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Assessment on safety practices in retrofitting of schools project of Kathmandu district

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***Abstract*---** Construction safety is a challenging issue in construction industry all around the world. For the construction works, regular monitoring and supervision are the important parameters. After the massive Gorkha Earthquake of April 25th, 2015 (Nepal), large number of schools have been affected hence to enhance repair, maintenance, rehabilitation and improve of this situation a large number of retrofitting projects have been added to the list of construction projects of Nepal especially school buildings .With the increase in construction projects, a large number of accidents have also been increased tremendously. Safety legislation for construction industry in developing countries is not sufficient in order to make construction a safe industry as well as prevailing rules and regulations were not properly implemented at construction sites because of poor civic awareness, knowledge regarding safety, training, and workshop. It was found that training, education and experience of workers had a slightly minor role in decreasing the possibility of occurrence of

accidents at site. Management shall also focus on accident record keeping and safety meeting with safety audit as no such records was maintained at the sites visited.

***Keywords*---**construction, earthquake, retrofitting, safety, accident analysis.

Introduction

Construction industry is taken into account because the stamina of development of a country, particularly immature countries like Nepal, where construction of infrastructures is simply setting out to take pace. Various projects like highways, bridges, hydropower plants, urban cities, housings, monuments, schools, etc. are constructed in Nepal in past few years. But together with the rise in construction works, issues regarding safety have also been increasing during this industry. Construction industry has consistently been among those industries with the very best injury and fatality rates for several years [1-5].Factors responsible for the high injury and fatality rates as reported in most of the reviewed literature are wide-ranging subcontracting, poor security awareness, and lack of safety training, inefficiency of security system and legislations, and uncooperative crest administration. It's estimated that more than ten million workers receive injuries during one year throughout the world and compared with the manufacturing sector that averages 60-80 accidents per 1000 workers, construction sector averages 160-250 accidents per 1000 workers [6-8]. Safety is an important aspect in construction sector that is related especially to the health of workers. There is no doubt that construction industry is one of the riskiest industries which are well known for its terrifying nature and achieving a safe work environment has been an ongoing challenge. Many accidents occur in construction sites all over the world resulting in huge loss of property and loss of life as well, this loss is impossible to compensate. Therefore, with continuing high injury & illness rates associated with construction, the identification of safety practices may help reverse these high injury & illness rates and people safety practices that are successful in achieving low injury rates guide the security performance to maneuver individual construction project towards the goal of zero accidents [9-14]. Hence, prevention of occupational injuries and illness should be a primary concern in construction industries. Despite this, construction site safety is typically ignored within the construction projects [15-17].

The conception of safety is continues to be unaccustomed the Nepalese construction industry. A large number of individuals lose their lives and thousands experience injury annually in Nepalese industry and also the accidents remain almost same or may be more which proves that the efforts to forestall accidents in construction sites aren't enough[18]. Moreover, the status of construction accidents is more severe in Nepal in compared to other countries [19]. It's projected that each year almost 20,000 workers suffer from accidents at workplace which cause about 200 lives lost in Nepal [20]. There's no firm policy of the government regarding the occupational safety, health and environment. Most of the work places which require more physical work and workers don't possess proper safety and preventive measures, also, the workers neither have proper

understanding of exposure to hazards, nor have proper understanding of the measures to reduce them [21].Due to lack of proper enforcement of law, most of accidents don't seem to be even reported to the concerned authority. Government authorities and personal companies have started the programs, rules and regulations but it doesn't seem to assist in making the environment safe in context of Nepal while it's well understood that there is equally significant role that is played by owners or consultants group and workers group in regards to keeping proper safety practices. Neither the owners or consultants play a vigorous role in encouraging contractors to effectively plan for and enhance neither their safety program, nor the safety performance of contractors isn't taken into consideration during the project bid award phase [22-25].Additionally, workers ignorance, carelessness, over-confidence, negligence, and workers disregarding proper use of safety wears are the key factors to blame for affecting safety practices [26-28].

To study the current practices regarding safety in the retrofitting of schools project of Kathmandu district. To find better practices and determine areas for improvement regarding construction safety in retrofitting of schools project.
Scope and limitations of the problem is given below,

- Gorkha Earthquake affected maximum number of schools building of all districts of Nepal. Here we shall deals with the study and evaluation of safety of retrofitting schools projects in Kathmandu district only after earthquake 2015.
- Accidents at construction site may range from minor to fatal but they aren't classified consistent with their severity during this study.
- Mental health of workers and occupational diseases isn't considered during this study.
- No open-ended questions were asked to the respondents.
- Only quantitative data were collected during the survey.
- The numbers of school selected are limited because of time and resources limitation.

Literature review

The literatures which are associated to the research topic on to the researcher's knowledge, research work and relevant study; review of journals, papers and articles, newspapers, annual reports and internet. This chapter will mainly discuss about phenomenon of earthquake, history of earthquake in Nepal, damages caused by earthquake in Nepal, retrofitting, various bodies working within the retrofitting of schools project in Kathmandu district, construction industry, accidents, construction safety practices, methods accustomed improve construction safety within the schools building construction industry, safety programs, safety legislations, safety training, workshop, OSH in Nepal, Labor act 2074, etc. An earthquake could be a sudden shaking of the layer caused by the discharge of energy within the Earth's Lithosphere. The lithosphere is formed from fragments of the layer and topmost mantle. There are seven major tectonic plates that move around in regard to each other [29]. The movement of tectonic plates is incredibly slow but continuous. Occasionally, due to friction, these plates get stuck at their edges. The plates keep pushing against each other; cause

the event of an enormous stress. When this stress overcomes the frictional resistance, all the stored mechanical energy directly causing the formation of seismic waves that travel through the earth's crust. These waves when reached to the surface will be felt as earthquake.

Nepal is such one in every of the country which is found in one among the foremost active seismic regions within the world and seismic events occur frequently throughout Nepal [30]. Nepal is vulnerable to earthquakes because two massive tectonic plates, namely Indian plate and Eurasian plate lie below it. In fact, the mountain ranges of Nepal are also formed by the collision of those two tectonic plates. As per the to the research done by Building Code Develop Project (BCDP), it's estimated that the recurrence interval for earthquakes with local magnitude greater than 8 is approximately 81 years. Similarly, the research led to the findings that stated the earthquakes with local magnitudes of 7.5-8, 7-7.5, 6-7 and 5-6 had recurrence intervals of 40, 8, 5 and 2 years respectively [31]. A destructive earthquake of moment magnitude Mw 7.8 hit central Nepal at 11:56 A.M.. local time on April 25, 2015, with the epicenter (N: 28°08′49.2"; E: 84°42′28.8") near Baluwa village, about 77 km northwest of Kathmandu Valley, at a focal depth of approximately 15 km[32]. This was the biggest event since 1934, Mw8.1 Bihar–Nepal earthquake. The earthquake lasted for 55 seconds. Then on May 12, 2015 (Tuesday) a enormous aftershock of magnitude 7.3 again hit Nepal. More than 465 aftershocks having magnitude above 4 were felt till December 30, 2016, 49 with magnitude greater than 5 and five with magnitude greater than 6 (National Earthquake Monitoring and Research Center, 2021).

