

EVALUATION PERFORMANCE OF CONSTRUCTORS IN CONCRETE PRODUCING BASED ON COST AND QUALITY PARAMETERS



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

University of Moratuwa



94522

DEPARTMENT OF BUILDING ECONOMICS
Faculty of Architecture
UNIVERSITY OF MORATUWA.

MSc Dissertation

2010

**EVALUATION PERFORMANCE OF
CONSTRUCTORS IN CONCRETE PRODUCING
BASED ON COST AND QUALITY PARAMETERS**

LIBRARY
UNIVERSITY OF MORATUWA, SRI LANKA
MORATUWA

Ashan Lakmal Pathirane



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

Department of Building Economics
University of Moratuwa
Sri Lanka

69"10"
69.003(043)

Submitted in Partial Fulfillment of the Requirements of the
Degree of Master of Science
February 2010

94522

A Study Submitted In Partial Fulfillment of the Requirements of the Degree of Master of Science in Project Management

Declaration

I hereby declare that this submission is my own work and that, it contains no materials previously published or written by another person nor material which, to a substantial extent, has been accepted for the award of any other degree or diploma of a University or other institution of higher learning, except where an acknowledgement is made in the text.



University of Moratuwa, Sri Lanka.

Electronic Theses & Dissertations

UOM Verified Signature lib.mrt.ac.lk

Ashan Lakmal Pathirane
09th February 2010

I hereby acknowledge that Mr./Mrs./Miss A. L. Pathirana has followed the dissertation process set by the Department of Building Economics.

UOM Verified Signature

Dissertation Supervisor

09/02/2010
Date



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

Dedication

I dedicate this dissertation to my ever loving parents and teachers.



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

Acknowledgement

I make this as an opportunity to extend my sincere gratitude to all who directed and supported me to achieve this goal.

First, I would like to express my deep and sincere gratitude to my supervisor, Senior Lecturer Architect Lalith De Silva, the former Head and a Senior Architect, Department of Building Economics, University of Moratuwa (UOM). The guidance given by him throughout this research with his wide knowledge and remarkable experience advanced this research exceptionally towards required goals and objectives by also enhancing my knowledge and logical way of thinking.

I have pleasure in acknowledging the encouragement, support, given through various means by Prof. C. Wedikkara, Prof. R. Rameezdeen (Immediate Former Head) and Mr. I. Senevirathne (The Head) of the Department of Building Economics. I am greatly indebted to Dr. Sepani Senarathne, the MSc dissertation coordinator, who provided the framework to conduct a successful research. And also I express my gratitude to all other academic and non-academic staff members for the interest they have taken in encouraging me in completing this dissertation.

My gratitude extends to Prof. A. Jayasinghe (Department of Civil Engineering, UOM), Senior Engineer Mr. S. Athukorala (Ceylon Electricity Board), Engineer Mr. Supun Abeysinghe (Maeda Engineering Corporation) and Research Assistant Mrs. R. Dissanayake (Lanka Hydraulic Institute) and all other Engineers for giving me a better encouragement and support to carry out my field data survey.

Finally, I would like to extend my gratitude towards all of my friends and all who were not mentioned above, yet contribute to my success with absolute support

TABLE OF CONTENTS

Acknowledgement.....	i
Table of Contents.....	ii
List of Chapters.....	iii-v
List of Appendices.....	vi
List of Figures.....	vii
List of Tables.....	viii
List of Abbreviations.....	ix
Abstract.....	x-xi
Chapters.....	1-48
References.....	49-51
Appendices.....	52



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

List of Chapters

CHAPTER 01	1
Introduction	1
1.1 Background.....	1
1.2 Research Problem	3
1.3 Strategic Aim of the Study.....	5
1.4 Objectives	6
CHAPTER 02	7
Literature Review and Research Design	7
2.1 Introduction.....	7
2.2. Literature Background	8
2.2.1 Study (01) - Studies that assess the assurance of concrete quality produced in ready mix plants.....	8
2.2.2 Study (02) – Studies on Concrete Mixing Methods and Concrete Mixers.....	9
2.2.3 Study (03) - Studies that assess the productivity and firm performance of production	11
2.2.4 Study (04) – Theoretical studies on productivity of concrete production	12
2.2.5 Study (05) – Empirical studies on Productivity and Plant Selection of concrete production	12
2.3 Literature outcomes and conclusion	13
2.4 Research Design	14
CHAPTER 03	15
Cost, Time, Quality Parameters and Different Concrete Producing Methods	15
3.1 Cost, Time, Quality (CTQ) Parameters	15
3.1.1 Background.....	15
3.1.2 Cost related parameters.....	16
3.1.3 Time related parameters.....	16
3.1.4 Quality related parameters	17
3.1.5 Variation of CTQ Parameters Reviewed via Data Analysis.....	17
3.2 Different Concrete Producing Methods	18

