# Control and Management of Reinforcement Steel Leftovers

# (Case Study In Kingdom Of Bahrain Industry)


**By**

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# COMMITTEE DECISION

**This Thesis (Control and Management of Reinforcement Steel Leftovers Case Study In Kingdom Of Bahrain Industry) was successfully Defended and Approved on**

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# *Dedication*

*The total thanks to my* ***god*** *who gives me all things, stand with me when no one was, and home "* ***Bahrain****"*

*This total effort was not done without you,*

*My* ***father****, who* ***stand by*** *me at every step in my life, and taught me that the best kind of knowledge to have is that which is help other,*

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*Mohamed Salem Mohamed Mutlaq Alruwaijeh*

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# List of Abbreviations

| Abbreviation | Meaning |
|---|---|
| **1D** | One-Dimensional |
| **1DCSP** | One Dimension Cutting Stock Problem |
| **1DCSPUL** | One Dimension Cutting Stock Problem With Usable Leftover |
| **2D** | Two-Dimensional |
| **ALBA** | Aluminum Of Bahrain |
| **BAPCO** | Bahrain Petroleum Company |
| **BBS** | Bending Schedules |
| **BD** | Bahrain Dinar, |
| **BIM** | Building Information Modelling |
| **BRC** | British Reinforcement Concrete Company |
| **C&D** | Construction And Demolition |
| **C&DWM** | Construction And Demolition Waste Management |
| **C-CUT** | Cutting Computer Program |
| **CG** | Column Generation |
| **CMS** | Control And Management System |
| **COLA** | Computerized Laying Out |
| **CSP** | Cutting Stock Problem |
| **CSPUL** | Cutting Stock Optimization Problem With Usable Leftovers |
| **CUT** | Cutting Computer Program |
| **EAF** | Arc Furnaces |
| **ESI** | Emirates Steel Industries |
| **EU** | European Union |
| **FFD** | First-Fit Decreasing |
| **GA** | Genetic Algorithm |
| **GCC** | Gulf Cooperation Council |
| **GPIC** | Gulf Petrochemical Industries |
| **Hadeed** | Saudi Iron And Steel Company |
| **IP** | Integer Programming |
| **IPTS** | Institute For Prospective Technological Studies |
| **K.S.A.** | Kingdome Of Saudi Arabia |
| **LP** | Linear Programming |
| **MBS** | Minimal Bin Slack |
| **NEP** | Number Of Efficient Cutting Patterns |
| **OECD** | Organization For Economic Cooperation And Development |
| **Qasco** | Qatar Steel Company |
| **RFID** | Radio Frequency Identification |
| **SDM** | System Dynamic Modeling |
| **SHP** | Sequential Heuristic Procedure |
| **Tw** | Trim Loss |
| **UAE** | Union Arab Emirates |
| **UNEP** | United Nations Environment Program |
| **USD** | United State Dollar |
| **WRAP** | Waste And Resource Action Program |

# ABSTRACT


## Control and Management of Reinforcement Steel Leftovers

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A cutting stock problem is one of the main and classical problems in different industries as well as in many aspects of our lives. The problem "Controlling and Managing of Reinforcement Steel Leftovers," is one of the important factors in construction industry. The aim of this study is to develop and test a system to minimize the waste, maximize the revenue and succeed in the optimal use of scarce resources.

Data will be collected from real projects from Kingdom of Bahrain biggest factories; meanwhile, the developed software will be used to reach the desired results. The first step is to analyze the validity of the developed software according to various aspects. Then several case studies were taken from national Companies. Furthermore, interview questions are set up for managers and employees in these companies to design a control and management system. During the interviews, the companies' team were shown the results of the developed software before they answer the questions. Finally, it is to develop a proper management system that saves the raw material.

It is found that the application of pre-determination of Reinforcement Steel Leftovers lengths will achieve significantly better results and thus reduce the amount of losses and achieve optimal use of resources. The most important result of this thesis is founding that not only achieving an optimum solution that leads to minimize losses, but to have an effective and flexible control and management system and an effective updated inventory system.