

**POTENTIAL OF IMPLEMENTING  
“WINDOW DELAY ANALYSIS”  
FOR ROAD PROJECTS IN SRI LANKA  
– CLAIMS CONSULTANTS’ PERSPECTIVES**

Gishan Sanjeewa Maddumasooriya

(149116U)

Master of Science in Construction Law and Dispute Resolution

Department of Building Economics

University of Moratuwa

Sri Lanka

February 2018

**POTENTIAL OF IMPLEMENTING  
“WINDOW DELAY ANALYSIS”  
FOR ROAD PROJECTS IN SRI LANKA  
– CLAIMS CONSULTANTS’ PERSPECTIVES**

Gishan Sanjeewa Maddumasooriya

(149116U)

Dissertation submitted in partial fulfilment of the requirements for the  
degree Master of Science in Construction Law and Dispute Resolution

Department of Building Economics

University of Moratuwa

Sri Lanka

February 2018

## DECLARATION

I declare that this is my own work and this 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 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.

.....

.....

Gishan Sanjeewa Maddumasooriya

Date

I hereby acknowledge that Gishan Sanjeewa Maddumasooriya has followed the dissertation process set by the Department of Building Economics.

.....

.....

Mr. Vijitha Disaratna

Date

Dissertation Supervisor

## DEDICATION

*“This dissertation is dedicated to my beloved  
mother & father for their unconditional love”*

## ACKNOWLEDGEMENT

This research study would not be successful without the kind assistance of numerous individuals and organizations. Hence, I take this opportunity to convey my gratitude to every one of them.

First and foremost, I am grateful to my supervisor, Senior lecturer, Mr. Vijitha Disaratna for all the guidance and assistance extended towards me. I am also indebted to him for his constructive criticism and most importantly for his extraordinary patience.

I would like to express my sincere thanks to the Head of the Department of Building Economics and Course Director, Dr. Yasangika Sandanayake, and other Lecturers for their immense assistance and advice during the course of two years of my studies.

Special thanks go to the industry practitioners who gave me an immense support to complete this research successfully by giving access and contacts to their experience, knowledge and records amid their busy schedules.

Last but not least, I express my heartfelt gratitude to my family members and my batch mates for giving me their utmost support, and motivating me to complete this job successfully.

Gishan Sanjeewa Maddumasooriya

February 2018

### **“Potential of Implementing ‘Window Delay Analysis’ for Road Projects in Sri Lanka – Claims Consultants’ Perspectives”**

An increased number of disputes with regard to the additional times and payments in respect of the construction delay claims, are presently experienced by the road construction industry of Sri Lanka.

The additional payment and time entitled to a claimant in respect of a delay, is generally computed utilizing an appropriate Delay Analysis Technique (DAT), the application and the outcome of which may vary from one another.

Previous researchers have identified that the DAT namely “Window Delay Analysis Technique (WDAT)” was the most appropriate DAT that can be used for road construction projects in Sri Lanka, which was also the minimally used DAT out of several methods practiced in the country.

Thus, the identification of the potential of implementing such highly recommended WDAT for road construction projects in Sri Lanka was of paramount importance, which was set as the aim of this study, which will also be towards the improvement of the practice of construction delay analysis in the country.

In the view of above, the areas such as “benefits of WDAT”, “constraining factors for the implementation of WDAT”, and “studying the contemporary practice of delay analysis and willingness of the practitioners to undertake WDAT”, were explored as research objectives.

A preliminary study carried out revealed that the awareness of construction community of the DATs was very low, which led the researcher to reach the Claims Consultants in Sri Lanka, who were supposed to be the most suitable resource persons on this subject area.

Accordingly, this research problem was approached through the interviewing of four selected leading construction claims consultants in Sri Lanka, and by reviewing their eight sets of delay analysis documentations.

WDAT was identified to be a versatile and practical approach of applying the delay analysis, rather than a primary method of delay analysis, which can be effectively applied in cases of complicated delay situations to resolve them successfully.

The findings of this research revealed that the non-existence of a direct contractual requirement for its implementation, inherent limitations of applicability of the method, specific and compromised requirements of the claimants, the limited resources (budgets) of the claimant, the unawareness and the inexperience of the analysts, additional effort required on the part of the analyst, absence of prior preparedness and awareness, indirect discouragement of the analyst, and reluctance of the analyst to do his best, were the factors constraining the implementation of WDAT in Sri Lanka.

