39 LB/DON/67/2012 UNIVERSITY OF MORATUWA **AORATIMA** 

# Safety Performance of Construction Industry In Sri Lanka

Loku Waduge Jayampath Nilantha De Alwis

(08/8871)



This Dissertation submitted in partial fulfillment of the requirement for the Degree of

Master of Science in Construction Project Management



Department of Civil Engineering

<u>624`12</u>" 69:005.8(043)

University of Moratuwa

Sri Lanka

102871 ᠿ CD-RCM

TH

January 2012

102871

#### Declaration

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature

08/8871

Date: 20/01/2012.

Date: 20/01/2012

# L.W.J.N.DE.AlwisUniversity of Moratuwa, Sri Lanka. Electronic Theses & Dissertations www.lib.mrt.ac.lk

The above candidate has carried out research for the Masters Dissertation under my supervision.

#### **UOM Verified Signature**

Signature of the Supervisor:

Dr.L.L.Ekanayake

Senior Lecturer

University of Moratuwa

#### Declaration

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature:

Date:



University of Moratuwa, Sri Lanka. Electronic Theses & Dissertations www.lib.mrt.ac.lk

The above candidate has carried out research for the Masters Dissertation under my supervision.

Signature of the Supervisor:

Date:

i

#### Abstract

A safe and healthy work environment is the basic right of every worker. However, the global situation falls far short from this right. The ILO estimates that more than 125 million workers are victims of occupational accidents and disease in single year. Of these, approximately 220,000 workers die and about 10 million are seriously injured.

Due to the ever changing environment and temporary nature of the construction industry, it contributes major component of aforementioned accidents. It is common in Sri Lanka, under privileged community has involved in construction industry. This leads to labour exploitation.

Contractors always try to maximize the profit. Hence they always try to allocate lesser amount for health and safety resulting under resources and poor trained labour force at the site.

Top management, middle management and even site personal are much aware of the benefits that can be gained through good health and safety practices. However it is sad to say that poor safety performance of the construction industry continues. This may be due to the poor safety culture, low education, lack of resources, poor commitment etc.

Hence this research tries to find the reasons for poor health and safety conditions of construction sites and find the ways and means to mitigate the risk.

#### Acknowledgement

This study was done with much enthusiasms and assistance in numerous ways, which I am indebted. It is important to place my deep gratitude to all the individuals and organizations those who impart and extended their strenuous cooperation towards the success of my goal.

At first, I would like to impart my grateful gratitude to the Head of the Department of construction project management Dr Asoka Perera, respected research coordinator, Dr L. L. Ekanayaka and all other academic and non academic staff who have made their utmost support towards the success of completing the research report.

I express my enormous indebtedness to Dr L. L. Ekanayaka who gave his responsible guidance in the correct time throughout the study.

I am indebted to offer my heart full thank to colleagues who made their attitudes for the success of my study from the start to end.

Finally, I offer my regards and blessings to all who supported me in any respect during the completion of the project and I made my heart feel gratitude to all in my family who gave their emotional and cooperation throughout the study.

### **Table of Content**

.

.

.

.

-

•

۰.

Declaration	on of the candidate & Supervisor	i
Abstract		ii
Acknowle	edgements	iii
Table of (	Content	iv
List of Fig	gures	vii
List of Ta	bles	x
List of Al	obreviations	xi
List of Ap	opendices	xii
СНАРТИ	ER 01 – Introduction	
1.1	Background	01
1.2	Problem definition	02
1.3	Objective of the study	03
1.4	Frame work/Scope limitations	03
1.5	Structure of the report	03
СНАРТИ	ER 02 - Literature Review f Moratuwa, Sri Lanka.	
2.1	overview to construction safety & Dissertations	05
2.2	Importance of safety in construction	05
2.3	Common causes of accidents in work sites	06
	2.3.1 Injuries due to falling	07
	2.3.2 Struck by falling objects	07
	2.3.3 Caught in or between objects	07
	2.3.4 Exposure or contact with electric currents	08
	2.3.5 Exposure or contact with harmful substances or gases	08
	2.3.6 Fire& explosions	08
2.4	Common Safety procedures in a construction site	08
	2.4.1 Arrangement of general site layout	08
	2.4.2 Site access and site traffic	10
	2.4.3 Fire prevention	11
	2.4.4 Proper site keeping	11
	2.4.5 Noise control	12
	2.4.6 Fall protection	14
2.5	Construction safety equipment	15

