CUMULATIVE IMPACT AND OTHER DISRUPTION CLAIMS IN CONSTRUCTION

RICHARD J. LONG, P.E.
ROD C. CARTER, CCP, PSP
HAROLD E. BUDDEMEYER

Order Your Copy of this Book Online Today at
www.virtualbookworm.com

http://www.virtualbookworm.com/bookstore/product/cumulative_imp_and_other_disrupt_claims_construct.html
TO ORDER BOOKS: CLICK ON THE LINK ABOVE

BOOK PRICE: $95.00 USD
Plus Shipping & Handling
Cumulative Impact and Other Disruption Claims in Construction

Richard J. Long, P.E.
Rod C. Carter, CCP, PSP
Harold E. Buddemeyer
## Table of Contents

Preface ........................................................................................................................................ ix
About The Authors .................................................................................................................. xiii
Acknowledgements ................................................................................................................ xvii

Chapter 1
Disruption and Cumulative Impact Defined ................................................................. 3
  1.1 Disruption .................................................................................................................. 3
      1.1.1 Disruption as Compared to Delay ................................................................. 4
      1.1.2 The Components of Disruption .................................................................. 5
  1.2 Cumulative Impact Defined .................................................................................. 6
  1.3 Direct Disruption vs. Cumulative Impact, Foreseeability, and Hidden Costs ................................................................................................................. 10

Chapter 2
Legal Considerations ........................................................................................................... 15
  2.1 Acknowledgement of Cumulative Impact ............................................................ 16
  2.2 Disruption and Cumulative Impact Claim Challenges ...................................... 17
      2.2.1 Demonstration of Causation ...................................................................... 18
      2.2.2 Reservation of Rights to Make a Claim ...................................................... 23
      2.2.3 Use of Proper Damages Methods .............................................................. 29
      2.2.4 Preservation of Good Records .................................................................. 33
      2.2.5 Overcome the Claim Premise Being Barred by Law or Contract ............. 35
  2.3 Arguments Against the Theory of Cumulative Impact .......................................... 35
  2.4 Successful Claim Recovery .................................................................................... 36
# Table of Contents

(continued)

## Chapter 3

Methods for Estimating Loss of Productivity Man-Hours for Disruption and Cumulative Impact Claims ............... 41

3.1 Causes of Productivity Loss .................................................................................................................. 42

3.2 Contractor-Caused Problems that Contribute to Growth in Quantities, Man-Hours, and Costs ......................................................................................................................... 45

3.3 Industry Recommended Practices for Calculating Productivity Loss ............................................................................................................................... 47

3.4 Methods for Estimating Productivity Loss .............................................................................................. 50

3.4.1 Estimating Loss of Productivity Man-Hours Related to Direct Disruption and Cumulative Impact .......................................................................................................................... 51

3.4.1.1 Measured Mile Analysis ................................................................................................................. 51

3.4.1.2 Earned Value Analysis .............................................................................................................. 60

3.4.1.3 Industry Studies on the Impact of Changes (Formulaic Approaches) ....................................... 62

3.4.1.3.1 1988 Leonard Study .............................................................................................................. 63

3.4.1.3.2 1990 CII Study ....................................................................................................................... 70

3.4.1.3.3 1995 CII Study ....................................................................................................................... 71

3.4.1.3.4 2001 CII Study ....................................................................................................................... 78

3.4.1.3.5 2005 Ibbs Study ....................................................................................................................... 81

3.4.1.3.6 Court’s General View of Formulaic Approaches ..................................................................... 87

3.4.1.3.7 Further Uncertainties in using Formulaic Approaches ............................................................ 88

3.4.1.4 The Use of Factors .......................................................................................................................... 90

3.4.1.4.1 MCAA Factors .................................................................................................................... 90

3.4.1.4.1.1 General Considerations .................................................................................................... 90

3.4.1.4.1.2 Method ............................................................................................................................ 92

3.4.1.4.1.3 Criticisms and Court Decisions ....................................................................................... 97

3.4.1.4.1.4 Estimating Cumulative Impact ....................................................................................... 98

Cumulative Impact and Other Disruption Claims in Construction
# Table of Contents

(continued)

3.4.1.4.5  Impacting the Project Schedule Using
the MCAA Factors .......................................................... 99

3.4.1.4.2  NAVSEA Guidelines .............................................. 99

3.4.1.5  System Dynamics Modeling ............................................. 101

3.4.2  Industry Studies Associated with Overtime and
Overcrowding/Congestion ...................................................... 102

3.4.2.1  Estimating Loss of Productivity Man-hours Related
to Working Overtime ................................................................. 103

3.4.2.1.1  U.S. Department of Labor Bulletin No. 917 .............. 103

3.4.2.1.2  Models Published by the Business Roundtable .......... 104

3.4.2.1.3  NECA Overtime Study ............................................. 105

3.4.2.1.4  1988 CII Study ............................................................. 106

3.4.2.1.5  1994 CII Study ............................................................. 108

3.4.2.1.6  U.S. Army Corps of Engineers Study ....................... 109

3.4.2.2  Estimating Loss of Productivity Man-hours Related
to Overcrowding/Congestion .................................................. 111

3.4.2.2.1  Studies Based on Worker Density .............................. 111

3.4.2.2.2  Studies Comparing Planned and/or Actual
Manpower .................................................................................. 113

## Chapter 4

### Example Calculations for Estimating Productivity Loss .......... 121

4.1  Example Calculations from Industry Studies ......................... 121

4.1.1  1998 Leonard Study .............................................................. 122

4.1.2  1995 CII Study ................................................................. 123

4.1.3  2001 CII Study ................................................................. 124

4.1.4  MCAA Factors ................................................................. 125

4.1.5  2005 Ibbs Study .............................................................. 126

4.2  Comparison of Results .......................................................... 127
Chapter 5
Choosing a Quantum/Damages Method ........................................ 131

