

JOHN G. BROCK

SketchUp

FOR BUILDERS

A COMPREHENSIVE GUIDE FOR
CREATING 3D BUILDING MODELS USING **SKETCHUP**



WILEY

SKETCHUP
FOR BUILDERS

SKETCHUP

FOR BUILDERS

*A Comprehensive Guide
for Creating 3D Building
Models Using SketchUp*

JOHN G. BROCK

WILEY

Cover image: Courtesy of John Brock
Cover design: Wiley

Copyright © 2019 by John Wiley & Sons, Inc. All rights reserved.
Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor the author shall be liable for damages arising herefrom.

For general information about our other products and services, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley publishes in a variety of print and electronic formats and by print-on-demand. Some material included with standard print versions of this book may not be included in e-books or in print-on-demand. If this book refers to media such as a CD or DVD that is not included in the version you purchased, you may download this material at <http://booksupport.wiley.com>. For more information about Wiley products, visit www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Names: Brock, John G., 1965- author.

Title: SketchUp for builders : a comprehensive guide for creating 3D building models using SketchUp / John G. Brock.

Description: 1st edition. | Hoboken, New Jersey : John Wiley & Sons, 2018. | Includes index. |

Identifiers: LCCN 2018029407 (print) | LCCN 2018042478 (ebook) | ISBN 9781119484004 (pbk.) | ISBN 9781119484134 (Adobe PDF) | ISBN 9781119484127 (ePub)

Subjects: LCSH: SketchUp. | Architectural design—Data processing. | Computer-aided design.

Classification: LCC NA2728 (ebook) | LCC NA2728 .B753 2018 (print) | DDC 729.0285—dc23