Table 1
Building Typology and damage of human settlement

Building Typology	Fully collapsed (Beyond repair)	Partially damaged (Can be repaired or retrofitted)
Low-strength masonry	474,025 (95%)	173,867 (67.7%)
Cement-based masonry	18,214 (3.7%)	65,859 (25.6%)
Reinforced concrete frame	6,613 (1.3%)	16,971 (6.7%)
Total	498,852	256,697

Source: Nepal Earthquake 2015, Post Disaster Needs Assessment

Complete recovery after a disaster is to succeed in a state adequate to or better than the pre-disaster state. Disaster recovery has four phases: Disaster Assessment, Short Term Recovery, Long-term Reconstruction-Retrofitting and Recovery Management. PDR could be a phase that comprises activities like debris management, construction, and repairing of structures and demolition, restoration, and retrofitting of damaged structures that are performed after the disaster until the whole recovery is achieved. Retrofitting is a pioneering and cost-effective technique of seismically intensification existing houses by strengthening structural elements and stabilizing the existing structure, making them earthquake resistant. Retrofitting is a fairly new concept which deals with restoring a damaged structure to its original form and function. There are three categories of retrofitting: Repair, Restoration and Seismic Strengthening.

The National Reconstruction Authority was well-known with the core objective of rapid reconstruction and retrofitting of the physical compensation caused by the immense earthquakes of April 25 and May 12, 2015 and their aftershocks. The NRA's on the whole objective is to promptly complete the construction works of the structures damaged by the devastating earthquake of 25 April and May 12, 2015 and succeeding aftershocks, in a sustainable, flexible and designed approach to encourage countrywide significance and afford social integrity by assembly relocation and relocation of the people and families displaced by the seismic activity. Here, 32 districts, together with 14 highly affected and 18 less affected districts fall under the scope of work of the NRA.

Central Level Project Implementation Unit (Education) well-known under the National Reconstruction Authority with an assignment to accelerate the reconstruction and retrofitting of the schools project affected from the devastating earthquake of April 2015. Having received the guiding policies, directives and resources from the National Reconstruction Authority, the Central Level Project Implementation Unit is accelerating the School reconstruction and retrofitting a project which is actively engaged in the school reconstruction activities with a nonstop and hard line harmonization, communication and teamwork with all the contributing donors, GOs, INGOs & NGOs, diplomatic agencies and other development partners. In the earthquake affected 32 districts, District Level Project Implementation Units have established under the Central Level Project Implementation Unit Education. Similarly District Level Project Implementation Unit (DLPIU) is paying attention to execute & supervise the school reconstruction and retrofitting schools project at the particular district. Labor Acts are passed in order to safeguard rights of the workers. Various amendments are made to these acts time and again according to the requirement. The major provisions of the New Labor Act which are related to health and safety are briefly outlined below: Working hours, Leave and holidays, Disability compensation, Compensation against injury, Death compensation, Accident insurance, Medical expenses and Disciplinary action.

Methodology

In order to ascertain and fulfillment the given objectives, first of all, systematic literature review methodology will be carried out which will gives a good understanding of the background of the study and researches will be carried out so far within the boundary of the objectives of the study.

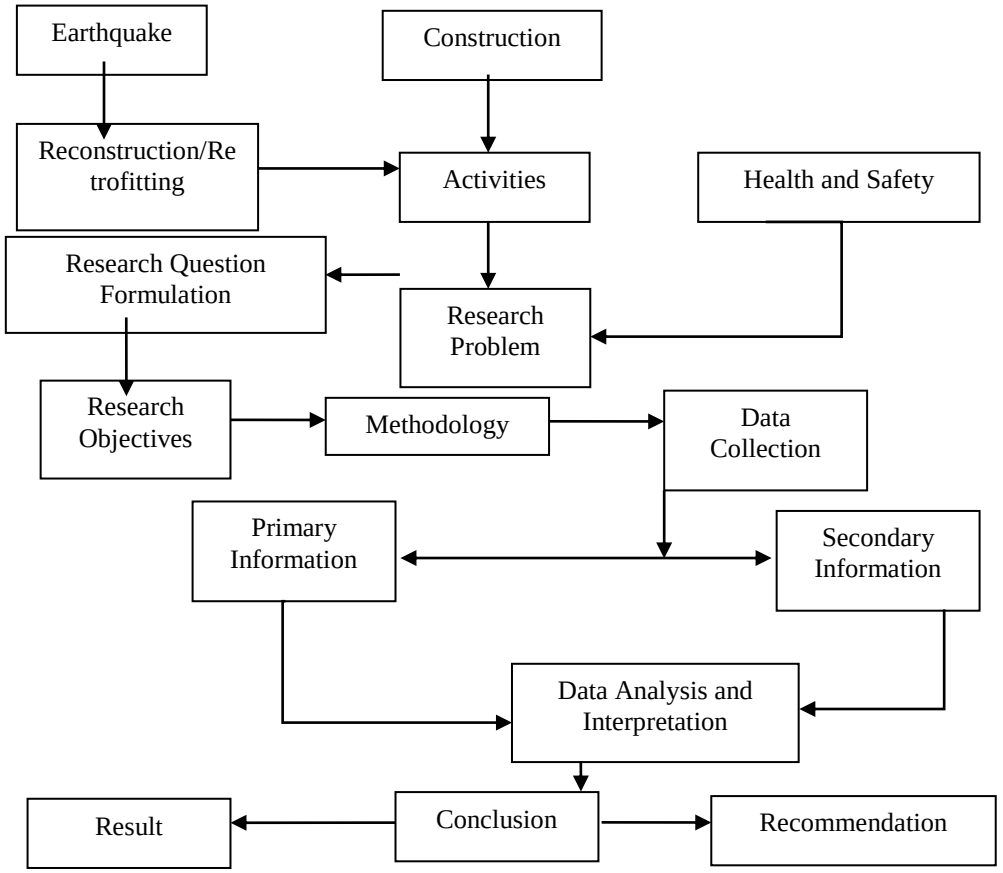

Figure 1.Research Design Flow Chart

Research results and Discussion

Research Approach and Study Area

Data were collected through questionnaire to the corresponding respondents, literature reviews and direct observations in the construction site systematic and effective way as per schedule. There are many retrofitting schools project ongoing in Kathmandu district which are directly administered by Disaster Resilience of Schools Projects (DRSP) under NRA-CLPIU (Education) in aggregate package of Retro -2, 3, 4 and 5. Only few schools are selected for the data collection, analysis and for further study about the safety practices, among them twelve retrofitting schools project which are running in Kathmandu districts.