The researcher ultimately realized that there is a potential for WDAT to be developed more as a separate area of expertise, which could co-exist as a support service to the general “construction claims consultancy services”.

**Key words:** *Construction Delay Analysis, Delay Analysis Techniques, Window Delay Analysis, Road Construction Projects, Sri Lanka.*

# TABLE OF CONTENTS

<b>Declaration</b> .....	i
<b>Dedication</b> .....	ii
<b>Acknowledgement</b> .....	iii
<b>Abstract</b> .....	iv
<b>Table of Contents</b> .....	v
<b>List of Figures</b> .....	viii
<b>List of Tables</b> .....	ix
<b>List of Abbreviations</b> .....	xi
<b>Chapter 01 - Introduction to the Research</b> .....	<b>1</b>
1.1 Background Study.....	1
1.2 Problem Statement .....	2
1.3 Aim and Objectives.....	3
1.4 Scope and Limitations.....	3
1.5 Introduction to Research Methodology .....	4
1.6 Structure of Dissertation .....	4
<b>Chapter 02 - Literature Review</b> .....	<b>6</b>
2.1 Introduction.....	6
2.2 Construction Delays .....	6
2.2.1 What are Delays and Disruptions .....	6
2.2.2 Types of Construction Delays.....	7
2.2.3 Identifying Delays.....	10
2.2.4 Recording of Delays .....	11
2.3 Analysis of Delays .....	12
2.3.1 The Requirement of Project Scheduling .....	12
2.3.2 The Requirement of Delay Analysis.....	12
2.3.3 The Use of CPM Techniques .....	13

2.3.4 Construction Delay Analysis Guidance Available and Comparison	14
2.3.5 Delay Analysis Techniques (DATs) Available.....	15
2.4 Comparison of Commonly Used DATs.....	17
2.4.1 Level of Awareness of the Approaches .....	17
2.4.2 Extent of Use.....	18
2.4.3 Essentially Required Inputs .....	20
2.4.4 Strengths and Weaknesses .....	21
2.4.5 Capabilities of Commonly Used DATs .....	24
2.4.6 Comparison of the outputs of DATs applied on a selected case.....	25
2.4.7 Selection of the Most Appropriate DAT for a Particular Case .....	25
2.5 Is Windows Delay Analysis Technique a Primary Method?.....	26
2.6 Specialities of WDAT.....	27
2.7 Basic Steps in Implementing a WDAT.....	30
2.8 The Legal Acceptance of the DATs Globally.....	35
2.9 Road Construction Industry of Sri Lanka .....	37
2.9.1 Delays in Road Construction Projects of Sri Lanka .....	38
2.9.2 Factors affecting time overruns in Sri Lankan Road Projects .....	39
2.9.3 Factors affecting cost overrun in Sri Lankan Roads Projects .....	40
2.9.4 Importance of the Mitigation of Delays.....	40
2.9.5 Contractors' Delay Claims and Reasons for failures in Sri Lanka ..	41
2.10 The Practice of DATs in Sri Lanka.....	42
2.10.1 DATs Used in Sri Lanka.....	42
2.10.2 The Framework to select the most suitable Delay Analysis for a given case.....	42
2.11 Summary.....	45
<b>Chapter 03 - Research Methodology .....</b>	<b>46</b>
3.1 Introduction.....	46
3.2 Research Design.....	46
3.3 Research Approach .....	46

3.4 Research Techniques .....	47
3.4.1 Data Collection Methods .....	47
3.4.1.1 Semi-Structured Interviews .....	48
3.4.1.2 Documentation Reviews .....	48
3.4.1.3 Sampling .....	49
3.4.2 Data Analysis Techniques.....	52
3.5 Validation of Research findings by Experts .....	55
3.6 Research Process Flowchart .....	55
3.7 Summary .....	57

**Chapter 04 - Research Findings and Data Analysis ..... 58**

4.1 Introduction.....	58
4.2 Responses and Analysis of Expert Interviews .....	58
4.2.1 Responses for Question – 1 and Analysis.....	58
4.2.2 Responses for Question – 2 & 3 and Analysis.....	61
4.3 Delay Analysis Documentation Reviews and the Findings .....	67
4.3.1 Analysis of the Data from the Documents of Expert – A .....	67
4.3.2 Analysis of the Data from the Documents of Expert – B .....	68
4.3.3 Analysis of the Data from the Documents of Expert – C .....	69
4.3.4 Analysis of the Data from the Documents of Expert – D .....	70
4.3.5 Summary of the Document Review and Conclusions .....	71
4.4 Validation of the Outcomes of the Research by the Experts .....	73
4.5 Summary .....	74