LC record available at <https://lccn.loc.gov/2018029407>

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Contents

Foreword Duane Addy

vii **Chapter 7: Importing Construction Drawings** **31**

PART I:
SketchUp Essentials

1

Workflow 33

Chapter 1: Introduction

3

Chapter 8: File Management **36**

Who Should Read This Book? 4

Layer Management 37

Why Should You Read This Book? 4

Templates 38

What Is In This Book? 4

PART II:
Phases of Construction **39**

Chapter 2: SketchUp Resources

7

Chapter 9: Existing Site Models **41**

SketchUp Free or SketchUp Pro? 7

Creating The Existing Site Model 44

LayOut 8

Geolocation 49

3D Warehouse 8

Extension Warehouse 8

Other Resources 9

Chapter 10: Foundations **53**

Chapter 3: SketchUp Basics

11

Monolithic Slab-on-Grade 53

The Interface 11

Crawl Space 61

Navigation 13

Basement 78

Parallel Projection Versus Perspective 14

Controlling Costs 100

Scenes 15

Chapter 11: Wall Framing **101**

Layers 15

Chapter 12: Floor Systems **112**

Measurements Box 16

Wood-Framed Floor Systems 112

Basic Tools 16

Case Study 135

Chapter 4: Model Your First Object **21**

Chapter 5: Groups and Components **26**

Chapter 13: Roof Systems **137**

Groups Versus Components 26

Roof Plan(e)s 137

Chapter 6: Extensions (Plugins) **29**

Conventional Roof Framing 148

Relevant Developers 30

Roof Trusses 159

Sub-Fascia 160

Roof Sheathing	162	Foundations	291
Case Study	165	Wall Framing	294
Chapter 14: Exterior Finishes	169	Floor Systems	295
Windows and Exterior Doors	169	Roof Systems	295
Chapter 15: Mechanical, Electrical, and Plumbing Rough-Ins	207	Exterior Finishes	296
Plumbing Rough-In	207	Mechanical, Electrical, and Plumbing (MEP)	297
HVAC Rough-In	208	Interior Finishes	297
Electrical Rough-In	209	Landscaping and Site Work	299
Chapter 16: Interior Finishes	212	PART IV:	
Insulation	212	Construction Documents	301
Drywall	214	Chapter 20: Introduction to LayOut	303
Floor Coverings	219	What Does LayOut Do?	303
Kitchens	238	What Would I Use LayOut For?	304
Bathrooms	244	Model Space and Paper Space	304
Chapter 17: Final Grading and Landscaping	252	PART V:	
Hardscapes	253	Renderings, Animations, and Virtual Tours	311
Proposed Site Model	258	Chapter 21: Renderings	313
Excavation	262	Thea Render	316
PART III:		V-Ray for SketchUp	317
Quantity Takeoffs and Estimating	273	Lumion	317
Chapter 18: Attributes	275	Chapter 22: Animations	323
Length	276	Chapter 23: Virtual Tours	325
Area	279	Chapter 24: Virtual Reality Versus Augmented Reality	328
Volume	282	What Is the Difference Between VR and AR?	328
Weight	285	Enscape	329
Chapter 19: Estimator for SketchUp	286	Index	333
Multitiered Cost Code System	290		
Takeoff Methods	290		

Foreword

I first met John Brock in 2010 at the International Builders Show in Las Vegas through two mutual acquaintances, and it was during this first meeting that I got a glimpse into the mindset of a man who was a dedicated builder, an inventor at heart, a rock star on the weekends, and a man determined to make change. Change the building industry had yet to see. Change that the software industry had yet to see. Little did anyone know change was coming, and it was coming fast.

You see, at the time both John and myself were both equally frustrated with the lack of information 3D Building Information Modeling (BIM) software was providing and what information flowed to and from our job sites. From quantity takeoffs and knowing every detail of a project and its costs, to how the project would look when completed, to how we would build the actual project—these were all things we expected to know *before* digging. Not during and sure as hell not after. We constantly asked:

- ☑ Why is modeling in 3D not industry standard? We don't live in black and white and surely do not live in a 2D world so why do we design and draw that way?
- ☑ Why does this software not allow me to look in simple 3D with one click?
- ☑ Why can't I gain real-world specifications and estimates from something that says it does estimating?
- ☑ Why don't the renderings look real? The box says realistic renderings.

In a matter of minutes, the two acquaintances who had introduced us that fateful day in 2010 were already looking for the exit in hopes of trying to escape the enormous cloud of “Why doesn't the world of building software think like we do?” Honestly, they probably thought, “Mother of all creatures big and small, what have we done?”

Something clicked though. It was at that point we made a pact to make the switch to SketchUp 100 percent. Let's try it. Let's see what we can do. No one else is, so let's be the driving force. For the next eight crazy years we plugged away, pushing limits, building, and, well—crying. Crying a lot, actually. When you spend hours modeling a floor system or stud system and have yet to learn about component modeling, and then realize how quickly you could have done that—well, crying is about all that is left. That being said, we were on to something; we just had to focus it further. How?

Mark Harrison, the marketing manager of SketchUp, once told us that the beauty of SketchUp is that it can be as little or as much as you want it to be; we just needed to think what we wanted it to be and not overthink it.

Over the years systems have been developed, processes created, and John and his crack team of programmers have developed some of the best plugins for the building and design industry I have ever used or been a part of: Estimator, Framer, 360 Spin, Takeoff Area, Takeoff Length, to name a few.

Today I am proud of the accomplishments made. I am proud of John and his enduring love for the industry, his constant pursuit of perfection, and his plugins developed to help designers and builders push the limits of what can be done. This book is a testament to his conviction to the industry and his love for knowledge and the thought that it should be shared. This is a book every designer or builder should have and I know that our company will be introducing it as the main training manual for all our designers to learn from. It is that good.

John, you are my brother, my friend, and my creative partner in crime. I thank you for your contributions to our industry and the dedication you have put toward this book.

It has been an honour (notice the spelling, John) to work with you over the years, share music, and share knowledge. While I am pretty sure we have driven our wives crazy over the years, I know change is happening and your book will continue to lead that charge.

Congratulations on this achievement.

Your Canadian friend,

Duane Addy, Dipl. Arch. Tech.

