## UNIVERSITY OF MORATUWA

# SAFETY, HEALTH AND WELFARE ON BUILDING CONSTRUCTION SITES

BY

### P. S. SADADCHARAN

SUPERVISED BY
DR. A. K. W. JAYAWARDANE

DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF MORATUWA
MORATUWA, SRI LANKA

පුස්තකාලය ඉතෘරටුව විශ්ව විදපාලය. ඉිී ලංකාව ඉතාරටුව.

# SAFETY, HEALTH AND WELFARE ON BUILDING CONSTRUCTION SITES

BY

PONNUDURAI SIVASUPRAMANIAM SADADCHARAN BScEng(Hons), University of Peradeniya

CEng, MIE(SL) PERMANENT REFERENCE NOT TO SE

REFERENCE NOT TO BE REMOVED FROM THE LIBRARY.

A THESIS SUBMITTED IN PARTIAL
FULFILMENT OF
THE REQUIREMENT FOR THE DEGREE OF
MASTER OF ENGINEERING
IN CONSTRUCTION MANAGEMENT

IN

THE FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING

69 94"
69.007: 614.8

We accept this thesis as conforming to the required standard

**UOM Verified Signature** 

63061 University of Moratuwa

May 1994

UWA

CTION B STRUCTURED

RIPERO CHEERING

CIVIL ENGINEERING

CIVIL ENGINEERING

OF MORATUWA.

#### TABLE OF CONTENTS

|     |      |  | PAGI |
|-----|------|--|------|
|     | Tabl | e of Contents                                | i    |
|     | Pref | ace  | iv   |
|     | A P  | ersonal Note from the writer of this         |      |
|     | Diss | sertation                                    | vi   |
|     | List | of Tables                                    | vii  |
| 1.0 | Intr | roduction                                    | 1    |
|     | 1.1  | Background                                   | 1    |
|     | 1.2  | Objectives PERMANENT                         | 3    |
|     | 1.3  | Methodology REFERENCE NOT TO BE REMOVED FROM | 4    |
| 2.0 | Lite | rature Review   THE LIBRARY.                 | 6    |
|     | 2.1  | Introduction                                 | 6    |
|     | 2.2  | Management Systems and Safe                  |      |
|     |      | Construction                                 | 6    |
|     | 2.3  | Provisions made in the Laws and Bills        |      |
|     |      | passed by the Government of Sri Lanka,       |      |
|     |      | Factories Ordinance.                         | 10   |
|     | 2.4  | Provisions made in the Laws and Bills        |      |
|     |      | passed by the Government of Sri Lanka,       |      |
|     |      | Workmen's Compensation Ordinance.            | 12   |
|     | 2.5  | Provisions made in the Conditions of         |      |
|     |      | Contracts .                                  | 14   |
|     |      | ICTAD/FIDIC Conditions of Contracts          | 14   |
|     |      | ICE Conditions of Contracts                  | 15   |
|     | 2.6  | Insurance Stipulated in the "Conditions      |      |
|     |      | of Contract"                                 | 15   |
|     | 2.7  | Conclusions                                  | 18   |

