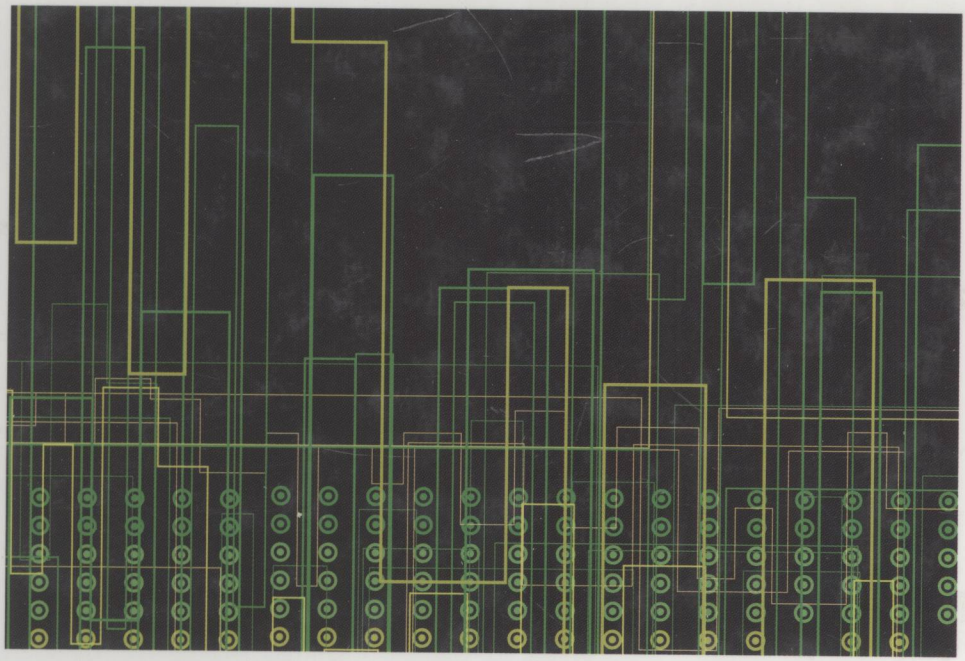
THIRD EDITION

MANUFACTURING FACILITIES

Location, Planning, and Design



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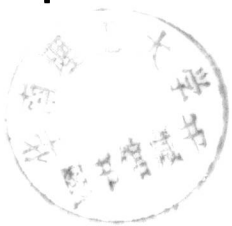

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Preface

Since the introduction of the previous edition of *Manufacturing Facilities*, worldwide industrial competition for consumer products has grown intense. International trade barriers are disappearing and few manufacturers have established themselves as trend setters while others have captured the mass market with high quality product at low cost. Thus to compete, one must plan, organize, and skillfully produce manufacturing units from concepts to the final product in an equally well planned facility that provides the means to achieve these objectives efficiently without waste.

Facility planners and engineers play an important part in understanding and enhancing all major aspects of manufacturing. A facility planner can also serve as a bridge between different departments within an organization that are trying to implement a comprehensive plan of action to produce economically and effectively. This edition provides the information and analytic tools necessary to convert a product design into a production strategy and then describes in detail all of the planning techniques needed to build and operate an efficient manufacturing facility. The new edition expands on the information a facility planner must have to take full advantage of today's technological advances.

Chapter 2 covers product design and development and includes techniques such as market research, forecasting and quality function deployment. These methods establish if there is a need for a product and important features that should be included in the product that will lead to improved customer satisfaction.

To increase operational efficiency, use of automation in manufacturing is almost always necessary. Chapter 3 covers automation. It includes topics such as bar codes, machine vision, radio frequency identifier and programmable logic controllers.

Chapter 4 describes some tools necessary to measure and improve operational performance. Production charts are used to display present and/or proposed methods of operation. Depending on volume and number of different products produced in the plant, distinct plant layout and operational flexibility are needed. Here, one type of production arrangement may be better than the other. Chapter 4 describes different production systems including job shop, batch processing, assembly line and application of group technology (GT) in developing cellular and flexible manufacturing.

Chapter 5 incorporates methods for selection of labor and equipment. Appropriate staffing and capacity of both manpower and equipment are necessary for keeping the production cost down.

To respond to the need of efficient plant operations, a number of new approaches have been recently developed. They are grouped together under an umbrella of Lean Manufacturing. The techniques includes 5S, Six Sigma, Andon, Takt Time, SMED, Value Stream Mapping, Visual Management, Poka-yoke and even supply chain management. All these techniques are described in Chapter 6.

Some supporting topics such as type and requirements of plant buildings and support facilities, as well as within plant functioning organization and methods of

communication, are described in Chapter 7. This background information is useful for looking at the entire picture.

Chapters 8, 9, and 10 are about material handling. Efficient material handling must be able to function without waste. Material handling has been evolving and information included in these chapters covers the basics of material handling, equipment descriptions, operations research techniques in material-handling system designs, as well as the use of robots and automated guided vehicles in material handling. Group technology is being increasingly used to divide product mix into coherent job cells and has become an important tool in developing production strategies and machine layouts. The topic of group technology is discussed in considerable depth in Chapter 10. The chapter also includes methods for efficient machine placement in a job shop and flexible manufacturing systems.

In production, even if we try to achieve Just in Time (JIT) production, some storage and warehousing may be essential. How to develop and operate a storage facility is illustrated in Chapter 11. Storage requires floor space, which can be expensive. MRP (Material Requirement Planning) has significantly reduced the need for excess inventory and discussion on MRP is included in the storage and warehousing section in Chapter 11.

Chapters 12, 13, and 14 discuss another very important topic, that of a plant layout. It is not sufficient to optimize only the layout of the facility. Facility planners are faced with simultaneously developing a plant layout and selecting material-handling equipment and ensuring material-handling systems. Chapter 14 discusses these issues and describes a procedure for concurrently minimizing plant layout and associated material-handling costs.

Every facility planner should be able to estimate the lighting, heating, and air-conditioning requirements for a new or existing facility. Techniques to determine these requirements are introduced in Chapter 15. Also included is a discussion of the Americans with Disabilities Act of 1990 (Chapter 15 and Appendix E), which has considerable influence on facility design.

Chapter 16 introduces computer integrated manufacturing systems (CIMS). It describes basic components of CIMS, benefits and deficiencies of CIMS, and how to plan for incorporating CIMS.

Chapters 17 through 19 focus on rudimentary methods of facilities locations. These heuristic methods are quick and easy to apply and provide good solutions to select facilities location problems. In most cases, these are sufficient to incorporate efficiency into the system.

A *solutions manual* for instructors is also available from the publisher; it contains complete solutions to all the problems in the text. In addition, there are suggested solutions for the two case studies included in Appendix F.

Although all the chapters in this text are useful, it may not be possible to cover them all in a one-semester course. This book provides the instructor with the opportunity to develop a course based on the students' backgrounds and particular areas that he/she feels must be emphasized in their curriculum. Lean manufacturing covered in Chapter 6 is a collection of methods that are presently used extensively in improving plant performance. In addition, an instructor wanting to stress plant layout and material handling may concentrate on Chapters 4, and 8 through 14. Those who are

primarily interested in understanding concepts of simultaneous plant layout and material handling may study Chapter 14 example without going through all the detailed calculations involved. To add some flavor of facility location, instructors may add Chapters 17 through 19 into their studies. Curricula that require students to synthesize the information on various topics in a capstone design course will find this book particularly useful because it integrates all the important aspects of industrial engineering as they relate to facilities planning.

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Dileep R. Sule

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