Creative Director—Design and Product Development

Jayman Built

PART I

SketchUp Essentials

As with any software program, learning SketchUp can be both fun and frustrating! Part One will cover the basic SketchUp fundamentals you must learn before jumping into modeling buildings. This author has learned a tremendous amount about SketchUp do's and don'ts over a decade of trial and error. The goal of this book is to save you countless hours by getting it right the first time, or at least avoiding the mistakes I have made over time!

Note: Your workflow depends upon your needs and use of SketchUp. If you are using SketchUp to design the building from scratch, you may focus on the design at first, keeping in mind the site boundaries. The workflow detailed in this book presumes you are modeling a building and site from a set of construction drawings. Your approach may be different, but the fundamentals, tools, and techniques detailed in this book will work for either approach.

Chapter 1

Introduction

For as long as anyone reading this book can remember, architects, designers, builders, and tradesmen have been using 2D paper drawings to design buildings, estimate quantities, layout buildings, build foundations, build walls, roofs, and install mechanical systems. Builders and trades that are provided with precise details and drawings will execute the building process with precision. This has been going on for centuries, but it is a process that is fraught with unclear or missing details and prone to mistakes, delays, and cost overruns. The designer must convey intent with their drawings and the builder must be able to read, understand, and execute to build the intended structure. For the past three decades, CADD (computer-aided design and drafting) has become the standard, virtually eliminating hand-drawn plans, other than conceptual ideas. But this has still been primarily used for 2D drawings. Typical drawing sets include floor plans, elevations, and a few sections and details. These still may not convey the full design intent or may be missing vital information or views.

We see in 3D, so why don't we design in 3D? Technology is finally available to allow designers and builders to design, view, and study structures in 3D and better understand how to build the structure and how it will look *before* it is built. By now, you have probably heard of BIM (building information modeling), which is essentially the process of creating digital representations of the building process. A large part of BIM involves 3D modeling of the project. SketchUp is a simple yet powerful tool for creating 3D models for any and all components of a building project. SketchUp comes with standard tools for creating,

texturing, organizing, and viewing geometry and they allow third-party developers to create “Extensions,” also known as “Plugins,” which extend the toolset and functionality that comes with the program. These are typically “scripts” utilizing Ruby Programming, a language built into SketchUp. These scripts are usually geometry-creating, time-saving, and reporting extensions that magnify the power and ease of use of SketchUp. Construction Documents can be generated using LayOut, the accompanying program that comes with SketchUp Pro.

WHO SHOULD READ THIS BOOK?

Anyone desiring to create 3D models for any and all aspects or phases of the construction process, from the design itself, to construction and how some or all of the pieces come together. Builders, architects, interior designers, landscape architects, carpenters, and trades will learn methods and techniques to create 3D models for their projects, big and small, as well as how to create construction documents, acquire takeoff information, create renderings, animations, virtual tours, and much more.

WHY SHOULD YOU READ THIS BOOK?

This book summarizes the workflow, practices and methods acquired and developed over years of practice, trial and error, and real-world applications from a seasoned custom home builder and designer with 30 years of experience in the construction industry. You will learn what to do, and more importantly, what *not* to do in modeling projects in SketchUp. The tips scattered throughout the book are worth the read. The goal is not only to create 3D models, construction documents, and visualizations, it is also to understand what you are building *before* it is built, and to avoid costly mistakes, delays, and overruns during the construction process.

WHAT IS IN THIS BOOK?

This book begins by covering SketchUp essentials and will guide the reader through modeling a construction project from start to finish. It is loaded with tips, methods, and tricks that were learned from years of modeling literally every phase of construction, for residential and light commercial, completely inside of SketchUp.