Sample Size Calculation

The population size is finite hence; sample size (n) is calculated with the use of equation [31];

$$n = \frac{\frac{z^2.p(1-p)}{e^2}}{1 + \frac{z^2.p(1-p)}{e^2.N}}$$

Where,
z = z-score for given confidence level
p = percentage of chances that questionnaire depicts the issues of implementation in different phases, expressed as decimal
e = margin of error
The study was carried out by adopting 95% confidence level as per general practice.
z = 1.96; p = 0.5; e = 0.05

Table 2
Sample sizes of projects under consideration

S.N.	PROJECT NAME	NO. OF TECHNICAL STAFFS	SKILLED MANPOWER	UNSKILLED MANPOWER	TOTAL MANPOWER
1	Vishwo Niketan SS	2	4	9	13
2	Manmaiju SS	2	3	7	10
3	Nepal Rastriya SS	2	8	8	16
4	Guheswori SS	3	6	9	15
5	Padmakanya Bidhyashram SS	2	3	4	7
6	Balkumari SS	2	3	2	5
7	Gram Shikshya SS	2	4	1	5
8	Nil Barahi SS	2	5	1	6
9	Nepal Adarsha SS	2	5	5	10
10	Bal Uddhar SS	2	1	5	6
11	Mahendra Bouddha SS	1	6	13	19
12	Shram Rastriya SS	1	3	6	9
	Total	23	53	74	121

Note: Whenever population size was small the whole population was taken as sample size

Data Collection Data Analysis

For the appropriate and reliable data, direct field visit, questionnaires to the correspondents and relevant documents have been done. All the collected data were classified into appropriate categories and finally compiled. Data from each project were compiled separately and compared with the data obtained from other projects. MS Excel was used to determine statistical parameters. Photo galleries, charts, plots and graphs were used to demonstrate the visual representation of the findings.

Cronbach's alpha test

Cronbach's alpha test is done in order to check the reliability of the questionnaire developed for the research. It is the most commonly used when you have multiple Likert questions in a survey or questionnaires that form a scale and you wish to determine if the scale is reliable. It is considered to be a measure of scale reliability[32]. The value of Cronbach's alpha was calculated by using equation:

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\sum s2y}{s2x}\right]$$

Where,
K = Total number of questions for survey
Sum of item variance, Σs2y
Variance of total score, s2x

Relative Importance Index (RII)

Relative Importance Index is used to establish the relative significance of the safety variables concerned. The points of Likert scale used are equal to the value of W, weightage given to each factor by the respondent [24].The Relative Importance Index was calculated by using equations:

$$RII = \frac{\sum W}{A*N}$$

Where, $\sum W = 5n_5+4n_4+3n_3+2n_2+1n_1$

W = weightage given to each factor by the respondent; n5 = occurrence of "very high"; n4 = occurrence of "high"; n3 = occurrence of "neutral"; n2 = occurrence of "low"; n1 = occurrence of "very low"; A = the highest weight that can be given; N = total number of respondents

Chi Square Test

In this study, Chi-square test was adopted because accident, training, age-group, education and experience are all categorical data. The chi-square statistic is calculated by using equation:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where,
O = observed value
E = expected value

This chapter presents the study and explanation of the collected data through the methods discussed herewith. The field data which were collected during survey time were imported to MS Excel software in order to simplify calculation. The data

were then categorized and various statistical tools were used in order to extract useful results from them. Finally, the results were illustrated through tables, bar graphs and pie-charts.

Demographic Survey

Demographic survey was carried out with the help of a questionnaire prepared based on existing literatures. The questionnaires were printed and distributed to surveyors who then filled the demographic details of the workers by asking them individually. The data collected from demographic survey were as follows:

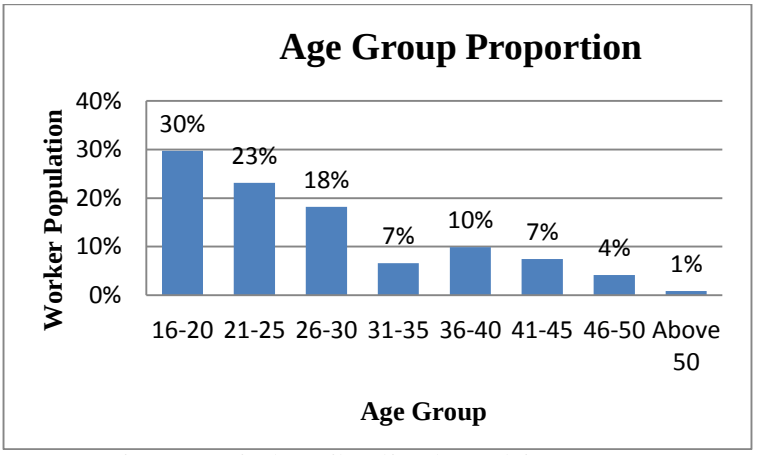

Figure 2. Worker population distribution with respect to age group

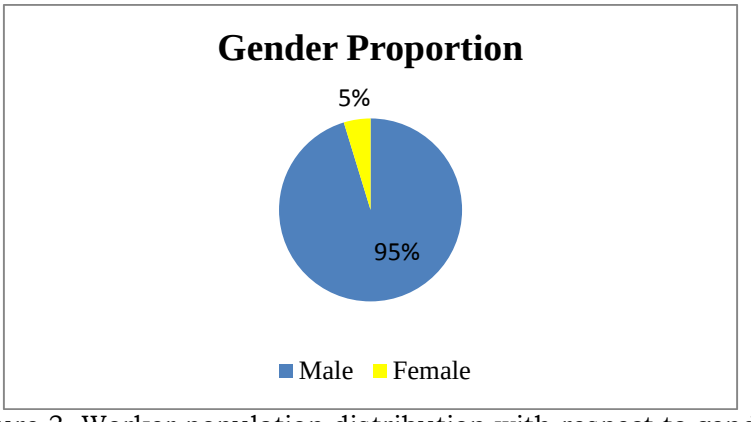

Figure 3. Worker population distribution with respect to gender

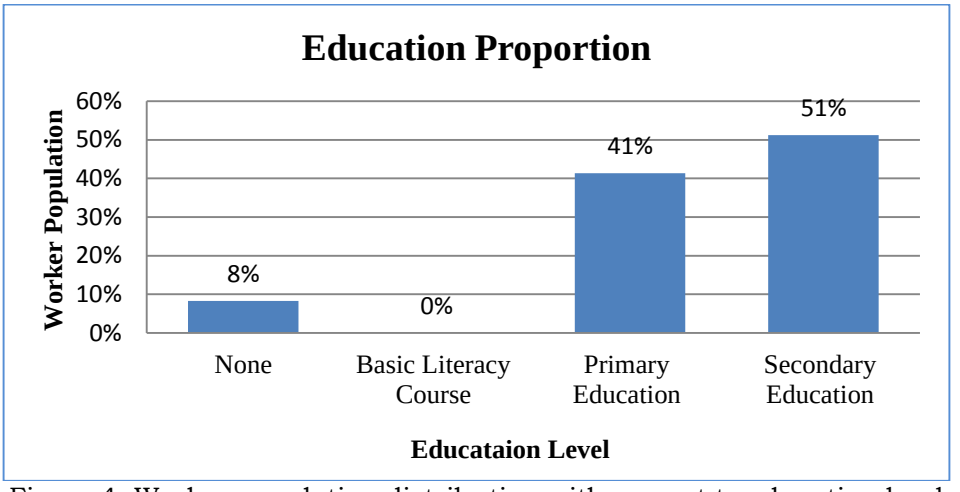

Figure 4. Worker population distribution with respect to education level

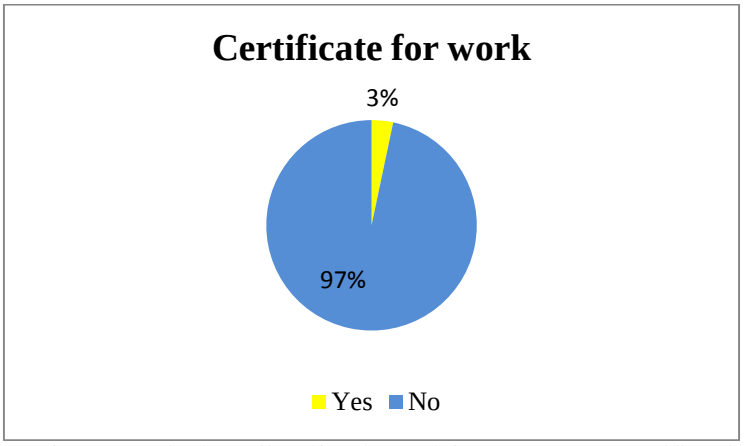

Figure 5. Worker population distribution with respect to certification of work

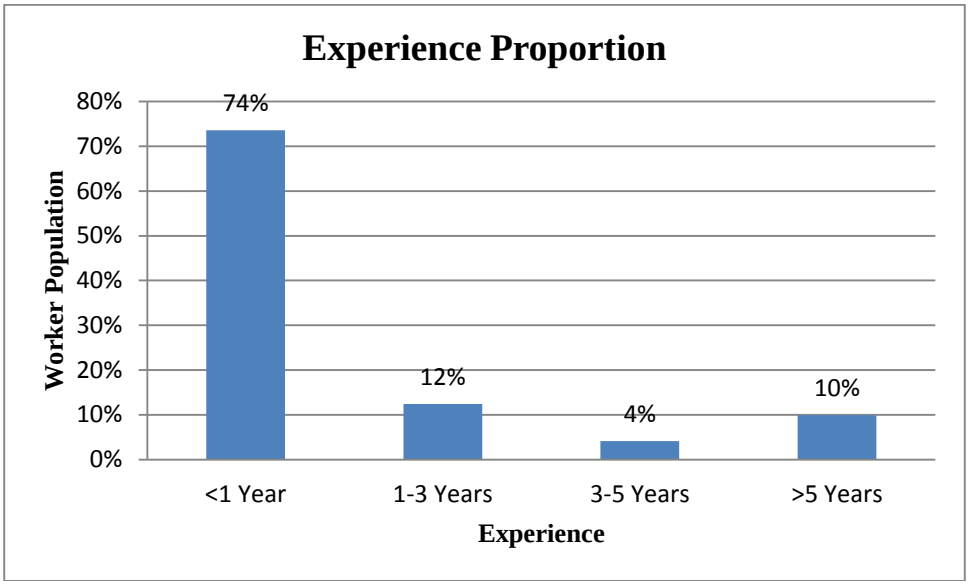

Figure 6. Worker population distribution with respect to years of experience

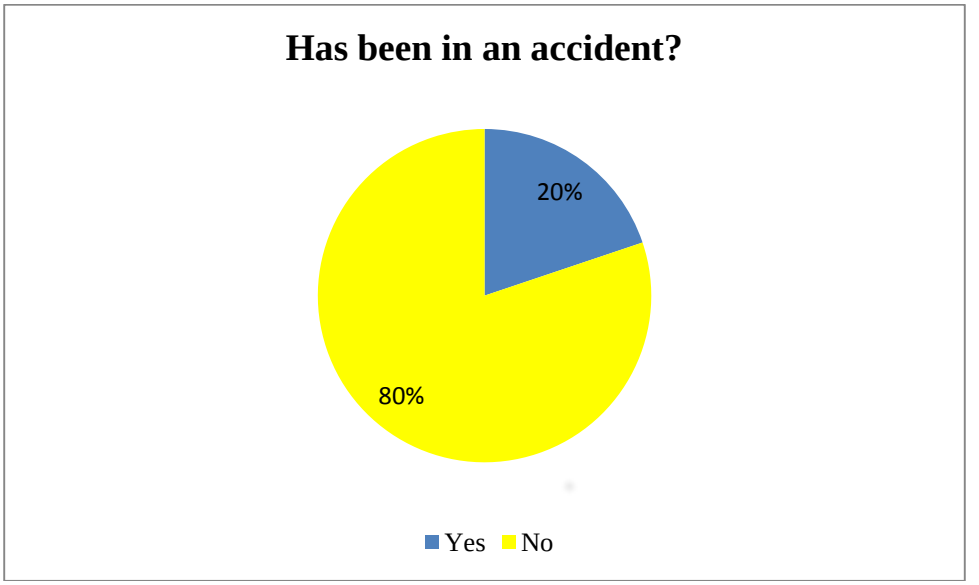

Figure 7. Worker population distribution with respect to occurrence of accident

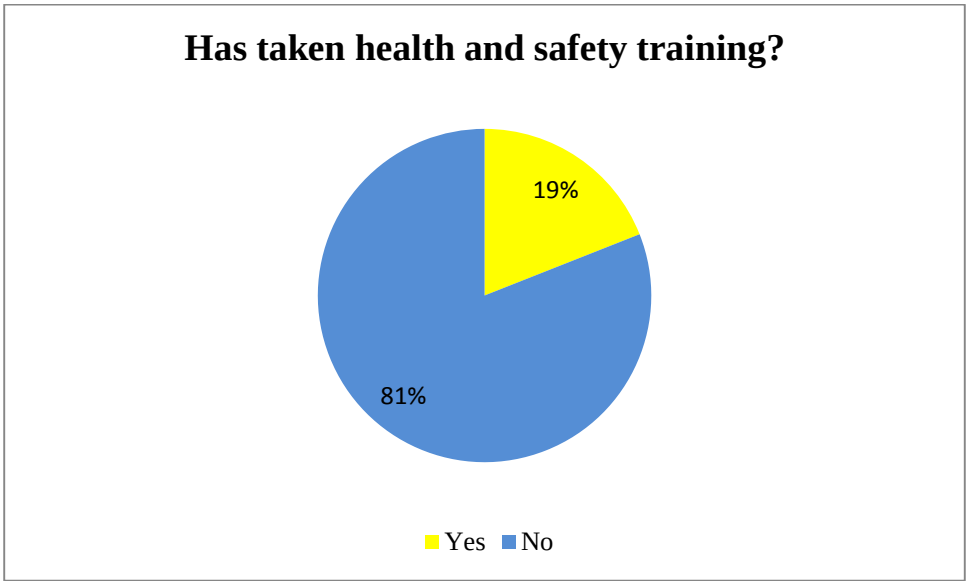

Figure 8. Worker population distribution with respect to training received

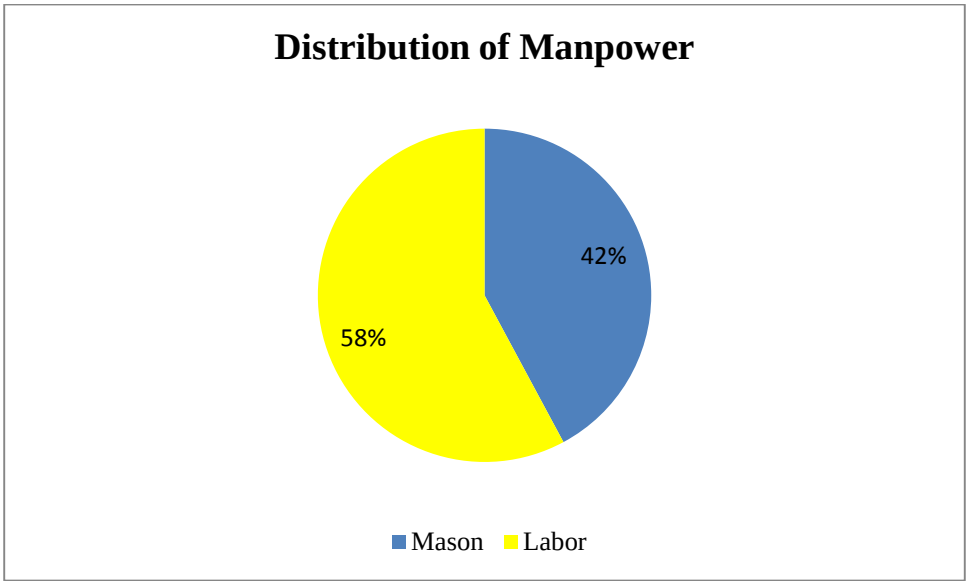

Figure 9. Worker population distribution

Relation between Demographic Variables

In order to review the relation between training and accident the subsequent hypotheses are tested with the utilization of Chi-square test: Null Hypothesis: There's no considerable relation between training and occurrence of accident. Alternative Hypothesis: There's considerable relation between training and occurrence of accident. Calculated value of $x^2 = 0.698$; Tabular value of $x^2 = 3.841$ at 95 % significance level. Hence, calculated value of x^2 < Tabular value of x^2.Therefore, null hypothesis is completely accepted; alternative hypothesis is