5.1 Preliminary Analyses .................................................................. 133

5.2 Methods of Damages Calculations........................................... 135

5.2.1 Total Cost Method................................................................. 135
5.2.1.1 Elements of Proof .......................................................... 137
5.2.1.2 Theoretical Bases .......................................................... 139
5.2.1.3 Prerequisites ................................................................. 140
5.2.1.4 Owner’s Failure to Provide Alternate Method..................... 141
5.2.1.5 The Total Cost Cumulative Impact Claim ......................... 142

5.2.2 Modified Total Cost Method .................................................. 143

5.2.3 Jury Verdict Method ............................................................... 149

5.2.3.1 When Can the Jury Verdict Method be Used? ...................... 151

5.2.3.1.1 Proof of Injury ......................................................... 151
5.2.3.1.2 No Other Reliable Method of Calculating Damages ............. 152
5.2.3.1.3 Adequate Evidence .................................................. 152

5.2.3.2 Procedure ........................................................................ 152
5.2.3.3 Reasonableness Requirement ........................................... 153
5.2.3.4 Unpredictable Nature ..................................................... 154

5.2.4 Quantum Meruit ................................................................. 154

5.2.5 “A”/“B” Estimates ................................................................. 156

5.2.6 Delta Estimate Method ........................................................... 158

5.2.7 Discrete Damages/Cost Variance Analysis Method ............... 159

5.2.7.1 Nine Step Process .......................................................... 161
5.2.7.2 Development of Cost Analysis Databases ......................... 164

5.2.7.2.1 Control Budget Calculations ...................................... 166
5.2.7.2.2 Actual Cost Calculations .......................................... 168
## Table of Contents (continued)

5.2.7.2.3 Cost Variance Calculations ........................................... 170  
5.2.7.2.4 Allocation of Cost Variances ........................................ 172  
5.2.8 Comparison of Methods.......................................................... 173  

### Chapter 6  
**Supporting a Cumulative Impact or Disruption Claim during the Project** ............................................................... 177  
6.1 Foreseeability and Reasonable Quantification of Direct Disruption and Cumulative Impact Costs during the Project........ 178  
6.2 Owner-Directed Change Example ................................................. 179  
6.3 Options for Contemporaneously Estimating Cumulative Impact .....181  
6.4 Documents that a Contractor Should Maintain ............................... 183  
6.5 Documenting Changes and Impacts.............................................. 184  
6.6 Tracking Productivity ................................................................. 185  
6.7 Notice .................................................................................... 186  

### Chapter 7  
**Proving the Cause-Effect Linkage** ............................................ 191  
7.1 Schedule Analyses ...................................................................... 192  
7.2 Tracking Impacts by Activity or Crew ......................................... 193  
7.3 Site Environment Changes ............................................................. 194  
7.4 Tell the Factual Story with Graphics ............................................ 196  
7.5 The Cause-Effect Matrix.............................................................. 199  

### Appendix A  
**Court/Board Decisions Awarding the Contractor Impact Costs** ................................................................................ 203
Table of Contents
(continued)

Appendix B
Court/Board Decisions Rejecting the Contractor’s
Impact Claims .................................................................209

Appendix C
Engineering and Construction Project Documentation ......217

Index .................................................................................221

Case Citations ......................................................................227

List of Tables

Table 3-1: Above-Ground Piping Data .................................................................54
Table 3-2: Planned and Actual Productivity – Above-Ground Piping .......................56
Table 3-3: “Should Have Been” Costs – Above-Ground Piping Labor .........................58
Table 3-4: Claim using Earned Value Analysis for Above-Ground Piping Labor ..................61
Table 3-5: Example of Forward Pricing Productivity Loss Estimations .........................93
Table 3-6: Example of Retroactive Productivity Loss Estimations ..............................96
Table 3-7: Labor Overtime Productivity Data – 1994 CII Study .................................109
Table 4-1: Man-Hour Data – Mechanical Project .....................................................121
Table 4-2: Results from Industry Studies .................................................................127
Table 5-1: Man-Hour/Cost Variances – Total Project .................................................133
Table of Contents
(continued)

List of Figures

Figure 3-1: Cumulative Linear Feet Installed per Week – Above-Ground Piping.........................................................55
Figure 3-2: Leonard Study – Effects of Change Orders on Productivity Electrical/Mechanical Work ..........................................65
Figure 3-3: Leonard Study – Effects of Change Orders on Productivity Civil/Architectural Work ...........................................66
Figure 3-4: Engineering Change vs. Engineering Productivity 1995 CII Study – SD 108..............................................................73
Figure 3-5: Construction Change vs. Construction Productivity ......................................................................................74
Figure 3-6: Comparison of Ibbs’ 1995 and 2005 Productivity Loss Data ..............................................................................82
Figure 3-7: Ibbs’ Productivity Loss Data as a Function of the Timing of Changes. ..............................................................86
Figure 3-8: U.S. Department of Labor Overtime Productivity Data ..................................................................................104
Figure 3-9: Effect of Overtime on Productivity – 50 and 60 Hour Workweeks – Business Roundtable Study ..........................105
Figure 3-10: Productivity Loss Curves 1969 NECA Study ..............................................................................................106
Figure 3-11: Productivity Loss Data – 1988 CII Study Large Bore Pipe Crews – 4/9s & 1/8 .......................................................107
Figure 3-12: Productivity Loss Data – 1988 CII Study Small Bore Pipe Crews – 4/9s & 1/8 .......................................................108
Figure 3-13: Productivity Loss Data – 1979 U.S. Corps of Engineers ..............................................................................110
Figure 3-14: Lost Efficiency Based on Worker Density ...............................................................................................111
Figure 3-15: Lost Efficiency Due to Trade Stacking (Hanna) .....................................................................................113
Figure 3-16: Effect of Crowding on Labor Efficiency ...............................................................................................114
Figure 3-17: Comparison of Overmanning Curves for a Base Work Force of 600 Craftsmen ..................................................115
Figure 3-18: Lost Efficiency Due to Overmanning (Hanna) .....................................................................................117
Figure 5-1: Total Cost Method .................................................................................................................................136
### Table of Contents

