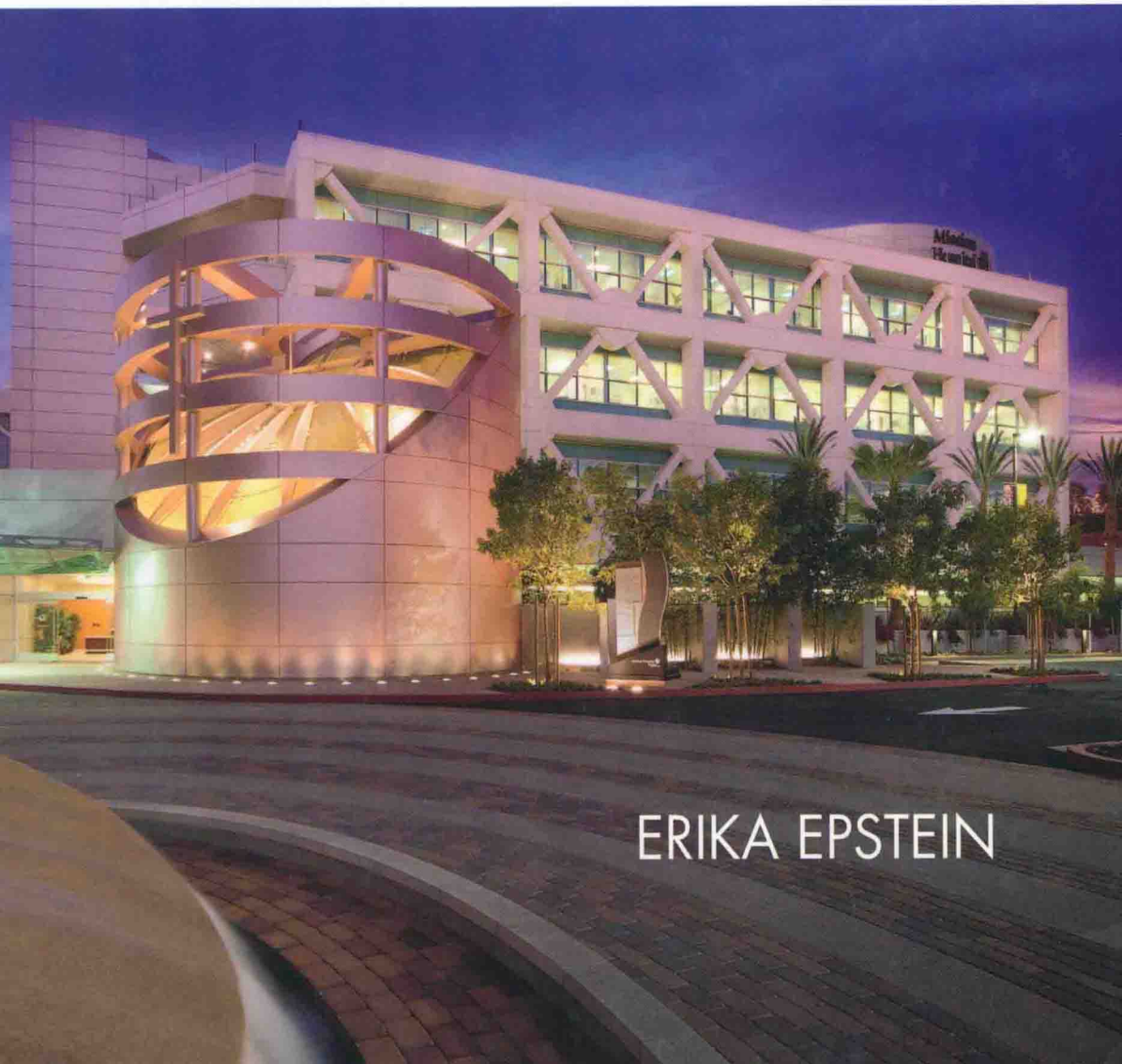
Implementing Successful Building Information Modeling



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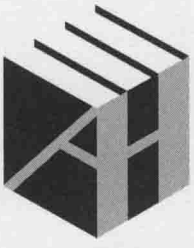

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Part I
Building Information Modeling (BIM) Overview

This book is a guide to building information modeling for firms and students intending to incorporate BIM in their work. Part I is an overview of BIM and how to implement it. The case studies in Part II present a global perspective of BIM as it is being implemented in architecture and construction companies. Of special interest are the last two case studies that showcase the BIMstorms orchestrated by Kimon Onuma of Onuma, Inc., whose participants include professionals, students, and BIMsoftware innovators from around the world.