**Chapter 05 - Conclusions and Recommendations ..... 75**

5.1 Introduction.....	75
5.2 Summary of the Research Study.....	75

5.3 Conclusions.....	76
5.4 Recommendations.....	78
5.5 Limitations of the Study.....	79
5.6 Directions for Further Research.....	79
<b>Reference List.....</b>	<b>80</b>
<b>Appendix.....</b>	<b>85</b>

## LIST OF FIGURES

	<b>Page</b>
Figure 2.1      Categorization of Delays	08
Figure 2.2      Entitlements of the Contractor against Delays	09
Figure 2.3      Capabilities of Commonly Utilized DATs	24
Figure 2.4      Frequency of Occurrence of DATs in Case Laws – All Global Jurisdictions	35
Figure 2.5      Frequency of Acceptance of DATs in Case Laws - All Global Jurisdictions	36
Figure 3.1      Research Process	56

## LIST OF TABLES

		<b>Page</b>
Table 2.1	Categories of Source Data for Delay Analysis	11
Table 2.2	Reasons for the failures in Contractor's Claims	13
Table 2.3	Delay Analysis Techniques Available	16
Table 2.4	Contractors' and Consultants' awareness of various DATs in UK Construction Industry	17
Table 2.5	Extent of Use of various DATs in UK Construction Industry	18
Table 2.6	Extent of Use of various DATs in Malaysian Construction Industry	19
Table 2.7	Inputs Required for the Implementation of Various DATs	20
Table 2.8	Strengths and Weaknesses of Impacted As-Planned Technique	21
Table 2.9	Strengths and Weaknesses of Time Impact Analysis	21
Table 2.10	Strengths and Weaknesses of the Collapsed As-Built Technique	22
Table 2.11	Strengths and weaknesses of the As-Planned Versus As-Built Technique	22
Table 2.12	Strengths and Weaknesses of Window Delay Analysis Technique	23
Table 2.13	Values of National Works done – Construction Industries – Year 2015	37
Table 2.14	Values of National Works done – Construction of Roads – Year 2015	38
Table 2.15	Factors Governing the Selection of a DAT	43
Table 2.16	Suitability of DATs	44
Table 3.1	Details of the Road Construction Projects Analysed	51
Table 3.2	Qualitative Data Analysis Techniques	52

Table 3.2	Brief of the Research Methodology	57
Table 4.1	Responses and Analysis of Question – 1	59
Table 4.2	Responses and Analysis of Question – 2	61
Table 4.3	Responses and Analysis of Question – 3	63
Table 4.4	Results of the Document Review of Expert - A	67
Table 4.5	Results of the Document Review of Expert - B	68
Table 4.6	Results of the Document Review of Expert - C	69
Table 4.7	Results of the Document Review of Expert - D	70
Table 4.8	Summary - The Case of Prospective Analysis of Delays	72
Table 4.9	Summary - The case of Retrospective Analysis of Delays	73

## LIST OF ABBRIVIATIONS

<b>Abbreviation</b>	<b>Description</b>
AACE	Association for the Advancement of Cost Engineering International
AACE RP	Association for the Advancement of Cost Engineering International Recommended Practice
ABCP	As Built Critical Path
ABCPA	As Built Critical Path Analysis
AHP	Analytic Hierarchy Process
APVAB	As Planned Vs As Built
ASCE	American Society of Civil Engineers
ASCII	American Standard Code for Information Interchange
CAB	Collapsed As Built
CPM	Critical Path Method
CSV	Comma Separated Values
CRE	Contractor's Risk Event
DA	Delay Analysis
DAT	Delay Analysis Technique
EOT	Extension of Time
ERE	Employer's Risk Event
IAP	Impacted As Planned
NE	Neutral Event
PDAT	Primary Delay Analysis Technique
RDA	Road Development Authority
SCLP	Delay & Disruption Protocol by Society of Construction Law
TIA	Time Impact Analysis
WDA	Windows Delay Analysis
WDAT	Windows Delay Analysis Technique