completely rejected. There's no significant relation between training and occurrence of accident.

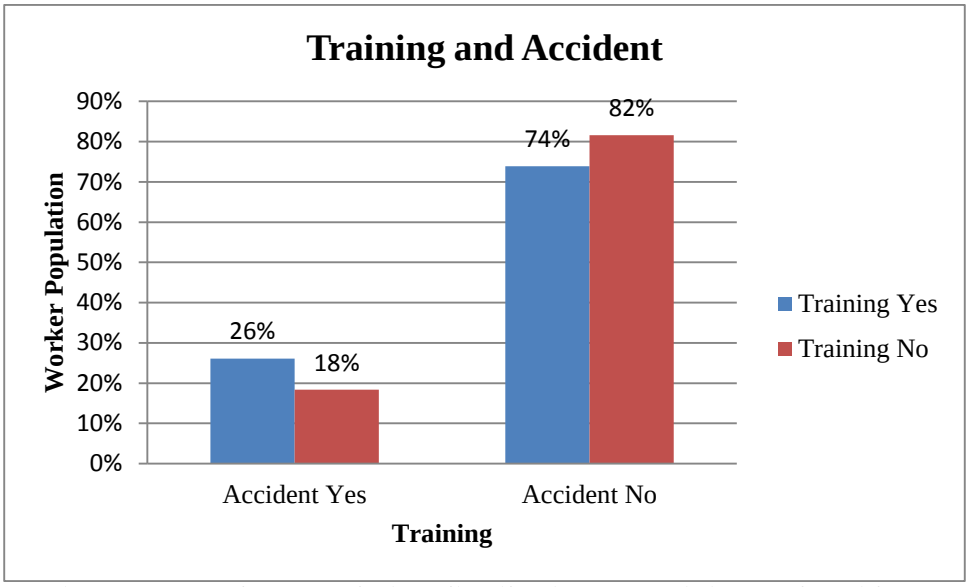

Figure 10. Worker population distribution vs. training and accident

Above specified bar chart illustrates the worker proportion as per training and occurrence of accident. It's seen that the worker proportion who took training experiencing 26 % accident like nailing in shoes and 74 % do not get accident meanwhile who do not took training they get accident by 18 % where 82 % do not experiencing any accident by 82 %. Similarly we can conclude from the given graph that there is no any significant relation between training related safety and occurrence of accident.

Age and Accident

Calculated value of x^2 = 5.435; Tabular value of x^2 = 14.067. Hence, calculated value of x^2 < Tabular value of x^2. Therefore, null hypothesis is completely accepted; alternative hypothesis is completely rejected. There's no significant relation between age group and occurrence of accident.

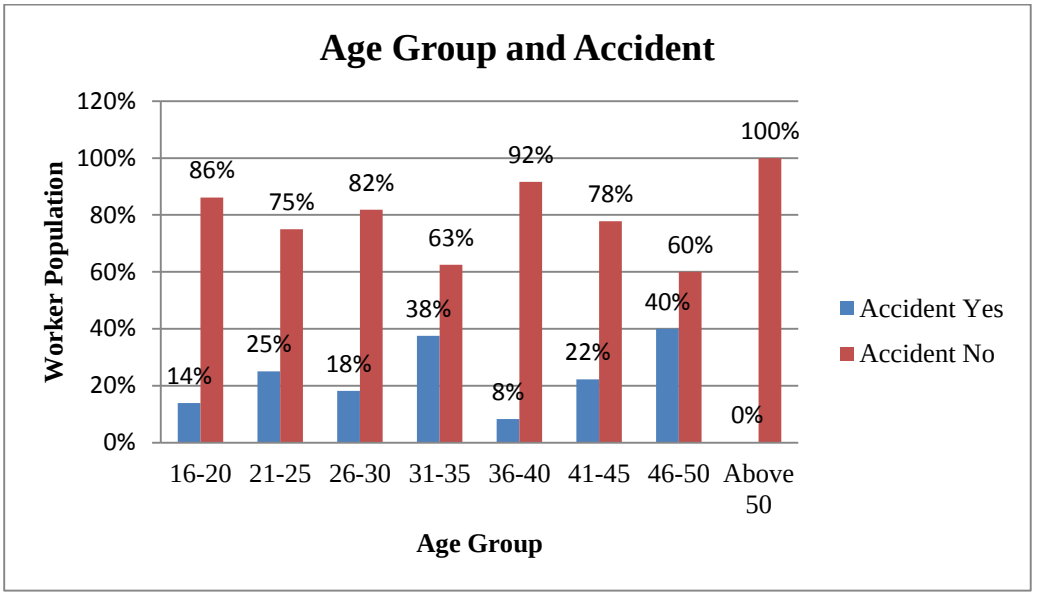

Figure 11. Worker population distribution vs. age group and accident

From the above graph it illustrates the worker proportion as per age group level and occurrence of accident. It's seen that the worker proportion experiencing accident slightly increases as the level of age group increases. Similarly we can conclude from the given graph that there is no any significant relation between age group level and occurrence of accident.