Part One: SketchUp Essentials

- ☑ SketchUp Free versus SketchUp Pro
- ☑ LayOut—an Introduction

- ☑ 3D Warehouse
- ☑ Extension Warehouse
- ☑ Online Resources
- ☑ SketchUp Basics—Review the basic toolsets included with SketchUp and how to navigate in your models.
- ☑ Geometry Creation, and how it relates to construction
- ☑ Groups and Components, and the important differences between the two
- ☑ Plugins/Extensions—How to install and use
- ☑ How to import drawings—Learn how to import and use drawings to create accurate models
- ☑ File management, including layer management and templates

Part Two: Phases of Construction

- ☑ Existing site modeling—Using topographic data to generate existing site models
- ☑ Foundations—Modeling footings, foundations, and slabs
- ☑ Walls—Learn how to model walls from simple to complex framed walls
- ☑ Floor systems—Conventional joists, TJs and floor trusses, subflooring
- ☑ Roof systems—From simplex to complex, conventional framing to trusses
- ☑ Mechanical systems—HVAC ductwork, plumbing, and electrical
- ☑ Exterior finishes—Modeling veneers, windows and doors, and other finishes
- ☑ Interior finishes—Cabinetry, flooring, trim, doors, etc.
- ☑ Final site modeling—Creating the final site model with landscape and hardscape elements

Part Three: Quantity Takeoffs and Estimating

- ☑ Attributes—Learn how to takeoff length, area, volume, and weight for use in your favorite estimating spreadsheet or program
- ☑ Volume—Must be a *solid*! Learn how to ensure and fix
- ☑ Estimator for SketchUp—An estimating extension for SketchUp that provides a disciplined approach to modeling accurate estimates

Part Four: Construction Documents

- ☑ LayOut—Learn how to create construction documents and presentations using LayOut

Part Five: Renderings, Animations, and Virtual Tours

- ☑ Rendering programs
- ☑ Animation programs
- ☑ Virtual tours
- ☑ Virtual reality versus augmented reality

Chapter 2

SketchUp Resources

SketUp offers both a free (web browser) and a paid (Pro—desktop) version, as well as LayOut, the accompanying program (SketchUp Pro), which is used for generating construction documents. This chapter will discuss the available versions of SketchUp and the 3D Warehouse, an online source for viewing and downloading SketchUp models created by users around the world that might prove useful and save you time creating them yourself! We will also discuss the Extension Warehouse, which is essentially an online store for finding and downloading SketchUp extensions, also known as plugins (both free and paid), which may be extremely useful in your workflow. We will also take a look at a variety of other online resources that you may find useful.

SKETCHUP FREE OR SKETCHUP PRO?

At the time of this writing, Trimble recently announced that they were discontinuing their free desktop version, SketchUp Make (SketchUp Make 2017 is apparently the last supported version of the free version and is still available for download at present). The new free version is available in a web browser at www.sketchup.com (Launch SketchUp Free). The interface is different than the Pro version and previous free version (Make). It essentially offers the same drawing tools, navigation and modification tools, materials, layers and scenes, but the use of extensions/plugins is *not* available as of this writing. If you are new to SketchUp or undecided as to whether to jump in, you can always explore the free version online and practice your modeling skills for free. If you are using SketchUp for your business, then you should be using the Pro version. The examples shown in this book are from the SketchUp Pro interface and may appear different if you are using the free browser version to practice along with the book.

LAYOUT

LayOut is installed when you install SketchUp Pro. LayOut is the program to use for generating construction documents and presentations derived from your SketchUp model. We will discuss LayOut in more detail later in this book; this is just an introduction to LayOut and its use. At any point in SketchUp, you can “Send to LayOut,” meaning it will open the current SketchUp scene in LayOut, allow you to choose the paper size, template, borders, etc. for your project. From there, you may manipulate scale, size displayed, add dimensions, notes, text, etc. LayOut is a great tool for creating impressive presentations and construction documents.



3D WAREHOUSE

The 3D Warehouse is an online resource (available in the SketchUp Menu) containing millions of SketchUp models, uploaded and shared by SketchUp users and manufacturers around the world, which allows you to search, view, download, and upload SketchUp models. Perhaps you are looking for a particular item, like a Thermador dishwasher, simply type in the search, choose the one you want and download it directly into your model or save it to your library for later use.