The beginning chapters of Part I, 1 through 6, are intended for BIM users. These chapters help users understand the changes in the processes by which they produce their work and place that work in the context of its BIM life cycle. Users will learn the benefits of the new collaborative decision-making process that transcends integrated project delivery (IPD). Chapters 7 through 10 are for BIM managers, firm owners, and those who want to understand the technical side of BIM. Chapter 11 is a summary and guide to evaluate a firm's implementation of BIM.

As frequently as BIM is mentioned today, there is still confusion as to what it is. This was reinforced while researching this book when no two people asked gave the same definition. The book begins with a discussion of what BIM is in Chapter 1. In Chapter 2 we look at where BIM came from and the impact that new tools have had on actual work processes in the building industry. BIM implementation is having the same profound effect on the building industry as inventions such as blueprinting had in the past: drastically reducing the time and number of people needed to produce the work while simultaneously and significantly raising the quality of the work.

Chapter 3, "Implementing BIM," outlines the steps to successfully plan and implement BIM in a firm. We study the effects on staff and changes in the processes they will take to produce the work. We also look at project teams in Chapter 4, both within an office and among the outside teams (including the owner, programmer, planner, architect, consulting engineers, contractors, governing agencies, and facility managers).

Chapter 5, "The BIM Process," traces the flow of data. Collecting, analyzing, and making decisions on a project becomes more streamlined using a single shared database. In Chapter 6 we look at new types of collaboration made possible by BIM. This collective approach provides benefits throughout the project as participants are able to make more informed decisions from the onset of the projects, reduce errors, project schedules, and costs.

Quality control and risk management, discussed in Chapter 7, are two of the most important considerations for every firm owner and manager when implementing any new process. For some the collaborative decision-making process of BIM has arguably brought more exposure to risk. As we will see, despite the fears from those who have yet to use BIM, those who have successfully implemented BIM have found the resulting benefits of higher quality work outweigh the risk exposure.

Interoperability and open standards, discussed in Chapter 8, are instrumental to successful data sharing. With multiple computer operating systems and growing numbers of programs, it is crucial to address how to manage and maintain data exchange without loss of integrity. Use of open standards, a common set of industry definitions, maintains the flow of data between current and future programs.

In Chapter 9, "Data Management," the core concept of BIM, we learn how to manage the single database, set up sharing protocols, and the benefits of tagging data to facilitate later extraction. Chapter 10, "BIM Tools," discusses the types of programs available to the AEC/FM industry that will help you manage this data.

After implementing a BIM workflow, how can firms measure the success of their new process? In Chapter 11 you learn the questions you should ask to ascertain the answer.

The adoption of BIM by the building industry is already reaping rewards. Part I of this book will help to guide you and your firm to a successful implementation of BIM.

CHAPTER 1

What Is BIM?

1.1 Introduction

Building information modeling (BIM) is revolutionizing the building industry. It is replacing the 2-D hand-drafting tools and methodologies that have been the industry standards for centuries at varying rates.

BIM is the process the building industry uses to create the built environment using computers and other digital technologies. The introduction of computer and digital technologies has fundamentally changed the architecture, engineering, construction, and facilities management (AEC/FM) process 2-D format data can be linked to, such that the same piece of data can be viewed and accessed simultaneously. This book provides an overview of the impact of the computer on the building industry and details how BIM is being used in countries around the world.

In this chapter we begin by defining BIM and digital technology. In subsequent chapters we examine in depth the principles of BIM, and look specifically at how BIM is changing the building industry and the concerns the firms of Part I had when transitioning to a BIM process. The case studies in Part II investigate how BIM is being integrated within the building industry worldwide.

BIM is a collaborative process used by the entire building industry including the AEC/FM community, owners, and stakeholders. The BIM database that defines a project can, because of its digital format, be used continually throughout the life cycle of a building. Since the database is assembled in the planning phase, project data can be amended and added through the subsequent design, construction, occupancy, and decommissioning phases. Simply put, BIM is the process of creating and maintaining buildings using digital technology.