Education and Accident

Null Hypothesis: There's no considerable relation between education and occurrence of accident.
Alternative Hypothesis: There's considerable relation between education and occurrence of accident.

Table 3
Observed and Expected values for education versus accident

Accident / Education	Yes	No	Row Total	Accident / Education	Yes	No	Row Total
None	2	6	8	None	1.587	6.413	8
Basic Literature Course (adult classes, informal classes)	0	1	1	Basic Literature Course (adult classes, informal classes)	0.198	0.802	1
Primary Education (Class 1-8)	9	41	50	Primary Education (Class 1-8)	9.917	40.08	50
Secondary Education	13	49	62	Secondary Education (Class	12.3	49.7	62

(Class 9-12)				9-12)			
Column Total	24	97	121	Column Total	24	97	121

Table 4
Calculation of Chi-square test for education versus accident

Observed Value (O)	Expected Value (E)	O-E	$(O-E)^2$	$(O-E)^2/E$
2	1.587	0.413	0.171	0.108
6	6.413	-0.413	0.171	0.027
0	0.198	-0.198	0.039	0.198
1	0.802	0.198	0.039	0.049
9	9.917	-0.917	0.842	0.085
41	40.083	0.917	0.842	0.021
13	12.298	0.702	0.493	0.040
49	49.702	-0.702	0.493	0.010
Total				0.538

Calculated value of $\chi^2 = 0.538$
Degree of Freedom = (nos. of column – 1) * (nos. of rows – 1)
= (2-1) * (4-1)
= 3
Confidence Level = 95%; Significance Level = 5%

Tabular value of $x^2 = 7.815$; Hence, calculated value of x^2 < Tabular value of x^2 Therefore, null hypothesis is totally accepted; alternative hypothesis is totally rejected. There is no significant relation between education and occurrence of accident.

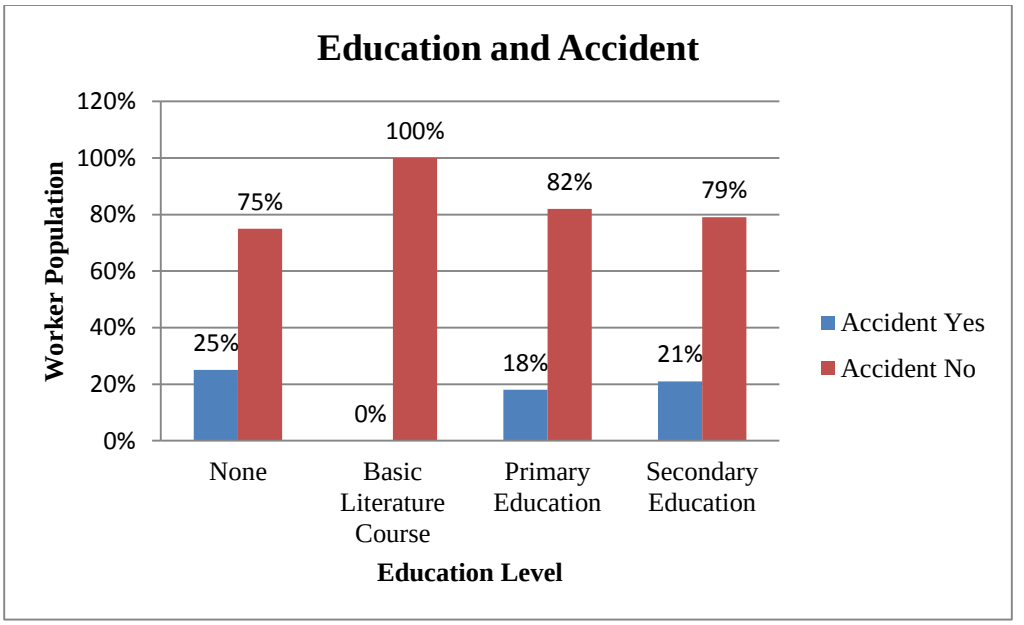

Figure 12. Worker population distribution vs. education and accident

Above graph illustrates the worker proportion as per education level and occurrence of accident. It's seen that the worker proportion experiencing accident slightly declines as the level of education increases. Similarly we can conclude from the given graph that there is no any significant relation between experience and occurrence of accident. Most of the reported deaths are outcome of carelessness, poor security performance of site, inexperienced labor and many more; thus, providing them with safe working environment is major concern. The strategies followed in developed country can be adopted to form the fundamental guiding principle that will help to manage security on Nepalese construction sites.

Experience and Accident

In order to study the relation between experience and accident the following hypotheses are tested with the use of Chi-square test: Null Hypothesis: There's no significant relation between experience and occurrence of accident. Alternative Hypothesis: There's significant relation between experience and occurrence of accident. Calculated value of χ^2 = 0.584; Confidence Level = 95%; Significance Level = 5%, Tabular value of x^2 = 7.815; Hence, calculated value of x^2 < Tabular value of x^2

Therefore, null hypothesis is totally accepted; alternative hypothesis is totally rejected. There is no significant relation between experience and occurrence of accident.

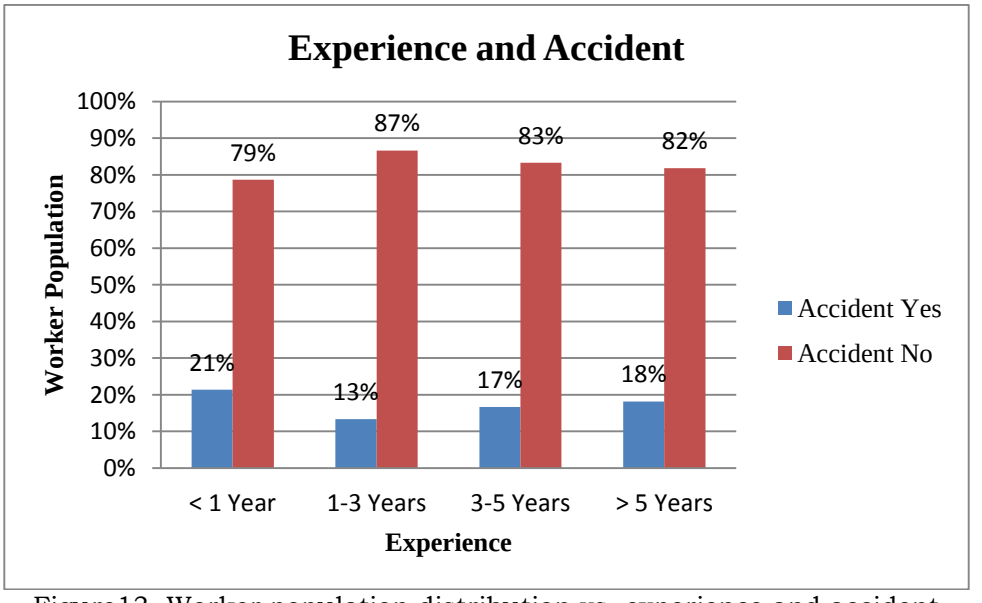

Figure13. Worker population distribution vs. experience and accident

From the given bar diagram it illustrates the worker proportion as per experience level and occurrence of accident. It is seen that the worker proportion experiencing accident slightly declines because the years of experience increases. Similarly we are able to conclude from the graph that there's no any significant relation between experience and occurrence of accident.