| 3.0 | Development of the Investigation Programme | 20 |  |
|-----|--|----|--|
|     | 3.1 Formulation of the Questionnaire       | 20 |  |
|     | 3.2 Identification of the Target Group     | 22 |  |
|     | 3.3 Consultancy organizations              | 25 |  |
|     | 3.4 Interview and conversations            |    |  |
| 4.0 | Execution of the Survey and Field Data     |    |  |
|     | Collection                                 | 26 |  |
| 5.0 | Data Analysis                              | 31 |  |
|     | 5.1 Analysis of the Questionnaire Survey   | 31 |  |
|     | 5.1.1 Analysis of Safety and Health        |    |  |
|     | details                                    | 31 |  |
|     | 5.1.2 The Safety facilities provided at    |    |  |
|     | sites                                      | 40 |  |
|     | 5.1.3 Safety Management                    | 41 |  |
|     | 5.1.4 Safety Planning                      | 44 |  |
|     | 5.1.5 Statutary requirements               | 45 |  |
|     | 5.1.6 Accidents due to Construction        |    |  |
|     | methods                                    | 48 |  |
|     | 5.1.7 Safety affected by site layouts      | 49 |  |
|     | 5.1.8 Problems associated in improving     |    |  |
|     | safety                                     | 50 |  |
|     | 5.1.9 Construction organisations who want  |    |  |
|     | help from outside organisations and        |    |  |
|     | their suggestions                          | 51 |  |
|     | 5.2 Analysis of Specific Accident Data     | 53 |  |
|     | 5.3 Statistics of accidents pertaining to  | •  |  |
|     | construction sites .                       | 56 |  |
|     | 5.4 Analysis of the provisions made in the |    |  |
|     | laws and bills passed by the Government    |    |  |
|     | of Sri Lanka and the Conditions of         |    |  |
|     | Contracts                                  | 60 |  |
|     | 5.4.1 Analysis of the provisions made in   |    |  |
|     | the Festamica Ondinance                    | 60 |  |

|     | 5.4.2 Ana                       | lysis of the provisions made in  |     |
|-----|---------------------------------|----------------------------------|-----|
|     | the                             | Workmen's Compensation Ordinance | 61  |
|     | 5.4.3 Ana                       | lysis of the provisions made in  | •   |
|     | the                             | Conditions of Contracts          | 64  |
| 6.0 | Conclusions and Recommendations |                                  |     |
|     | 6.1 General Conclusions         |                                  |     |
|     | 6.2 Conclusi                    | ons by Objectives                | 72  |
|     | 6.3 Recommen                    | dations                          | 78  |
|     | References                      |                                  |     |
|     | Bibliography                    |                                  | 84  |
|     | Appendix-1                      | Questionnaire                    | 86  |
|     | Appendix-2                      | Data Collection on accidents at  |     |
|     |                                 | Construction Sites               | 93  |
|     | Appendix-3                      | ICTAD Conditions of Contracts    |     |
|     |                                 | Clauses related to Safety        | 95  |
|     | Appendix-4                      | FIDIC Conditions of Contracts    |     |
|     |                                 | Clauses related to Safety        | 104 |
|     | Appendix-5                      | ICE Conditions of Contracts      |     |
|     |                                 | Clauses related to Safety        | 113 |

#### **PREFACE**

This Dissertation is an attempt by me within my capabilities and the available resources to probe into the ways and means of improving the Safety, Health and Welfare aspects in the Construction Industry in Sri Lanka and to give some recommendations to the Construction Industrialists towards achieving the desired results in the endevour.

I have collected valuable information for writing this Dissertation from the Construction Organisations in Sri Lanka and from the sources in the libraries at the University of Moratuwa, at the British Council, at the Institution of Engineers Sri Lanka, and at the Road Development Authority at Sethsiripaya, Battaramulla.

In having made this Dissertation a reality I owe my sincere gratitude

- \* to the learned lecturer Dr. A. K. W. Jayawardane, BScEng(Hons), MSc Construction (Loughborough), PhD Construction Management (Loughborough), CEng, MIE(SL), Senior Lecturer in the Faculty of Engineering of the University of Moratuwa, Sri Lanka for his guidance and valuable suggestions while I was engaged in collecting field data in the Construction Industry and in writing this Dissertation.
- \* to the Chairman and the General Manager of the Road Development Authority for having granted me permission to follow this Post-graduate course in Construction Management.

- \* to the Deputy Director (Construction Management) and the Deputy Director (Bridge Designs) of the Road Development Authority for having sanctioned my leave for following the lectures and to conduct the field survey for this Dissertation through a questionnaire in the Construction Industry.
- \* to the Deputy Commissioner of Labour (Safety and Health) for his valuable information regarding the Safety and Health and the Factories Ordinance.
- \* to the Construction Industrialists and to my colleages who have helped me in various ways in carrying out relevant field survey for my Dissertation in Construction Organisations in Colombo.