iv

	2.5.1	Safety gloves	15
	2.5.2	Safety glasses and goggles	16
	2.5.3	Ear plugs and earmuffs	17
	2.5.4	Mask and respirators	17
	2.5.5	Safety helmets (Head wear)	18
	2.5.6	Safety footwear	18
	2.5.7	Protective clothing	19
	2.5.8	First aid facilities	19
2.6	Safety	regulations	20
	2.6.1	Sri Lankan safety regulations	20
	2.6.2	Constitutional provision for occupational safety and health	22
	2.6.3	Necessity of policies, regulations and standards for construction safety	22
	2.6.4	Accident recorded according to regulations	23
	2.6.5	New act	24
2.7	Stakel	holders in Construction safety	25
	2.7.1		25
	2.7.2	LINDIOYEES	25
	2.7.3	Safety officer	26
	2.7.4	Safety supervisor	27
	2.7.5	Safety representative	28
	2.7.6	Consultant's representative	29
2.8	Occup	pational injuries in construction	30
2.9	Asses	sing project hazards	32
2.10	Measuring contractors' safety performance		34
2.11	Safety	v culture	36
2.12	Const	ruction workers' health and safety knowledge	39
2.13	Summ	nery	40
<b>PTE</b>	R 03 –	Methodology of Study	
3.1	Introd	uction	41
3.2	Resea	rch design	41
	3.2.1	Preliminary discussion	41
	3.2.2	Literature survey	42
	3.2.3	Questionnaire survey	42
	2.7 2.8 2.9 2.10 2.11 2.12 2.13 <b>PTE</b> 3.1	2.5.2 2.5.3 2.5.4 2.5.5 2.5.6 2.5.7 2.5.8 2.6 Safety 2.6.1 2.6.2 2.6.3 2.6.4 2.6.5 2.7 Stakel 2.6.5 2.7 Stakel 2.7.1 2.7.3 2.7.4 2.7.5 2.7.6 2.8 Occup 2.9 Asses 2.10 Measu 2.11 Safety 2.12 Const 2.13 Summ <b>APTER 03</b> – 3.1 Introd 3.2 Resea 3.2.1 3.2.2	<ul> <li>2.5.2 Safety glasses and goggles</li> <li>2.5.3 Ear plugs and earmuffs</li> <li>2.5.4 Mask and respirators</li> <li>2.5.5 Safety helmets (Head wear)</li> <li>2.5.6 Safety footwear</li> <li>2.5.7 Protective clothing</li> <li>2.5.8 First aid facilities</li> <li>2.6 Safety regulations</li> <li>2.6.1 Sri Lankan safety regulations</li> <li>2.6.2 Constitutional provision for occupational safety and health</li> <li>2.6.3 Necessity of policies, regulations and standards for construction safety</li> <li>2.6.4 Accident recorded according to regulations</li> <li>2.6.5 New act</li> <li>2.7 Stakeholders in Construction safety</li> <li>2.7.4 Safety supervisor</li> <li>2.7.5 Safety representative</li> <li>2.7.6 Consultant's representative</li> <li>2.8 Occupational injuries in construction</li> <li>2.9 Assessing project hazards</li> <li>2.10 Measuring contractors' safety performance</li> <li>2.11 Safety culture</li> <li>2.12 Construction workers' health and safety knowledge</li> <li>2.13 Summery</li> <li>PTER 03 – Methodology of Study</li> <li>3.1 Introduction</li> </ul>

v

	3.3	Method of sample selection	43
СНА	рте	R 04 – Analysis of Data	
	4.1	Introduction	44
	4.2	Analysis of responses received to questionnaire survey	44
		4.2.1 Analysis demographic data	44
		4.2.2 Analysis of respondents views	46
	4.3	Summery	76
CHA	РТЕ	R 05 – Conclusion and Recommendations	
	5.1	Conclusion	77
	5.2	Recommendations	79
	5.3	Recommendations for future research	80
Refer	rence	S	81
Appe	ndix	1 – Questionnaire form	85



## List of Figures

•

.

-

.

.....

.

.