(continued)

| Figure 5-2: | Modified Total Cost Method | 144 |
| Figure 5-3: | Jury Verdict Method | 153 |
| Figure 5-4: | “A”/“B” Estimate Method | 157 |
| Figure 5-5: | Delta Estimates Method | 158 |
| Figure 5-6: | Discrete Damages/Cost Variance Analysis Method | 160 |
| Figure 5-7: | Typical Cost Account Structure | 162 |
| Figure 5-8: | Cost/Damages Analysis Matrix | 165 |
| Figure 5-9: | Control Budget Revisions with Time | 167 |
| Figure 5-10: | Sample Evolution of Control Budget | 167 |
| Figure 5-11: | Allocation of Cost Variances | 173 |
| Figure 5-12: | Comparison of Damage Analysis Methods | 174 |
| Figure 7-1: | Bar Chart Schedule and Manpower Comparisons | 195 |
| Figure 7-2: | Example of Tracking Impacts by Activity | 197 |
| Figure 7-3: | Multiple Impacts to Project | 198 |
| Figure 7-4: | Simple Cause-Effect Matrices | 199 |
| Figure 7-5: | Typical Cause-Effect Matrix for a Delay/Disruption Construction Claim | 200 |
Preface

Construction contracts usually contain a “Changes” clause by which the owner can bilaterally or unilaterally request changes to the scope of work that is to be performed by the contractor, and these requests are typically converted into change orders. However, the owner’s actions or inactions can also result in constructive changes to the contract. Change orders to adjust the contract price and time for completion result from a wide range of owner responsible events, including but not limited to, owner-directed increases or decreases in the scope of work to be performed by the contractor, owner-directed changes in the means and methods of the contractor’s performance or the materials or equipment to be installed, owner-directed changes in the contractor’s planned sequence in which the work is to be performed, design changes, changes in the performance specifications, differing site conditions, constructability issues, late responses to the contractor’s properly prepared submittals and requests for information, delays in the delivery of owner-supplied materials and equipment, failure to secure permits in a timely manner, owner interference with the contractor’s work, owner delays resulting in changes in the weather season during which the work is to be performed, changes due to actions or inactions of other trades working on the project for which the owner is responsible, and “constructive changes.”

A directed change order or a constructive change typically entitles the contractor to a time extension if the changed work is on the then critical path, and to additional compensation not only for all direct costs, time-related costs, and costs for direct disruption that are caused by the change, but also indirect disruption costs for the unforeseen impact of the change on unchanged work.

The disruptive effect of a change is a function of the size (man-hours and cost) of the change, the nature or scope of the change, the number of changes (although the number of changes may not be a sufficient determining factor in an assessment of cumulative impact), and the impact of the change on the other work. Also critical to the magnitude of the disruptive impact of a change is the time within the engineering and construction cycle when the change is issued. The further into the construction phase of the project, the greater the disruptive impact. If the changes are significant in scope and require significant additional man-hours to perform the changed and/or impacted work, direct and indirect disruption may occur.

The cost of direct disruption that is known and foreseeable should be included in the contractor’s change order requests as they are submitted to the owner for approval. The indirect disruption is often unforeseeable and referred to as the cumulative impact of changes. If requests for additional compensation for these indirect disruption costs are not included as part of the change order process because they are not foreseeable, cumulative impact claims may be submitted by the contractor, usually
near or shortly after the completion of the project. These cumulative impact claims most often seek recovery of the contractor’s additional expenditure of resources, typically labor costs.

By any measure, it is difficult for a contractor to recover claimed costs that allegedly result from the cumulative impact of changes, either during the project, through a request for equitable adjustment and claim negotiations, or through arbitration/litigation. The construction industry, courts, and arbitration panels in the United States generally agree that the theory of cumulative impact is reasonable, and that multiple change orders and other types of delays and disruption can negatively impact the contractor’s performance of unchanged work such that a contractor expends additional time, man-hours, and costs in completing its “unchanged” base scope of work. Yet, as will be discussed, the standard of proof set by the courts in proving these cumulative impact claims is burdensome, and their decisions are somewhat subjective. Further, the construction industry has no definitive standard to calculate loss of productivity claims that allegedly result from the cumulative impact of changes. Finally, the concept of cumulative impact claims has not always been accepted in dispute resolution venues outside of the United States.

Cumulative impacts remain largely an ill-defined concept. A more thorough understanding of cumulative impacts as defined by the construction industry and courts and boards will aid the contractor in preparing its damages and proving causation. The information herein provides a blueprint for the contractor seeking to recover costs that result from disruption and the cumulative impact of changes. Conversely, information is also provided that can be used by the owner to identify weaknesses in the contractor’s claim submittal, and to better defend against such a claim.

The term “contractor” is used throughout this book to indicate the party claiming damages for disruption and cumulative impact. Subcontractors may also be claimants. The term “owner” is used throughout this paper to indicate the party defending against a disruption and cumulative impact claim. Engineering and construction firms, prime contractors, or construction managers may also be defendants against disruption and cumulative impact claims that are submitted by subcontractors.

Chapter 1 discusses disruption and cumulative impact as defined by the construction industry, as well as by courts and boards. Legal considerations affecting disruption and cumulative impact claims, and the challenges that contractors may encounter to sustain a cumulative impact claim, are discussed in Chapter 2. Methods for estimating loss of productivity man-hours for disruption and cumulative impact claims are presented in Chapter 3, including references to commonly referenced industry studies. Chapter 4 presents examples of productivity loss and cumulative impact calculations using various industry studies and methods. A discussion of quantum/damages quantification methods associated with construction claims is presented in Chapter 5,
and these quantum/damages calculation methods are discussed in the context of preparing cumulative impact and other disruption claims. Chapter 6 provides information for preparing a cumulative impact or disruption claim during the project. Finally, a discussion of cause-effect analysis is provided in Chapter 7.