Further, I sincerely thank the Dean of the Faculty of Engineering, the Head of the Department of Civil Engineering and all the other lecturers of the Post-graduate Diploma/Master of Engineering course in Construction Management in the Faculty of Engineering, University of Moratuwa (Sri Lanka) for having caused an impact in my attitude towards the subject of Construction Management while I was engaged in my post graduate studies.

Sadadcharan. P. S.

#### A PERSONAL NOTE FROM THE WRITER OF THIS DISSERTATION

In the satisfaction of my having written this dissertation on the topic of my choice, further to those I had referred to in the preface, I wish to express my indebtness in a great way.

- \* to my beloved mother ( who entered glory at the feet of God) for having been a source of encouragement to me since my school days until I was reading for my Bachelors Degree in Civil Engineering at the University of Peradeniya, Sri Lanka.
- \* to my beloved father for having been instrumental in my taking up the Engineering profession and for having encouraged me to persue my Post Graduate studies in Construction Management in the University of Moratuwa, Sri Lanka.
- \* to my sibblings for having made conditions at home conducive for me to persue my studies at the Undergraduate and Post Graduate levels.

#### LIST OF TABLES

| TABLE | DESCRIPTION                             | PAGE |
|-------|---|------|
| 4.1   | Details of the Questionnaires given and |      |
|       | responded                               | 28   |
| 4.2   | Nature of business of the organizations | 28   |
| 4.3   | Area of work of the organizations       | 28   |
| 4.4   | Details of the "Accident Data           |      |
|       | Collection Forms" given and responded   | 29   |
| 4.5   | Nature of business of the organizations | 29   |
| 4.6   | Area of the work of the organizations   | 29   |
| 5.1   | Training or demonstration given by the  |      |
|       | organizatios                            | 33   |
| 5.2   | Safety precautions for demolition and   |      |
|       | site clearance works                    | 35   |
| 5.3   | Safety precautions for excavation and   |      |
|       | earth works                             | 35   |
| 5.4   | Safety precautions for scaffolding and  |      |
|       | means of access                         | 36   |
| 5.5   | Safety precautions for lifting          |      |
|       | appliances such as cranes, hoists etc.  | 37   |
| 5.6   | Safety precautions for compressed air   |      |
|       | tools                                   | 37   |
| 5.7   | Safety precautions for electrical       |      |
|       | equipment                               | 38   |
| 5.8   | Safety precautions for chemicals such   |      |
|       | as cement, asbestos, solvents etc.      | 39   |
| 5.9   | Safety precautions for noisy and        |      |
|       | vibratory works                         | 39   |
| 5.10  | Details of rest periods given to the    |      |
|       | workers                                 | 40   |
| 5.11  | Facilities provided by organizations at |      |
|       | construction sites                      | 41   |
| 5.12  | Other welfare facilities                | 41   |

| TABLE | DESCRIPTION                             | PAGE |
|-------|---|------|
| 5.13  | Organizations which are aware of Safety |      |
|       | & Health recommendation and have their  |      |
|       | own Safety policies                     | 42   |
| 5.14  | Detail of staff who know about the      |      |
|       | recommendations by the Government of    |      |
| •     | Sri Lanka                               | 43   |
| 5.15  | Organizations who keep accident records | 44   |
| 5.16  | Stage at which the contractors do       |      |
|       | overall planning including safety       | 45   |
| 5.17  | The importance given to safety by       |      |
|       | contractors                             | 45   |
| 5.18  | Awareness of Bills and Laws in Sri      |      |
|       | Lanka applicable to the construction    |      |
|       | industry                                | 46   |
| 5.19  | What the contractors do after an        |      |
|       | accident                                | 47   |
| 5.20  | Opinion of the contractors about the    |      |
|       | construction methods                    | 48   |
| 5.21  | Why the contractors deviate from the    |      |
|       | safest methods                          | 49   |
| 5.22  | The details which illustrate the        |      |
|       | specific accidents                      | 57   |
| 5.23  | Fatal accidents in the construction     |      |
|       | sites from 1982 to 1990                 | 58   |
| 5.24  | Non-fatal accidents in the construction |      |
|       | sites from 1983 to 1990                 | 59   |