Figure 1	Good Site Layout Arrangement	Page 09
Figure 2	Safe Accesses and Site Traffic	Page 10
Figure 3	Safe Storage Facilities for Flammable Goods	Page 11
Figure 4	Clean Oil or Grease	Page 12
Figure 5	No Prodding on Nails	Page 12
Figure 6	Ear Protection Zone/ Distance for Noisy Equipment	Page 13
Figure 7	Safety Harness and Safety Belt	Page 14
Figure 8	Safety Gloves	Page 16
Figure 9	Safety Glasses & Goggles	Page 16
Figure 10	Earmuff & Disposable Ear Plugs University of Moratuwa, Sri Lanka.	Page 17
Figure 11	Electronic Theses & Dissertations www.lib.mrt.ac.lk	Page 17
Figure 12	Head Wear	Page 18
Figure 13	Safety Footwear	Page 18
Figure 14	Protective Clothing	Page 19
Figure 15	First Aid Facilities	Page 20
Figure 16	Hazard Vs Safety Trade – Off	Page 33
Figure 17	Fishbone Diagram – Building Hazard Attributes	Page 34
Figure 18	Respondents Experience Relating to Construction Industry	Page 44
Figure 19	Respondent's Representation	Page 45
Figure 20	Respondent's Representative Organizations Experience Relating to Construction Industry	Page 45

Figure 21	Respondents Behavior for Pre Planning of the Project	Page 49
Figure 22	Top Management Commitment	Page 50
Figure 23	Contractual Clauses on Health & Safety in FIDIC and ICTAD Condition of Contract	Page 51
Figure 24	Allocated B.O.Q Amount for Health & Safety	Page 52
Figure 25	Project Manager's Concentration on Safety and Health Issues	Page 53
Figure 26	Training of Technical Staff	Page 54
Figure 27	Construction Workers Preference to Adopt Safety Measures	Page 55
Figure 28	Respondents Attitudes of Additional Cost Incurred in Safety	Page 56
Figure 29	Adopting Safety Practices Against Efficiency of the Employees	Page 57
Figure 30	Suitability of Safety Wears to Sri Lankan Climate Electronic Theses & Dissertations	Page 58
Figure 31	Consultant's Behavior Regarding the Health & Safety Issues	Page 59
Figure 32	Resource Availability	Page 60
Figure 33	Willingness of Respondent to Wear Safety Wears	Page 61
Figure 34	Top Management Willingness to Use Safety Wears	Page 62
Figure 35	Construction Workers Education Regarding the Health & Safety	Page 63
Figure 36	Respondents Satisfaction of Safety Equipment Which They Already Used	Page 64
Figure 37	Illustration of Record Keeping	Page 65
Figure 38	Client/Engineer behavior towards Health & Safety At Tender Evaluation	Page 66
Figure 39	Client's Right to Interfere the Contractor's Safety Performances	Page 67

Figure 40	Respondents Attitude Regarding Cost of Accidents	Page 68
Figure 41	Availability of Dedicated Safety Officers	Page 69
Figure 42	Availability of Safety Guide Lines	Page 70
Figure 43	Follow up of Safety Guide Lines	Page 71
Figure 44	Discussion of Safety Issues at Progress Review Meetings	Page 72
Figure 45	Conducting Safety Audits	Page 73
Figure 46	Inclusion of Safety Guide Lines in the Body of Contract Agreement	Page 74
Figure 47	Contractors Concentration on Hazardous Activities	Page 75



### List of Tables

Table 1	Permissible Noise Levels and Exposure Times	Page 13
Table 2	Fatal Accidents Recorded During 1999 To 2008	Page 23
Table 3	Non-Fatal Accidents Recorded During 1999 To 2008	Page 24
Table 4	Hinze And Wilson (2000) Explains Health Problems Affecting Construction Workers	Page 31
Table 5	Hinze and Wilson (2000) Intensely Analyzed the Root Causes of Construction Accidents Their Work Can Be Summarized by the Four Clusters	Page 32
Table 6	Reponses Received For Questionnaire Survey	Page 47



# Abbreviations

•

•

.

.

.

-

.

.

Abbreviation	Description
OHSA	Occupational Health and Safety Act
ILO	International Labour Organization
B.O.Q	Bill of Quantities
ACGIH	American Conference of Industrial Hygienists
HSWA	Health and Safety at Work Act
ISD	Industrial Safety Division
QFM	Quality Fee Method
H & S	Health and Safety
SPE	Safety Performance Evaluation
ICTAD	Unstitute of Construction Training And Development
IESL	Electronic Theses & Dissertations Institute of Engineers, Sri Lanka
FIDIC	International Federation of National Associations of Independent Consulting Engineers
GDP	Gross Domestic Product

Appendix 1 Questionnaire Form