Appendix A includes 18 cases in which a court or board awarded a contractor monies pursuant to its disruption claims. In six of these cases, the theory and legal precedent associated with cumulative impact was specifically discussed. Appendix B includes 31 cases in which a court or board denied a contractor’s disruption claims, along with a brief description of the reasons for rejecting the claim. In 24 of these cases, the theory and/or legal precedent associated with cumulative impact was specifically discussed. Appendix C provides a list of documentation that is typically preserved on an engineering and construction project.

This book contains information from numerous published sources, and in many cases, the claims made by the various writers of those publications are restated herein. Therefore, the views and conclusions in this book are not necessarily those of the authors.

Richard J. Long, P.E.
Rod C. Carter, CCP, PSP
Harold E. Buddemeyer
About The Authors

Richard J. Long, P.E., is Founder and CEO of Long International, Inc., one of the world’s largest construction claims consulting companies, which also provides project management consulting services. Based in Colorado with offices throughout the U.S. and the Middle East, Long International focuses its practice on owners, engineering and construction firms, and contractors performing oil & gas, petroleum refining, petrochemical, chemical, power, mineral processing, manufacturing, industrial, building, and infrastructure projects worldwide. Mr. Long has over 40 years of U.S. and international engineering, construction, and management consulting experience involving construction contract disputes analysis and resolution, arbitration and litigation support and expert testimony, project management, engineering and construction management, cost and schedule control, and process engineering. As an internationally recognized expert in the analysis and resolution of complex construction disputes for over 30 years, Mr. Long has served as the lead expert on over 300 projects having claims ranging in size from US $100,000 to over US $2 billion. He has presented and published numerous articles and training seminars on the subjects of claims analysis, entitlement issues, CPM schedule and damages analyses, and claims prevention.

Before forming Long International, Mr. Long was Senior Vice President, Contract Administration for a major electrical and mechanical contractor. In this role, he had corporate-wide responsibility for technical management and oversight of the preparation and resolution of construction claims. In addition, he was responsible for the development, training, and implementation of project management policies and procedures to ensure that profit, cost, schedule, scope, quality, and safety objectives were achieved. For 13 years, Mr. Long managed the construction claims practices of two large consulting firms. Prior to his consulting career, Mr. Long gained 13 years of project management and process engineering experience on petroleum refining, oil shale, synfuels, mining, and power generation projects with Tosco, Fluor, and Conoco.

Mr. Long earned a B.S. in Chemical Engineering from the University of Pittsburgh in 1970 and an M.S. in Chemical and Petroleum Refining Engineering from the Colorado School of Mines in 1974. He is a Registered Professional Engineer in the State of Colorado. Mr. Long is based in Littleton, Colorado, and can be contacted at rlong@long-intl.com and (303) 972-2443.
About The Authors

Rod C. Carter, CCP, PSP, is a Principal with Long International and has over 15 years of experience in construction project controls, contract disputes and resolution, mediation/arbitration support, and litigation support for expert testimony. He has experience in entitlement, schedule, and damages analyses on over thirty construction disputes ranging in value from US $100,000 to over US $2 billion. His experience includes heavy civil, nuclear, environmental, chemical, power, industrial, commercial, and residential construction. He is proficient in the use of Primavera Project Planner software, and has extensive experience in assessing the schedule impact of RFIs, change orders, and other events to engineering and construction works.

Mr. Carter specializes in loss of productivity, cumulative impact, and quantum calculations, and has held a lead role in assessing damages on more than a dozen major disputes. In addition, Mr. Carter has developed cost and schedule risk analysis models using Monte Carlo simulations to address the uncertainty of estimates and claims. He has testified as an expert in construction scheduling and damages, and has presented expert findings to an international arbitral tribunal.

Mr. Carter earned a B.S. in Civil Engineering from the University of Colorado at Boulder in 1996, with an emphasis in Structural Engineering and Construction Management. Mr. Carter is based in Littleton, Colorado, and can be contacted at rcarter@long-intl.com and (303) 463-5587.

Harold E. Buddemeyer is a Senior Principal with Long International and has over 40 years of experience in all aspects of program and construction project management and construction disputes. His experience includes construction and property damage/business interruption claims analysis, preparation, defense, and negotiation of settlements on projects including refineries, offshore oil & gas, petrochemical plants, heavy civil and mining projects, tar sands facilities, nuclear, coal and gas-fired power plants, and building projects. Mr. Buddemeyer’s project experience includes project cost/schedule control, systems and procedures development and implementation, and program planning, as well as capital and operating cost estimating and economic analysis during the design, construction, and start-up phases of a diverse cross section of projects.

Mr. Buddemeyer has over 30 years of construction contract disputes consulting experience. In this regard, he has been responsible for entitlement and issue analysis; change order analysis; labor productivity analysis; cost and damages analysis;
schedule delay and impact analysis; claim report preparation and rebuttal; negotiation and mediation assistance; the organization, development and maintenance of document databases; assistance to counsel during discovery; and depositions and interrogatory preparation.

Mr. Buddemeyer has testified in U.S. and international arbitration. He was enrolled in a professional degree program, majored in applied mathematics and operations research, and minored in Chemical and Petroleum Refining Engineering at the Colorado School of Mines from 1965 to 1970. Mr. Buddemeyer is based in Littleton, Colorado, and can be contacted at hbuddemeyer@long-intl.com and (303) 798-8594.

Douglas J. Nutter, Long International’s Manager of Graphic Services, prepared the graphical illustrations throughout this text and formatted the text for layout and indexing. He has nearly 40 years of experience in design, illustration, cartography, and graphic production for technical support, arbitration, and litigation. Mr. Nutter is skilled in developing complex technical issues and data into concise presentations for use by counsel, juries, and arbitration panels. Prior to his consulting career, Mr. Nutter gained 12 years of engineering drafting and graphics experience on petroleum refining, oil shale, synfuels, mining, and power generation projects with Tosco Corporation.