3.2.1 Introduction.....	18
3.2.2 Manually handling & mixing method (LM).....	19
3.2.3 Manually handling while mixing in a rotary machine (LM).....	19
3.2.4 Completely machine based method (CM).....	20
3.2.5 Hardware: Concrete Mixers.....	20
3.2.6 Batch Mixers.....	21
Drum mixers.....	21
Pan mixers.....	24
3.2.7 Continuous Mixers.....	24
CHAPTER 04.....	25
Research Methodology.....	25
4.1 Background.....	25
4.2 Research Method.....	27
4.3 Program of Work and Data Collection.....	28
4.3.1 Schedule of work.....	28
4.3.2 Data collection.....	29
CHAPTER 05.....	30
Data Analysis.....	30
5.1 Statistical Analysis.....	30
5.1.1 Background.....	30
5.1.2 Statistical Results of the Analysis of CTQ Parameters.....	34
5.2 Mathematical (Regration) Analysis.....	34
5.3 Final Evaluation (Typical Model) and Results.....	36
5.3.1 Qualitative analysis.....	39
5.4 Discussion.....	43
CHAPTER 06.....	45
Conclusions and Recommendations.....	45
6.1 Conclusions.....	45
6.1.1 Generalization.....	46
6.2 Recommendations, Limitations and Further Researches.....	47

REFERENCES..... 49
APPENDICES.....52



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

List of Appendices

APPENDIX A	-	Schedule of work
APPENDIX B	-	Form for the Data Collection
APPENDIX C	-	Research Design (Flow Chart)
APPENDIX D	-	Variation of CTQ Parameters with respect to R
APPENDIX E	-	Descriptive Statistics at Different Confidence Levels
APPENDIX F	-	Four Individual Evaluations for each Bidder
APPENDIX G	-	Results out of General Evaluation
APPENDIX H	-	Results of Extra Evaluation



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



List of Figures

Figure 3.1 Cross section of drum mixer	23
Figure 3.2 Cross section of a non-tilting mixer	23
Figure 3.3 Cross section of a tilting mixer.....	24



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

List of Tables

Table 1.1 – Concrete producing methods and their general features.....	2
Table 1.2 – Parties, generally making C, T, Q losses & general reasons	5
Table 3.1 – CTQ Parameters used in evaluation	16
Table 4.1 – CTQ Parameters evaluation in detail	27
Table 5.1 – Descriptive Statistics calculated using sample data of cube strength.....	33
Table 5.2 - Limitations of Relationships and Reasons for Limitations	35
Table 5.3(a) Calculated S, W, W_s and U values among 81 Bidders	37
Table 5.3(b) Calculated S, W, W_s and U values among 81 Bidders.....	38
Table 5.4(a) Criteria of giving Marks for S, W, W_s and U for 81 Bidders out of 1.0.....	39
Table 5.4(b) Criteria of giving Marks for S, W, W_s and U for 81 Bidders.....	40
Table 5.5(a): The Total Marks obtained by each Bidder.....	41
Table 5.5(b): The Total Marks obtained by each Bidder.....	42
Table 5.6: Different Weighting Components for Further Evaluation.....	44
Table 6.1: The Best Ranges of “R” According to Quality and Costs Objectives.....	46



List of Abbreviations

- C – Cost
- T – Time
- Q – Quality
- CTQO - cost, time, and quality objectives
- TOR – Terms of Reference
- ITB - Instruction to Bidders
- CM - Completely machine based/ producing in a batching plant
- HM - Handling manually while mixing in a rotary machine
- LM - Both handling and mixing manually by labors
- CP - concrete production
- U - Unit production cost
- W_s - Wastage
- R - Rate of production
- S - Concrete strength (Cubic Strength)
- W - consistency/ workability (Slump)
- BS - British Standard
- SRS - simple random sample
- X – Sample Mean
- S^2 - Variance
- S - Standard Deviation
- CI - Confidential Intervals
- CL – Confident Level
- UL – Upper Limit
- LL – Lower Limit
- CTQ - cost, time, and quality
- UOM – University of Moratuwa
- WT – Weighting factors for S, W, U and W_s