taddy, 2019).

**Table 8:** Performance of All Models and Selection of Best Fit Model

| Parameters | K | AICc | Delta_AICc | AICcWt | Cum.Wt | LL |
|---|---|---|---|---|---|---|
| Usage~Effectiveness | 3 | 8.93 | 0.00 | 0.83 | 0.83 | 1.53 |
| Usage~Importance | 3 | 12.37 | 3.44 | 0.15 | 0.98 | -0.19 |
| Usage~Importance+Effectiveness | 4 | 16.09 | 7.15 | 0.02 | 1.00 | 2.62 |
| Interaction | 5 | 31.44 | 22.51 | 0.00 | 1.00 | 4.28 |

The model that fits the data the best and is listed first in Table 9 has the lowest AIC value. These findings suggest that the Usage-Effectiveness model provides the best fit. This model explains 83% of the total variation in the dependent variable which can be explained by the entire set of models, as it has the lowest AIC value and 83% of the AIC weight. Although the model with the importance term contains an additional 15% of the AIC weight, it is not a best-fit model because it performs worse than the best model by more than one delta-AIC.

## 5. Conclusions and Recommendations

Construction has historically been guilty of poor safety performance. The construction engineering and management fraternity has been trying to find ways to improve safety performance for quite a while. Worldwide, construction safety still remains quite dangerous, and in developing nations like Pakistan, improvement to construction safety is much more challenging. The projects are executed where construction safety is usually not a priority; given other aspects trying to capture the available resources. Therefore, it may be the time when contracting parties are held contractually liable for better safety performance to help them prioritize safety as well. With this notion, the study was carried out to benchmark the perception of local industry.

Contractual safety issues and disputes represent a considerable burden for the local construction industry in terms of time, cost, and magnitude. Although the majority of the contractors submit written safety programs, the respondents viewed mandatory worker training as one of the mechanisms for improving safety performance. The respondents perceived the "safety incorporation" in contracts in Pakistan's Construction Sector as 'Poor'. Inferentially, it appears that the importance of contractual provisions has a statistically significant impact on their usage. Furthermore, the effectiveness of contractual provisions has a statistically significant impact on their usage. By adding the parameter of Effectiveness or Importance to the model, it appears to have made the model perform better. The Usage-Effectiveness model is found to be the best fit among the different models, explaining 83% of the total variation in the dependent variable (Usage) by the entire set of models.

The limitations of the current study relate to the data set; it is recommended to undertake the study with more data sets. The data can be collected from different sectors of the construction industry and from different projects. A case study approach can also be undertaken to assess the contractual provisions related to safety between the respective contracting parties. Most respondents mentioned poor safety assessment during the bidding stage and resource constraints as some of the barriers impeding the wide adoption of contractual safety measures. It is therefore recommended that, in light of international best practices, may be employed while the projects are being pursued. Case studies may be planned to be executed and documented with the collaboration of academia and industry so that evidence can be established regarding contractual safety provisions in the local industry. It is also recommended to include relevant details in the curriculum at undergraduate, graduate, continuing education, and professional

development courses by concerned higher education institutions, professional development bodies, and other training institutions.

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