Mr. Nutter has provided graphic design, illustration, and technical support for construction claim preparation, analysis, defense, and negotiation of settlements for various parties, including owners, contractors, transit agencies, universities, sureties, financial institutions, law firms, and architectural firms. Mr. Nutter is based in Littleton, Colorado, and can be contacted at dnutter@long-intl.com and (303) 427-4368.
Index

“A”/“B” Estimate .......................................................... 156–57, 173
1988 CII Study .............................................................. 106–8
1990 CII Cumulative Impact Study ................................ 70–71
1994 CII Overtime Study ............................................... 108–9
2001 CII Cumulative Impact Study .............................. 78–81, 124
2005 Ibbs Study .............................................................. 81–87, 126–27, 181
Abandonment ............................................................... 155–56
Acceleration ....................... 3, 24, 42, 46, 48, 51, 57, 59, 61, 64, 67, 93, 99, 102, 122–27
........................................ 131, 135, 163, 169, 184, 192, 194, 201, 204, 207, 212, 216
Accord and Satisfaction .............................................. 24–29, 37, 91, 211
Actual Cost Calculations ................................................ 168
Actual vs. Estimated Cost of Changes ......................... 29, 148
Allocation of Cost Variances ....................................... 172–73
Bid Error ........................................................... 30, 46, 59, 95, 102, 133, 139, 143, 145, 153
........................................................... 159–61, 162, 166, 170–74, 205, 213, 215
Cause-Effect Analysis
  Cause-Effect Matrix .................................................. 198–201
  Schedule Analysis ...................................................... 192–93
  Site Environment Changes ........................................ 194–96
  Tracking Impacts ....................................................... 193–94
  Use of Graphics ....................................................... 196–98
Challenges to Sustaining a Cumulative Impact Claim ........ 17–35, 18–23, 36–37
  Barred by Law .......................................................... 34–35
  Proving Causation ................................................... 18–23, 196–201
  Reservation of Rights ............................................... 23–29, 209
  Successful Claim Recovery ....................................... 36–37
  Use of Proper Damages Methodology ......................... 29–32
Change Orders
  Actual Costs ........................................................... 17, 29–30, 53, 58, 138, 142, 145, 148
  ........................................................... 152, 162, 166, 168, 170–71, 174, 183
  Coding of Costs ...................................................... 34, 169
  Documentation of Changes ....................................... 9, 148
  Hidden Cost of Changes .......................................... 11–12, 36
  Quantity of Changes ............................................... 18, 20, 23, 37, 196
## Index

<table>
<thead>
<tr>
<th>Topic</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCAA</td>
<td>5–6</td>
</tr>
<tr>
<td>Society of Construction Law</td>
<td>4</td>
</tr>
<tr>
<td>Disruption and Delay</td>
<td>4–5</td>
</tr>
<tr>
<td>Documentation</td>
<td>32–34, 45, 132, 134</td>
</tr>
<tr>
<td>Documenting Changes and Impacts</td>
<td>184–85</td>
</tr>
<tr>
<td>Documents and Recordkeeping</td>
<td>183–84</td>
</tr>
<tr>
<td>Engineering and Construction Project Documentation</td>
<td>217–19</td>
</tr>
<tr>
<td>Earned Value</td>
<td>16, 127, 169, 185</td>
</tr>
<tr>
<td>Extra Work</td>
<td>37, 45, 84, 88, 152, 156, 186</td>
</tr>
<tr>
<td>Foreseeability</td>
<td>3, 6–11, 7, 24, 35, 41, 94, 132, 177–81, 185–87</td>
</tr>
<tr>
<td>Global Claim</td>
<td>30–31, 178</td>
</tr>
<tr>
<td>Ibbs Studies</td>
<td>81–87, 126–27</td>
</tr>
<tr>
<td>Industry Studies Regarding Cumulative Impact</td>
<td></td>
</tr>
<tr>
<td>1990 CII Cumulative Impact Study</td>
<td>70–71</td>
</tr>
<tr>
<td>2001 CII Cumulative Impact Study</td>
<td>78–81, 124</td>
</tr>
<tr>
<td>2005 Ibbs Study</td>
<td>81–87, 126–27, 181</td>
</tr>
<tr>
<td>Leonard Study</td>
<td>8, 63–70, 83, 87–88, 122–23, 127, 174, 194</td>
</tr>
<tr>
<td>Adequate Evidence</td>
<td>152</td>
</tr>
<tr>
<td>No Other Reliable Method of Calculating Damages</td>
<td>151–52</td>
</tr>
<tr>
<td>Procedure</td>
<td>152–53</td>
</tr>
<tr>
<td>Proof of Injury</td>
<td>151</td>
</tr>
<tr>
<td>Reasonableness Requirement</td>
<td>153</td>
</tr>
<tr>
<td>Unpredictable Nature</td>
<td>154</td>
</tr>
<tr>
<td>When Can a Jury Verdict Method be Used</td>
<td>151–52</td>
</tr>
<tr>
<td>Learning Curve</td>
<td>48, 56, 90, 93, 194–96</td>
</tr>
<tr>
<td>Leonard Study</td>
<td>8, 63–70, 83, 87–88, 122–23, 127, 174, 194</td>
</tr>
<tr>
<td>MCAA Factors</td>
<td>90–99, 125–26, 135, 174, 194, 204, 206–7</td>
</tr>
<tr>
<td>Criticisms and Court Decisions</td>
<td>97–98</td>
</tr>
<tr>
<td>Estimating Cumulative Impact</td>
<td>98–99</td>
</tr>
<tr>
<td>General Considerations</td>
<td>90–92</td>
</tr>
<tr>
<td>Impacting the Project Schedule</td>
<td>99</td>
</tr>
<tr>
<td>Method</td>
<td>92–97</td>
</tr>
<tr>
<td>Advantage</td>
<td>59</td>
</tr>
<tr>
<td>Criteria</td>
<td>53</td>
</tr>
</tbody>
</table>
## Index

