Change Order Pricing Principles and Best Management Practices

By

Dr. Awad S. Hanna

Copyright © 2013 by Dr. Awad S. Hanna

ALL RIGHTS RESERVED. This book contains material protected under International and Federal Copyright Laws and Treaties. Any unauthorized reprint or use of all or any part of this book is prohibited. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system without express written permission from the author and publisher. For licensing information, contact Hanna Consulting Group Inc., 1315 Farwell Drive, Madison, WI 53704.

ISBN-13: 978-0-9829042-2-0

About the Author

Dr. Awad S. Hanna is a professor and chair of the construction engineering and management program at the University of Wisconsin-Madison, Department of Civil and Environmental Engineering. He holds M.S. and Ph.D. degrees from Penn State University and he is a registered professional engineer in the United States and Canada. Dr. Hanna has been an active construction practitioner, educator, and researcher for over 30 years including 10 years as a design engineer and project manager. He has taught construction management courses at Pennsylvania State University, Memorial University in Canada, and University of Wisconsin-Madison.

Dr. Hanna is arguably today's leading active North American researcher working in the area of quantifying the impact of change orders and change order management. He has been active in industry-funded productivity research for nearly 20 years, with such renowned research sponsors as the Electrical Contracting Foundation, the Mechanical Contracting Foundation, the New Horizon Foundation, and the Construction Industry Institute, among others.

Dr. Hanna was ranked by the Journal of Management and Engineering as the number one author in the world in the area of labor productivity and change orders, with a total contribution of 18 refereed papers published in the best journals in the world and an overall impact score of 7.35.

He has authored over 100 refereed journal articles and 15 major productivity-related books on construction-related topics, with special emphasis on labor productivity, construction methods, cumulative impact of change orders, and construction risk management. He has published four extensive national studies relating to change order management and pricing principles.

Dr. Hanna has presented over 1000 one-day seminars and instructed more than 20,000 people in the U.S. and Canadian construction industry on quantifying the impact of change orders on labor productivity and calculating the cumulative impact of change orders. His audiences have included the National Electrical Contractors Association (NECA), the Mechanical Contractors Association of America (MCAA), Canadian Mechanical Contracting Education Foundation, Electrical Contractors Association of Canada, Sheet Metal and Air Conditioning Contractor's National Association, and the National Association of Boilermaker Construction Employees (NACBE). He has also served as consultant and/or expert witness on many major national claims cases that involved craft productivity evaluation, including such projects as the Massachusetts Central Artery "The Big Dig" and the New England Patriots Stadium.

Dr. Hanna was selected by a jury of internationally known experts as the winner of the Canadian Construction Research Board's 1990 international competition for the "Best Innovative Ideas in Construction." In 2006, Dr. Hanna was the recipient of the Construction Industry Institute's Outstanding Researcher Award, and in 2009, he was elected Fellow of the American Society for Civil Engineers. Most recently, Dr. Hanna was selected by the American Society of Civil Engineers Construction Institute Board of Directors to receive its 2010 Construction Management Award for his significant contributions as an educator and researcher in the construction industry.

Table of Contents

Preface	V
Chapter One: Definitions, Concepts, and Impact of Construction Changes	
1.1 Definition of Change	1
1.2 Causes for Increasing Size and Frequency of Change Orders	2
1.3 Types of Change Orders	3
1.3.1 Changes in the Electrical and Mechanical Construction Industries	5
1.4 Increased Change Order Cost: How and Why	
Chapter Two: Cost Guidelines and Pricing Principles	8
2.1 Underpinning Concepts	
2.2 Typical Recoverable Change Order Costs	8
2.2.1 Cost Associated With Labor Burden	8
2.2.2 Job Overhead Cost (Direct Job Expenses)	
2.2.3 Mark-up	19
2.2.4 Impact	25
Chapter Three: Change Orders and Factors Affecting Labor Productivity	
3.1 Factors Affecting Labor Productivity	35
3.1.1 Impact of Overtime on Labor Productivity	40
3.1.2 Impact of Overmanning on Labor Productivity	
3.1.3 Impact of Second Shift Work on Labor Productivity	
3.1.4 Impact of Stacking of Trades on Labor Productivity	68
3.1.5 Impact of Labor and Material Cost Escalation	72
3.2 Summary and Concluding Remarks	83
Chapter Four: Change Order Best Practices	
Best Practice #1	85
Best Practice #2	87
Best Practice #3	92
Best Practice #4	
Best Practice #5	
Best Practice #6	
Best Practice #7	
Best Practice #8	
Best Practice #9	
Best Practice #10	
Appendices	
Appendix A-1	
Appendix A-2	
Appendix B	
Appendix C	120
Appendix D	124
Ribliography	120