Padmakanya Bidhyashram SS lies within the first rank (81.25%) as per safety score among 16 indicators and Balkumari SS lies within the last rank (56.25%) of safety score.

Table 5
Safety score in steps with the observation survey

S.N.	Description	Padmakanya Bidhyashram SS	Nil Barahi SS	Vishwo Niketan SS	Balkumari SS	Nepal Adarsha SS	Nepal Rastriya SS	Manmaiju SS	Shram Rastriya SS	Mahendra Bouddha SS	Bal Uddhar SS	Gram Shikshya SS	Guheswori SS
1	Boundary wall	√	×	√	×	×	√	√	√	√	×	√	√
2	Proper entrance and exit	√	√	√	×	√	√	√	√	√	√	√	√
3	Security personnel in entrance and exit	√	×	×	×	×	×	×	×	×	×	√	×
4	Labor accommodation	√	√	√	√	√	√	√	√	√	√	√	√
5	Proper latrine	√	√	√	√	√	√	√	√	√	√	√	√
6	Drinking water	√	√	√	√	√	√	√	√	√	√	√	√
7	Lunch time	√	√	√	√	√	√	√	√	√	√	√	√
8	First-aid	√	√	√	√	√	√	√	√	√	√	√	√
9	Free of muddy and marshy area	√	√	√	√	√	×	√	√	√	√	√	√
10	Proper drainage system	√	√	√	√	√	√	√	√	√	√	√	√
11	Proper lighting and ventilation	√	√	√	√	√	√	√	√	√	√	√	√
12	Firefighting equipment	×	×	×	×	×	×	×	×	×	×	×	×
13	Emergency exit	√	×	√	×	×	×	×	×	×	×	×	√
14	Safety signs and warnings	√	√	√	√	√	√	√	√	√	√	√	√
15	Full-time paramedical health worker	×	×	×	×	×	×	×	×	×	×	×	×
16	Emergency vehicle	×	×	×	×	×	×	×	×	×	×	×	×
	Total score (%)	81.25	62.5	75.0	56.2	62.5	62.5	68.7	68.7	68.7	62.5	75.0	75.0

Safety Variables and Their Importance

Respondents acting on the twelve sites were asked to rate ten safety variables according their importance in improving safety aspects of the retrofitting of faculties' project. The respondents included project managers, site engineers and supervisors. The information was collected with the utilization of questionnaire developed in five point Likert scale design. As per their response, ranks of the security variables were obtained as shown in table:

Table 6
Relative Importance Index and ranks of the security variables

S.N	Safety Variable	Very Low	Low	Neutral	High	Very High	RII	Rank
1	Inclusion of safety clauses in contract	-	-	-	-	60	0.47	1
2	Regular housekeeping	-	8	15	12	-	0.17	5
3	Use of Private Personal Protective Equipment (PPE)	-	8	21	-	-	0.12	7
4	Regular Safety meeting	2	10	15	-	-	0.11	8
5	First-aid facilities	1	2	12	20	5	0.23	4
6	Proper scaffolding	-	-	3	36	10	0.32	2
7	Use of safety signs and signals	-	2	6	28	5	0.25	3
8	Provision of emergency exit	-	8	3	20	-	0.17	6
9	Safety audit and inspection	-	18	9	-	-	0.10	9
10	Security against trespassing	2	20	-	-	-	0.07	10

The ranking of safety variables per their importance shows that inclusion of safety clauses in contract is that the most vital safety variable closely followed by the security variables like use of proper scaffolding, use of safety signs and signals, first aid facilities, regular housekeeping. Hence, it's understood that these top five variables shall be properly implemented during the project duration. Similarly, the variables like provision of emergency exit, use of Personal Protective Equipment (PPE), regular safety meeting, regular safety audit and inspection and security against trespassing. Although it is seen that these bottom five variables have comparatively lesser impact on improving safety aspects of a construction project, it shall not be completely neglected but from future point of aspects use of personal protective equipments should be implemented within the sites.

Safety Variables and Their Implementation

Respondents working on the twelve sites were asked to rate sixteen safety variables according their implementation at site. The respondents included project managers, site engineers and supervisors. The data were collected with the use of questionnaire developed in five-point Likert scale design. As per their response, ranks of the focused variables were obtained as shown in table:

Table 7
Relative Importance Index and ranks of focused variables

S.N	Safety Variable	Never	Rarely	Occasionally	Mostly	Always	RII	Rank
1	Inclusion of safety clauses in contract	-	-	3	12	40	0.40	1
2	Holiday on Saturday and public holidays	1	16	6	4	-	0.11	15
3	Regular safety meeting conducted	-	14	9	8	-	0.14	14
4	Maintenance of accident records	4	2	9	8	10	0.18	11
5	Servicing and maintenance of PPE, tools and equipment	1	-	6	28	10	0.29	5
6	Provision of health/life insurance	7	2	-	8	10	0.15	13
7	Reward to workers following safety rules and regulations	1	4	6	20	10	0.25	6
8	Punishment to workers not following safety rules and regulations	6	8	3	4	-	0.07	16
9	Provision of compensation to injured worker	1	2	12	20	5	0.23	8
10	Restriction of child labor below 16 years age group	-	-	6	20	25	0.35	3
11	Implementation of limit of carrying manual load	2	6	6	16	5	0.19	10
12	Presence of safety engineer/supervisor at site	-	2	3	16	30	0.36	2
13	Regular housekeeping practiced in the sites		8	3	20	10	0.24	7
14	Use of PPE by the workers in the sites	2	4	9	20	-	0.18	11
15	Proper scaffolding techniques practiced in the sites	-	-	3	36	10	0.32	4
16	Regular safety audit and inspection conducted in sites	-	4	18	12	5	0.21	9

The ranking of safety variables according to the degree of implementation at the construction of retrofitting of schools site shows that the safety variables like inclusion of safety clauses in contract, presence of safety engineer/supervisor at site, restriction of child labor below 16 years age group, proper scaffolding

techniques practiced in the sites, Servicing and maintenance of PPE, tools and equipment etc. have been receiving minimum attention from the management level. The trend of punishing workers who break safety rules and regulations was not seen on any construction sites incorporated in this study. Similarly, accident records were not found to be maintained properly in any of those sites which I have visited during the survey time. There was poor practiced of using the personal protective equipments by the workers in the construction sites. Likewise, there was no provision of health or life insurance of the workers who worked in the sites and no regular safety meeting was found to be conducted in the sites. Last but not least, it was found that safety audit and inspection was also not being held in a regular interval.