Steps to Prepare ............................................................................................................... 53  
Notice ................................................................. 186–87  
Out-of-Sequence Work .......................................................... 3, 184, 194  
Overcrowding/Congestion ............................................ 110–17, 159, 161  
Comparison of Planned vs. Actual Manpower ......................... 111, 113–17  
Overtime ............................................................ 41–43, 48–51, 57, 59, 61, 80, 90–92, 102–10  
................................................. , 125, 134–35, 159, 161, 163, 172, 179, 192  
Overtime Studies  
1988 CII Overtime Study ............................................................... 106–8  
1994 CII Overtime Study ............................................................... 108–9  
Business Rountable Study .................................................. 104  
NECA Overtime Study ............................................................. 105–6  
U.S. Army Corps of Engineers Study ...................................... 109–10  
U.S. Department of Labor Bulletin No. 917 .................................... 103  
Productivity Loss  
Causes ................................................................................. 42–45  
Tracking Productivity .......................................................... 185–86  
Productivity Loss/Cumulative Impact Calculation Methods .............. 50  
1990 CII Cumulative Impact Study ................................................. 70–71  
2001 CII Cumulative Impact Study ................................................. 78–81, 124  
2005 Ibbs Study ....................................................................... 81–87, 126–27, 181  
Court’s General View of Formulaic Approaches .......................... 87–88  
Earned Value Analysis ........................................................... 60–61  
Example Calculations ............................................................. 121–27  
Industry Studies on the Impact of Changes  
(Formulaic Approaches) .......................................................... 62–89  
Leonard Study .............................................................. 63–70, 122–23  
MCAA Factors ................................................................. 90–99, 125–26  
Measured Mile Analysis ......................................................... 50–62  
NAVSEA Guidelines ............................................................ 99–100  
Overcrowing/Congestion ....................................................... 110–17  
Overtime .............................................................................. 103–10  
System Dynamics Modeling .................................................... 100–102  
Timing of Changes ............................................................... 78, 84, 86  
Uncertainties of Formulaic Approaches ......................................... 88–89
Index

Proof of Damages.............................................................. 22, 29, 48, 132, 138, 147, 151, 159, 183, 204

Quantum Meruit ........................................................................ 135, 154–56, 174

Quantum/Damages Methods
  “A”/“B” Estimates Method ....................................................... 156–57
  Choosing a Method ................................................................... 131–74
  Comparison of Methods ........................................................... 173–74
  Delta Estimate Method .............................................................. 158–59
  Discrete Damages/Cost Variance Analysis Method .................... 159–73
  Jury Verdict Method ................................................................. 151–52
  Modified Total Cost Method ..................................................... 143–48
  Quantum Meruit ..................................................................... 154–56
  Total Cost Method ................................................................. 31–34, 135–43

Reservation of Rights ............................................................... 23–29, 91, 209

Society of Construction Law ..................................................... 4, 52, 178

System Dynamics Modeling ..................................................... 100–102

Total Cost Method ................................................................. 31–34, 135–43
  Elements of Proof ................................................................. 137–39
  Owner’s Failure to Provide Alternative Method ......................... 141
  Prerequisites .......................................................................... 140
  Theoretical Bases .................................................................. 139
  Total Cost Claim ..................................................................... 142–43

Tracking Impacts ....................................................................... 196–97

U.S. Army Corps of Engineers Study ......................................... 109–10

Uncertainties in using Formulaic Approaches ............................. 88–89

Worker Density ......................................................................... 111
Case Citations

Cases

Acme Missiles & Constr. Corp., ASBCA Nos. 11256, 11716, 68-1
BCA ¶ 6,873 (1968)........................................................................................................ 209

Advanced Engineering & Planning Corp., ASBCA Nos. 53366,
54044, November 2004.................................................................................................. 99, 100, 193, 216

Aetna Casualty & Surety Co. v. George Hyman Const. Co., U.S. Dist.,
LEXIS 22627 (E.D. Pa. 1998)................................................................................. 69, 88, 138, 211

AMEC Civil, LLC v. DMJM Harris, Inc., Civil Action No. 06-64
(FLW), US District Court, D. New Jersey (June 2009)................................. 35, 144, 148, 213

Amelco Elec. v. City of Thousand Oaks, 98 Cal. Rptr. 2d 159
(Cal Ct. App. 2000)........................................................................................................ 9, 139, 207

Aragon Constr. Co. v. United States, 163 Ct. Cl. 382 (1964)....................... 143, 214

Atlantic Dry Dock Corp. v. United States, 773 F. Supp. 335,
338-39 (M.D. Fla. 1991)......................................................................................... 27, 210

8593, 7903, 8143, 8653 (1990)............................................................................... 206

Bagwell Coatings, Inc. v. Middle S. Energy, Inc., 797 F.2d 1298,
1309 (5th Cir. 1986)..................................................................................................... 138

Bay Construction Co., VABCA Nos. 5594, 5625, 5626, 5628 and
5831, 2002 WL 442118 (2002)............................................................................... 211

Beaty Electric, EBCA No. 408-3-88, 90-2 BCA (CCH)
¶22,829 (1990)............................................................................................................. 28

Bechtel National, NASA BCA No. 1186-7, 90-1 BCA
¶22,549 (1989)........................................................................................................... 7, 16, 32, 203

Bell BCI Co. v. United States, No. 03-1613C, 81 Fed. Cl. 617,
2008 U.S. Claims LEXIS 116 (April 2008)......................................................... 16, 28, 36, 196, 204

Bell v. United States, 404 F.2d 975, 983, 186 Ct.Cl. 189,
205 (1968)............................................................................................................... 151

C. Norman Peterson Co. v. Container Corp of Am., 218 Cal Rptr. 592
(Cal. Ct. App 1985).................................................................................................... 156, 205

California Canners & Growers Ass'n v. United States, 9 Ct.Cl. 774,
785 (1986)............................................................................................................... 152

Centex Bateson Constr. Co., VABCA Nos. 4613, 5162, 5165,
Co. v. West, 250 F.3rd 761 (Fed Cir. 2000)....................................................... 6, 7, 9, 21, 22, 23, 41, 191, 211

227
Case Citations

Central Mechanical Construction, ASBCA No. 29434, 86-3
BCA ¶ 19,240 (1986)........................................................................................................... 26, 210

Chantilly Construction Corp., ASBCA No. 24138, 81-1
BCA ¶ 14,863 (1980)........................................................................................................... 205