The virtual buildings created in computed-aided design (CAD) programs are now a familiar representation of BIM. As seen in Figure 1.1, a building and its systems created by designers and engineers in separate, multiple CAD programs can be overlaid to create a virtual building. The many objects that comprise a building, such as windows, doors, walls, ducts, and piping, can be tagged with information about each component. This information can be extracted in other forms commonly used in the process. Typical examples of extracted information are the schedules produced (door and window schedules), quantity takeoffs and construction labor, and material schedules (see Figures 1.2, 1.3, and 1.4).

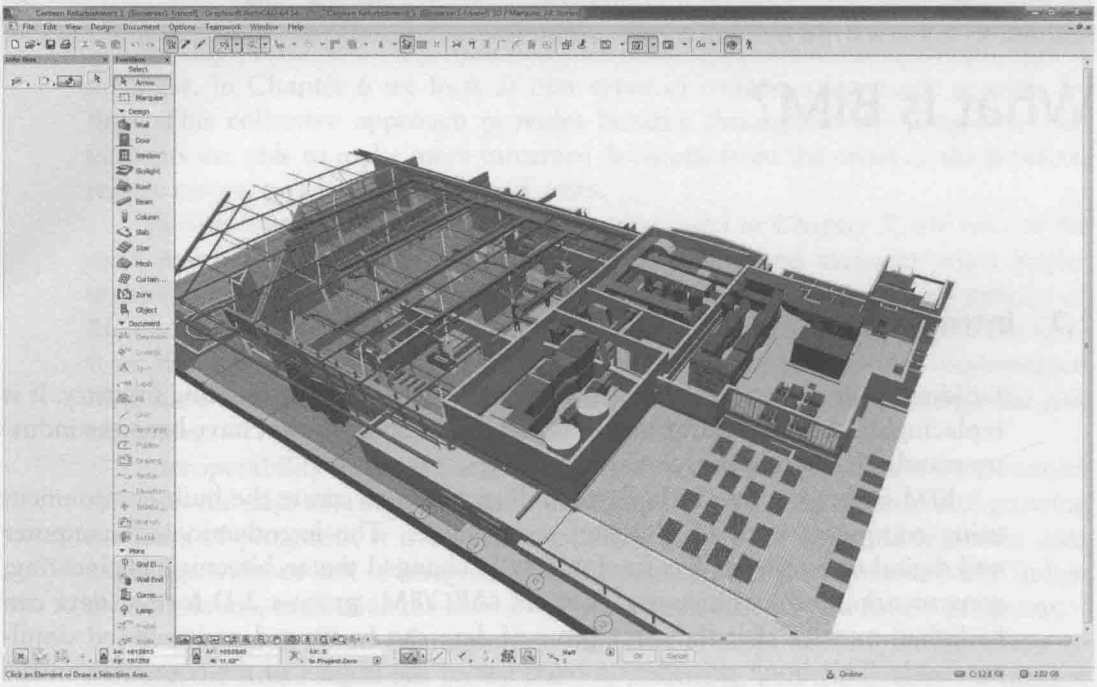

Figure 1.1 Virtual building. Aziz Tayob Architect's Canteen project includes the HVAC system, the structural system, and building design models (see also Chapter 10).

The Internet has played a huge role in shaping the BIM process. Via the Web, information can be gathered, stored, shared, and used by anyone with an Internet connection. Moreover, the 2-D information shown on-screen is derived from the same BIM database as the 3-D representations. As more information becomes available to the construction industry via the Web, the speed with which applicable data can be amassed further compresses the project schedule, saving time and reducing cost.

Adopting a new business process is only done when there are quantifiable benefits. BIM is already showing the potential to produce work more efficiently and in less time, which directly translates to project cost savings. As the BIM process and its database are used throughout a building's life cycle, these benefits will be seen throughout the life cycle and not just from the planning through construction stages.

The implementation of BIM throughout the building industry is still in its infancy. While there has been an upsurge in use of BIM in the AEC/FM sectors in the last decade, its potential has yet to be fully realized. To some extent, this has been hindered by the current global economic problems that are limiting construction.