Conclusion and Recommendation

This chapter summarizes the study and aims to supply conclusion and recommendations regarding safety aspects of construction industry with regard to retrofitting of schools project of Kathmandu district. The conclusions that were drawn for this study are presented as follows:

- Safety clauses were included in contract of all the visited sites.
- It was observed that accident record wasn't maintained altogether the development of retrofitting sites where I visited.
- Significant relation was observed between training and occurrence of accident. It absolutely was observed that workers who had received training were less likely to have an accident at site.
- A significant relation was seen between education and occurrence of accident because the level of education of workers increased, the occurrence of accident decreased in an exceedingly ratio.
- Significant relation was also seen between experience of workers and occurrence of accident. Experienced workers were less likely to have an accident at site.

References

1. Aboagye-Nimo, E., Raiden, A., & Tietze, S. (2011). *Investigating Good Health and Safety Practices in Small Construction Firms in the United Kingdom*.
2. Abu Aisheh, Y. I., Tayeh, B. A., Alaloul, W. S., & Jouda, A. F. (2021). Barriers of Occupational Safety Implementation in Infrastructure Projects: Gaza Strip Case. *Int J Environ Res Public Health, 18*(7). doi:10.3390/ijerph18073553
3. Alexander, D. E. (2010). Rebuilding after Disasters: From Emergency to Sustainability. *Construction Management and Economics, 28*(10), 1117-1119. doi:10.1080/01446193.2010.517776
4. Carter, G., & Smith, S. (2006). Safety Hazard Identification on Construction Projects. *Journal of Construction Engineering and Management-asce - J CONSTR ENG MANAGE-ASCE, 132*. doi:10.1061/(ASCE)0733-9364(2006)132:2(197)
5. Chaulagain, H., Gautam, D., & Rodrigues, H. (2017). Revisiting Major Historical Earthquakes in Nepal: Overview of 1833, 1934, 1980, 1988, 2011, and 2015 Seismic Events. In (pp. 1-17).

6. Choudhry, R. M., & Fang, D. (2008). Why operatives engage in unsafe work behavior: Investigating factors on construction sites. *Safety Science, 46*(4), 566-584. doi:10.1016/j.ssci.2007.06.027
7. CLPIU. (2016). Central Level Project Implementation Unit (GMALI). Retrieved from http://www.moepiu.gov.np/en/content.php?id=58
8. Coker, D. R., & Friedel, J. N. (1991). The Data Collection Matrix Model: A Tool for Functional Area and Program Evaluation. *Research in Higher Education, 32*(1), 71-81.
9. Department of Archaelogy. (1956). Ancient Monument Preservation Act, 2013. *Government of Nepal*.
10. DOA. (2021). Department of Archaeology. Retrieved from http://www.doa.gov.np/
11. DoLIDAR. (2017). Occupational safety and health guidelines. *Ministry of Federal Affairs and Local Development*.
12. El Kechebour, B., & Zeloum, H. (2015). Choice between Retrofitting and Reconstruction of Buildings in Reinforced Concrete after an Earthquake. *Advanced Materials Research, 1119*, 736-740. doi:10.4028/www.scientific.net/AMR.1119.736
13. Gautam, D. (2017). Unearthed lessons of 25 April 2015 Gorkha earthquake (MW 7.8): geotechnical earthquake engineering perspectives. *Geomatics, Natural Hazards and Risk, 8*(2), 1358-1382. doi:10.1080/19475705.2017.1337653
14. Goda, K., Kiyota, T., Pokhrel, R. M., Chiaro, G., Katagiri, T., Sharma, K., & Wilkinson, S. (2015). The 2015 Gorkha Nepal Earthquake: Insights from Earthquake Damage Survey. *Frontiers in Built Environment, 1*. doi:10.3389/fbuil.2015.00008
15. Government of Nepal. (2018). National Population and Housing Census. Retrieved from https://cbs.gov.np/
16. Gujarat-- State Disaster Management Authority. (2002). Repair, Restoration and Retrofitting of Masonry Buildings in Kachchh earthquake Affected Areas of Gujarat. *Government of Gujarat*.
17. Han, Y., Feng, Z., Zhang, J., Jin, R., & Aboagye-Nimo, E. (2019). Employees' Safety Perceptions of Site Hazard and Accident Scenes. *Journal of Construction Engineering and Management, 145*(1). doi:10.1061/(asce)co.1943-7862.0001590
18. Hasanzadeh, S., Dao, B., Esmaeili, B., & Dodd, M. D. (2019). Role of Personality in Construction Safety: Investigating the Relationships between Personality, Attentional Failure, and Hazard Identification under Fall-Hazard Conditions. *Journal of Construction Engineering and Management, 145*(9). doi:10.1061/(asce)co.1943- 7862.0001673
19. Health and Safety Executive. (2006). Health and safety in construction.
20. Institute for Digital Research & Education. (2021). What does Cronbach's Alpha mean?
21. Retrieved from https://stats.idre.ucla.edu/spss/faq/what-does-cronbachs-alpha-mean/
22. International Labour Organization. (2017). The ILO's Social Finance Programme. *Publications of the International Labour Office*.
23. Israel, G. D. (2021). Determining Sample Size. *University of Florida IFAS Extension*.

24. Johnson, J. W., & Lebreton, J. M. (2004). History and Use of Relative Importance Indices in Organizational Research. *Organizational Research Methods, 7*(3), 238-257. doi:10.1177/1094428104266510
25. Kc, A., Sharma, K., & Pokharel, B. (2017). Performance of Heritage Structures during the Nepal Earthquake of April 25, 2015. *Journal of Earthquake Engineering, 23*(8), 1346-1384. doi:10.1080/13632469.2017.1360225
26. Kheni, N. A., Gibb, A. G. F., & Dainty, A. R. J. (2010). Health and Safety Management within Small- and Medium-Sized Enterprises (SMEs) in Developing Countries. *Journal of Construction Engineering and Management*. doi:10.1061/共ASCE天CO.1943- 7862.0000218
27. National Earthquake Monitoring and Research Center. (2021). National Earthquake Monitoring and Research Center. Retrieved from http://seismonepal.gov.np/home
28. OSHA. (2011). Occupational Safety and Health Administration. *United States Department of Labor*.
29. Park, I., Kim, J., Han, S., & Hyun, C. (2020). Analysis of Fatal Accidents and Their Causes in the Korean Construction Industry. *Sustainability, 12*(8). doi:10.3390/su12083120
30. Rawlinson, F., Peace, S., & Farrell, P. (2010). UK construction industry site health and safety management. *Construction Innovation, 10*(4), 435-446. doi:10.1108/14714171011083597
31. Sawe, B. E. (2020). How many tectonic plates are there? Retrieved from https://www.worldatlas.com/articles/major-tectonic-plates-on-earth.html
32. Sharma, A. (2019). Safety Issues in Nepalese Construction Industry. doi:10.13140/RG.2.2.21836.87687.