TIP *The 3D Warehouse contains some really excellent models as well as some really bad ones. Many users may not be as organized as you will become. Some models may be bloated, not modeled properly, or contain extra layers that you may not want introduced into your model. Best practice is to NOT download it directly into your model. While I am modeling a project, I prefer to have another occurrence of SketchUp open and download them directly into that open file, where I can inspect them, clean them up, and delete the unwanted layers that they may bring in. Another suggestion, if you will be downloading multiple models, is to name this file “Assets” and save this file to the project’s SketchUp folder. If there are components you may want later, save them to your Components library folder while it is fresh!*



EXTENSION WAREHOUSE

The Extension Warehouse is an online resource (available in the SketchUp menu) full of extensions, also known as plugins, that have been developed especially for SketchUp. Extensions may be free or may require purchasing a license. Licenses may be perpetual (one-time fee) or subscription-based (monthly or yearly). These extensions enable you to add special tools and features to SketchUp, beyond the native tools that come with the program. Extensions are most often time-saving tools and features, typically developed by other SketchUp users who needed a particular tool that did not exist so they developed/programmed one. Anyone can develop an extension for SketchUp, but they need to know how to use the Ruby programming language or hire a programmer to develop it.

The Extension Warehouse enables you to:

- ☑ Search for an extension by name, author, or the functionality needed
- ☑ Install the extension with a simple click of a button
- ☑ Manage all installed extensions in one location—Extension Manager

We will discuss a variety of Extensions particularly suited for the construction industry throughout this book.

OTHER RESOURCES

The SketchUp community is vast and there are a number of available online resources to learn from, get support, and download additional extensions perhaps not available on the Extension Warehouse.

SketchUp Forum

The SketchUp team hosts a forum at www.forums.sketchup.com, where users may visit and search for topics of interest and learn from users around the world, many of whom most likely have experienced the same issue you have and may provide helpful information. It is great place to learn about new methods and new products.

Sketchucation.com

A popular online resource is www.sketchucation.com, where you may visit and find a variety of useful tips and tricks as well as download extensions and models that may or may not be available on the Extension Warehouse and the 3D Warehouse. Sketchucation has thousands of members and has a robust forum you may visit to further your knowledge about SketchUp.

TIP *Sketchucation has an extension available from Sketchucation.com that contains the Sketchucation Store, allowing one to search for and download extensions while in SketchUp, much like the Extension Warehouse.*

Smustard.com

Another popular online resource is www.smustard.com, where you may visit and find a variety of useful plugins and Ruby scripts that may or may not be available on the Extension Warehouse and the 3D Warehouse.

SketchUp Texture Club

As you become more proficient with SketchUp, you will need a particular texture or material for your model that is not available in the stock materials library in SketchUp. We will be discussing how to import materials into your models later in this book, but www.sketchuptextureclub.com is a great source for searching for and downloading seamless textures to use in your models.

TIP *If you are not familiar with the term “seamless texture,” you will need to understand it and its use. In order for a texture (material) to look correct in your model, it must be seamless, meaning there is no pattern that repeats in a undesired manner. For example, you cannot just import a picture of a stone veneer, unless it is seamless, and apply it to your model. You will see a repeating box pattern throughout and not be happy with the results. Take care to search for Seamless textures and/or you may create one yourself using tools such as Photoshop.*

SketchUp for Builders

www.sketchup4builders.com is an online resource for builders to learn about tips and techniques from other builders, learn about the latest extensions and resources, and view tutorials specifically created for the building community.

Chapter 3

SketchUp Basics

This chapter is intended for newbies to SketchUp. If you already know the basic fundamentals and basic tools that come with SketchUp, you can proceed to the next chapter—but you may find this helpful!

Builders use basic tools—hammer, saws, etc. In SketchUp, we have several basic tools that come installed with the program, as well as numerous *extensions*, also known as *plugins* (both free and paid), that expand SketchUp's capabilities. This book will detail the use of the native tools as well as popular plugins for the construction industry in later chapters.