Charles G. Williams Constr., Inc., ASBCA No. 33766, 89-2
BCA ¶ 21,733 (1989)........................................................................................................... 192, 206

City of Del Rio v. Ulen Contracting Corp., 94 F.2d 701, 704
(5th Cir. 1938). Accord, California Civil Code § 1689 (a) .................................................. 155

City of Portland ex rel. Donohue & Fleskes Corp. v. Hoffman Constr. Co.,
236 Ore. 739, 596 P.2d 1305, 1309, 1313 Fn. 22 (1979).................................................. 156

Clark Concrete Contractors, Inc. v. General Services Administration,
99-1 BCA ¶ 30280, GSBCA No. 14340 (1999) .............................................................. 41, 98, 206

Clark Construction Group, Inc. v. Hoffman Constr. Co.,
236 Ore. 739, 596 P.2d 1305, 1309, 1313 Fn. 22 (1979).................................................. 156

Coastal Constr. Grp., Inc. v. Stellar J. Corp., Court of Appeals of
Washington, Division One, No. 66932-0-1, October 2011 ........................................... 148

Coates Industrial Piping, Inc., VABCA No. 5412, 99-2
BCA ¶ 30,479 (1999)........................................................................................................... 211

David H. Tierney Jr., GSBCA Nos. 7107, 6198, 5585, 88-2
BCA ¶ 20,806 (1988)........................................................................................................... 8, 16, 22, 27, 203

Dawco Constr., Inc. v. United States, 930 F.2d 872, 880,
882 (1991)......................................................................................................................... 150, 151, 152, 184

Delco Electronics Corp. v. United States, 17 Ct.Cl. 302,
320-324 (1989)................................................................................................................... 150, 151, 154

App.4th 1396 ...................................................................................................................... 148

Drexel Dynamic Corp., 67-2 BCA ¶ 6,410, pages 29,698,
29,699 (ASBCA 1967)...................................................................................................... 147, 154

Dugan & Meyers Constr. Co., Inc. v. Ohio Dept. of Adm. Servs., 113
Ohio St.3d 226, 864 N.E.2d 68 (2007) ........................................................................... 212

Dugan & Meyers Constr. Co., Inc. v. Ohio Dept. of Adm. Servs.,
2003-Ohio-3709 (2003).................................................................................................. 204

Dyson & Co., ASBCA No. 21,673, 78-2 BCA ¶ 13,482,
on reconsid., 7901 BCA (CCH) ¶ 13,661 (1979)................................................................. 26, 143, 209

E. Arthur Higgins, 79-2 BCA ¶ 14,050, pp. 69,052, 69,066
(AGBCA 1979) .................................................................................................................. 149

E.C. Ernst, Inc. v. Koppers Co., Inc., 626 F.2d 324, 327
(3rd Cir. 1980).................................................................................................................. 147

Elete, Inc. v. S.S. Mullen, Inc., 469 F.2d 1 127 (1972).......................................................... 147
Case Citations

Fattore Co., Inc. v. Metropolitan Sewerage Comm’n, 505 F.2d 1, 4 (7th Cir. 1974) ...................................................................................... 149, 152
Fire Security Systems, Inc., 91-2 BCA ¶ 23,743 ................................................................. 98
Freeman-Darling, Inc., GSBCA No. 7112, 89-2 BCA ¶ 21,882 (1989) ......................... 19, 210
Fruehauf Corp., PSBCA No. 477, 74-1 BCA ¶ 10,596 (1974) ..................................... 7, 205
Great Eastern Hotel Company Ltd v. John Laing Construction Ltd
(2005) EWHC 181 (TCC)........................................................................................................ 33
Great Lakes Dredge & Dock Co. v. United States, 96 F. Supp. 923
(119 Ct.Cl. 1951) ........................................................................................................ 136, 143, 146
Greenwood Constr. Co., Inc., 78-1 BCA ¶ 12,893, pp. 62,818,
62,830-1 (AGBCA 1977) .................................................................................... 151, 152
Grover-Black, ENGBCA No. 4557, 85-3 BCA (CCH) ¶ 18,398 (1985) ................... 88
H.T.C. Corp. v. Olds, 486 P.2d 463, 466 (Colo.App. 1971) ........................................ 155
Haas & Haynie Corp., GSBCA Nos. 5530, 6224, 6638,
6919-20, 84-2 BCA ¶ 17,446 (1984) ............................................................... 8, 10, 11, 210
Haskell Corporation, et al v. ConocoPhillips Company, No. A124446,
Court of Appeals of California, First District, Division Four.
(March 2012)................................................................................................................... 214
Hensel Phelps Construction Co., GSBCA 14744; 01-1
BCA ¶ 31,249 (2001) ............................................................................................. 204
Hensel Phelps, ASBCA No. 49270, 99-2 BCA ¶ 30,531 ........................................ 19
Ingalls Shipbuilding Division, Litton Systems, Inc., ASBCA 17579,
78-1 BCA, ¶ 13,038 (1978) .................................................................................... 16, 205
J. A. Jones Construction Co., 00-2 BCA ¶ 31,000, ENGBCA
Nos. 6390-1, 6386-7, 6348, 6388-9, 2000 WL 1014011 ............. 18, 30, 69, 192, 211
Jackson Construction Co. v. United States, 62 Fed.Cl. 84
(Fed. Cl. 2004) ...................................................................................................... 27, 212
Jacobellis v. Ohio, 378 U.S. 184, 197 (1964) ......................................................... 23
John Doyle Construction Limited v. Laing Management (Scotland) Ltd
[2002] BLR 393 (Outer House) and [2004] BLR 295 (Inner House) ................. 31
John E. Green Plumbing & Heating Co., Inc. v. Turner Const. Co.,
742 F.2d 965, 968 (6th Cir. 1984) ........................................................................... 142, 215
Super. 425, 460 A.2d 260, 263 (1983) ................................................................. 140
Kit-San-Azusa, J. V. v. United States, 32 Fed Cl. 647 (1995) .............................. 206