1.2 BIM: An Elusive Definition

There is much debate over the exact definition of BIM, but a commonality is that BIM reflects the change from the use of analog tools to digital ones. The term *BIM*

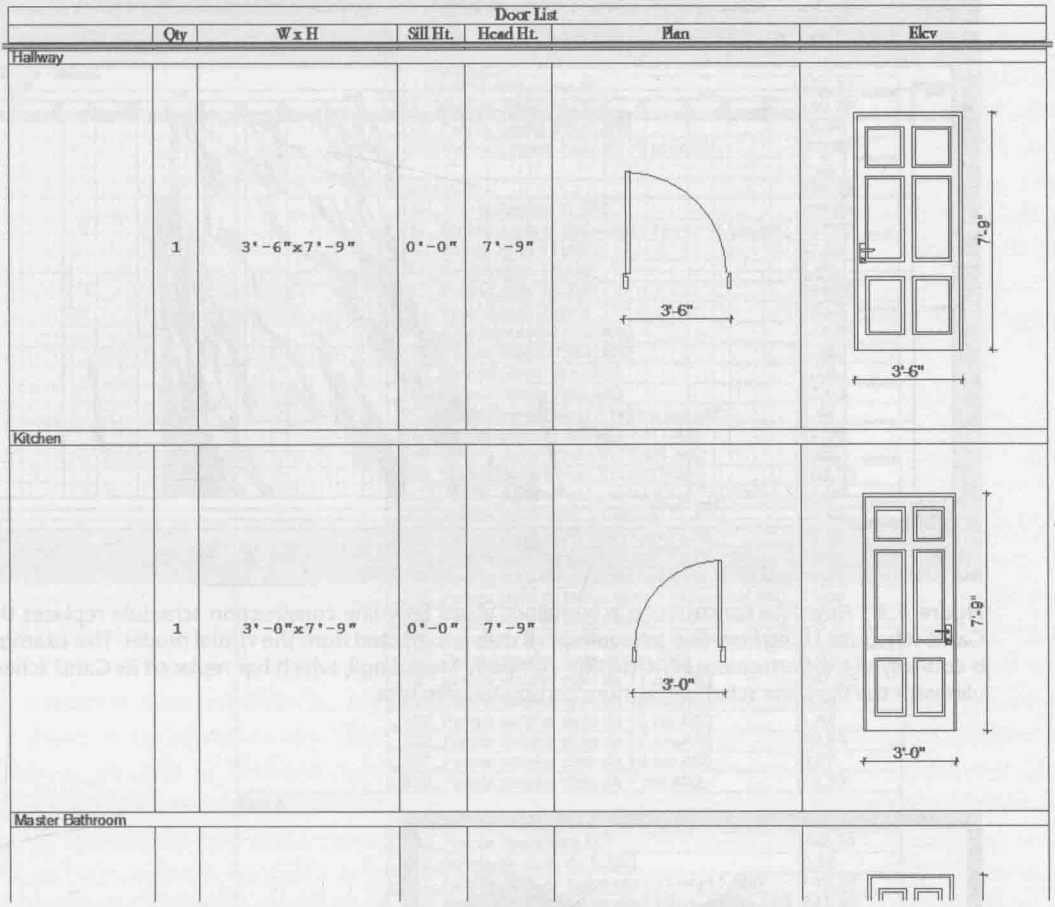

Figure 1.2 Door schedule. Typical door schedule information courtesy of bT Square Peg, Mumbai, India. Project information can include the typical door and window schedules shown here. The schedule data is extracted from the BIM database.

was widely publicized in 2002 by industry analyst Jerry Laiserin [1]. He used it to describe the process that architects begin when integrating digital technology into their workflow. Laiserin has continued to refine his definition [1], expanding it to include the process spanning a building's life cycle from planning through design, construction, occupancy, and, finally, its demolition.

Building refers to any man-made built project, which includes the buildings we inhabit and any other infrastructures such as bridges. *Information* refers to any and all data about the project. *Model* is used here in its scientific definition of *representation* (i.e., any form by which the data or portions thereof can be viewed). We can further define BIM by the words that comprise it.

The 2-D drawings and schedules seen in Figures 1.2, 1.3, and 1.5 are representations of the project database. Although these illustrations are from different projects, their information is extracted from the same BIM database as the 3-D virtual models seen in Figures 1.1 and 1.4. Note that both the 2-D and 3-D representations can be updated.

The architect's 3-D virtual building (VB) is but one representation of a building's information model. The VB models created by the designers are the most