In this chapter, you will learn how to navigate in SketchUp, understand the core features, learn how to draw, modify, and view attributes of geometry, and finally how to model your first 3D object—a cubic yard of concrete!—all from the perspective of a builder. A cube is a simple object, but creating it covers some basic fundamentals of SketchUp, as well as viewing the quantities builders need for takeoffs to generate estimates. The goal of this chapter is to cover the highlights and need-to-know features and functions, and not detail every available tool and function in SketchUp.

Let's get started!

THE INTERFACE

TIP *Keep your toolbars to a minimum. Take a look at the main set of tools in the image above, you will find you use keyboard shortcuts for many of these tools and can eliminate as many toolbars as possible, providing more viewable real estate. I recommend limiting yourself to one strip of tools across the top.*

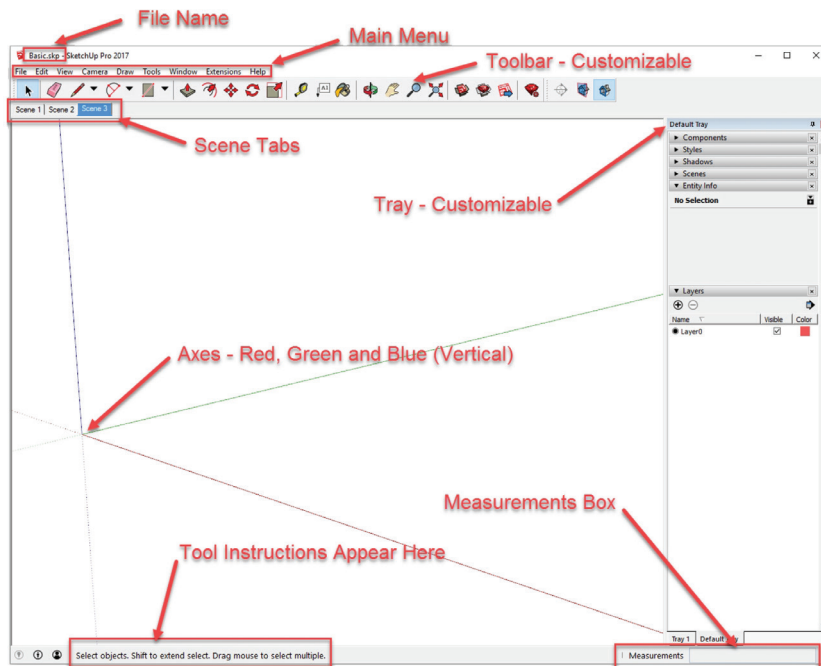


Figure 3.1 The SketchUp Interface.

The SketchUp Interface in Figure 3.1 is broken down to the following main areas, which we will explore in much more detail later:

- ☑ *File name.* SketchUp files have .skp file extensions and backup files are named with .skb file extension. *Note:* SketchUp automatically backs up your file (.skb) at intervals you may control.
- ☑ *Main menu.* You can access most features from here but note there are keyboard shortcuts and tool icons that access these functions and features as well.
- ☑ *Toolbar.* This strip is a customizable set of tools and extensions—most can be placed anywhere you like on the screen. The Getting Started strip of tools contains a lot of the most used tools. You can add to it from there to build your own toolbar of favorites.
- ☑ *Scene tabs.* You can create as many Scenes as you like—a scene is basically a saved VIEW with desired parameters we will discuss later. With scenes, you can export a 2D graphic of a scene or a 3D animation of your scenes. You can transition between scenes, meaning it will fly to the next scene in an interpolated path, or off for a no-scene transition.
- ☑ *Axes.* By default, SketchUp axes (X, Y, and Z) are red, green, and blue (Vertical).
- ☑ *Trays.* SketchUp trays are containers for various windows (Layers, Materials, Scenes, etc.). The Tray locations are movable and dockable, and content is customizable. You can create your own customized Trays as well. We will discuss each of these in detail later.