229
Lamb Engineering & Construction Company, EBCA 97-2 BCA ¶ 29,207 .................................................................................. 51
McAlpine Humberoak v. McDermott (1992) 58 BLR 1 ........................................ 33
McGee Landscaping, Inc., AG-BCA No. 91-172-1, 93-3 BCA (CCH) ¶ 25,946 (1993) ................................................................. 88
Mergentime Corp. v. WMATA, 1997 U.S. Dist. LEXIS 23408 ...................... 151
Metropolitan Sewerage Comm’n v. R.W. Constr., 78 Wis.2d 451, 255 N.W.2d 293-302 (1977) ......................................................... 150
Needles v. United States, 101 Ct. Cl. 535 (1944) ........................................ 149
New Pueblo Constructors, Inc. v. State, 144 Ariz. 95, 696 P.2d 185, 194 (1985) ................................................................. 150, 152
Obert v. Ede, 38 Wis.2d 240, 156 N.W.2d 422, 424 (1968) ...................... 156
Oliver-Finnie Co. v. United States, 279 F.2d 498, 506, 150 Ct.Cl. 189 (1960) ................................................................. 140
Phillips Construction Co. v. United States, 394 F.2d 834, 839, 184 Ct.Cl. 249 (1968) ................................................................. 154
Pittman Construction Co., GSBCA Nos. 4,897, 4,923, 81-1 BCA ¶ 14,847, 1980 WL 2643 ......................................................... 8, 11, 19, 21, 26, 32, 180, 209
Propellex, 342 F.3d ................................................................. 144
Pugh v. Holmes, 486 Pa. 272, 405 A.2d 897 (1979) ......................................................... 139
R. J. Lampus Co. v. Neville Cement Products Corporation,
378 A.2d 288 (1977) ................................................................. 132

R-D Mounts, Inc., 75-1 BCA ¶ 11,237, Pages 53,491, 53,492
(ASBCA 1975) ............................................................................. 150

Reflectone, Inc. v. Dalton, 60 F.3d 1572 (Fed. Cir. 1995) ............... 184

Roanoke Hospital Association v. Doyle & Russell, Inc.,
214 S.E.1d 155 (1975) ................................................................. 132

Robert McMullan & Sons, Inc., ASBCA No. 19129, 76-2
BCA ¶ 57,947 ................................................................................ 145

Roche Bros., Inc. v. Rhoades, 527 F.2d 891 (1975) ................. 132

S. Comfort Builders, 67 Fed. Cl. 124, 139 (2005) ....................... 144

S. J. Groves & Sons Co. v. Warner Co., 576 F.2d 524 (1928) .... 132

S. Leo Harmonay Inc. v. Binks Manufacturing Company,
79 F 2d 1014 (S. D. N.Y. 1984) aff’d. 762 F.2d. 990 (2d Cir. 1984) 147

Santa Fe Eng’g, Inc., ASBCA Nos. 24578, 25838, 2838, 28687,
94-2 BCA ¶ 26,872 ....................................................................... 19

Sandi Tarmac Co., Ltd and Tarmac Overseas, Ltd., ENGBCA
No. 4841, 89-3 BCA ¶ 22,036 (1989) ........................................ 27, 210

Schwartz v. Shelby Constr. Co., 338 S.W.2d 781, 788 (Mo. 1960) .... 155

EWHC 773 and (2004) EWHC 1748 (TCC) .................................. 33

Southwest Marine, 94-3 BCA ¶ 27,102, DOTCAB
No. 1663 (1994) .............................................................................. 11, 20, 100, 143, 210

Sovereign Construction Company, Ltd., ASBCA No. 17792,
75-1 BCA ¶ 11,251 ....................................................................... 143, 145

Specialty Assembling & Packing Co. v. United States, 355 F.2d 554,
572, 174 Ct.Cl. 153 (1966) ......................................................... 151

State Highway Comm’n of Wyoming v. Brassel & Sins Construction
Co., Inc., 688 P.2d 871, 877 (Wyo. 1984) .................................. 139, 150

State of California ex rel. Dept. of Transportation v. Guy F. Atkinson

States Roofing, ASBCA No. 55505 (January 2010) ...................... 204

Strand Hunt Const., Inc. v. Lake Washington School Dist., No. 414,
Not Reported in Pd, 2006 WL 2536315 (Wash. App. Div. 1) ........ 212

Stroh Corporation, GSBCA No. 11029, 96-1 BCA ¶ 28,265 .......... 98

Teledyne McCormick-Selpb v. U.S., 588 F.2d 808, 810 (Ct.Cl. 1987) 146

The Triax Co. v. United States, 28 Fed.Cl. 733 (1993), aff’d 19 F. 3d.
1196 (Fed. Cir. 1994) ................................................................. 215
Case Citations

Triple “A” South, 94-3 BCA ¶ 27,194, ASBCA No. 46,866 (1994) ....... 6, 100, 191, 210
U.S. v. J. H. Copeland & Sons, 568 F.2d 1159 (1928) .................................................. 132
Uble v. Tarlton Corp., 938 S.W.2d 594 (Mo. Ct. App. 1997) ........................................ 27
Vanlar Construction, Inc. v. County of Los Angeles, 217 Cal. Rptr. 53
(Cal. App. 1985) .............................................................................................................. 26
Walsh/Davis Joint Venture, CBCA No. 1460 (March 2012) ........................................ 213
Watt Plumbing, A.C., and Electrical v. Tulsa Rig, Reel, and Manufacturing Co., 533 P.2d 980 (1975) .................................................. 214
Western Contracting Corp. v. United States, 144 Ct.Cl. 318, 320,
333, 334, 369 (1958) ..................................................................................................... 154
WRB Corp. v. United States, 183 Ct.Cl. 409, 426-427 (1968) .............. 30, 31, 137, 151
Wunderlich Contracting Co. v. U.S., 173 Ct.Cl. 180,
351 F.2d 956 (1965) ............................................................................................... 19, 20, 133, 140, 151, 214