- ☑ *Measurements box.* This box in the lower right corner of your screen is known as the Measurements Box (formerly known as the VCB—Value Control Box). The name displayed will change depending upon command activated.
- ☑ *Tool instructions.* You will notice as you use certain tools, that specific instructions will appear in this box, depending upon selected tool.

TIP *You can hide the Trays (as seen docked to the right in the image above) to enlarge your viewable space. You can use a keyboard shortcut, like Ctrl-D, to toggle the visibility!*

Now that you are familiar with the basic Interface or Workspace, I will review some of the most important features and functions you need to know, starting with viewing and navigating your models in SketchUp.

NAVIGATION

One of the most important skills to master in SketchUp is learning how to navigate or move around your models. This can be a little awkward and even frustrating at first, which is why I want to discuss it right from the start. Navigation commands are located in Camera under the Main Menu, and are included in the basic toolset. I recommend that you practice these commands first to understand the basic navigation. While there are several navigation methods, the following are the most used and most important to start with:



ORBIT: Click on the icon or press O (keyboard shortcut)—hold down the left mouse button or scroll wheel on your mouse and move your mouse to orbit about the model. Note that if you hold down Shift while orbiting, the icon will switch to Pan (below) for easier navigation.



PAN: Click on the icon or press H (keyboard shortcut)—hold down the left mouse button and move your mouse to pan about the model. *Note:* You may be panning about the model holding down the left mouse button, then hold down the scroll wheel to Orbit as necessary before resuming pan.



ZOOM: Click on icon or press Z (keyboard shortcut)—hold down the left mouse button and move your mouse up and down to zoom in and out. However, if you have a scroll wheel on your mouse, this will do the same and become your best friend.

The commands above are your daily, go-to methods for navigating. There are some other options in the same menu that you should be aware of that may come in handy from time to time.



POSITION CAMERA: Position the camera view with a specific location, eye height and direction. Let's say you are looking at a house model and would like to go into a particular room. You can click on this icon and click on the floor where you want to go, perhaps the center of the room, and this will position the camera at eye level in that room. You can then Look Around.



LOOK AROUND: Pivot the camera around a stationary point. This command will automatically be invoked when using the preceding Position Camera command. Basically, you hold down the left mouse button and move the mouse to look around as if you're moving your head all around to view something.



WALK: Walk with the camera. Hold down the left mouse button and move your mouse to walk in that direction.



TIP *After you have mastered the basic navigation, and you become a fellow SketchUp junkie, I would highly recommend that you purchase a 3D mouse (www.3dconnexion.com)—I have several SpaceNavigators and do not leave home without one (I carry a wireless version with my laptop). This device costs about \$100 and is used in conjunction with a standard mouse. I keep my left hand on the SpaceNavigator, which allows you to smoothly navigate about your model, combining most of the above commands in a seamless and smooth motion. Basically it is a puck, akin to a joystick, that you can toggle to zoom, pan, and orbit. It takes a bit of getting used to but it is well worth it!*

PARALLEL PROJECTION VERSUS PERSPECTIVE

When viewing a SketchUp model, you will be in either Parallel Projection (lines are parallel in 2D and 3D) or Perspective view. These are also located under Main Menu—Camera. I prefer to view models in Perspective view versus Parallel Projection, but use Parallel Projection when viewing an object straight on or in plan view.

A good example of this is floor plans and elevations. To view these properly, you should be in Parallel Projection and can choose from standard views (top, bottom, front, back, right, left, iso). I suggest taking the time to create keyboard shortcuts for these views. Go to Window > Preferences > Keyboard Shortcuts. You can search for the command you wish to assign a shortcut. For example, I like to toggle Parallel Projection and Perspective, I chose to use V as my keyboard shortcut to toggle back and forth. I also created shortcuts for the Standard Views. I use Alt-T for top view, the Shift-right arrow for right, Shift-left arrow for left, Shift-down arrow for front, and the Shift-up arrow for back, but use shortcuts that make sense to you.

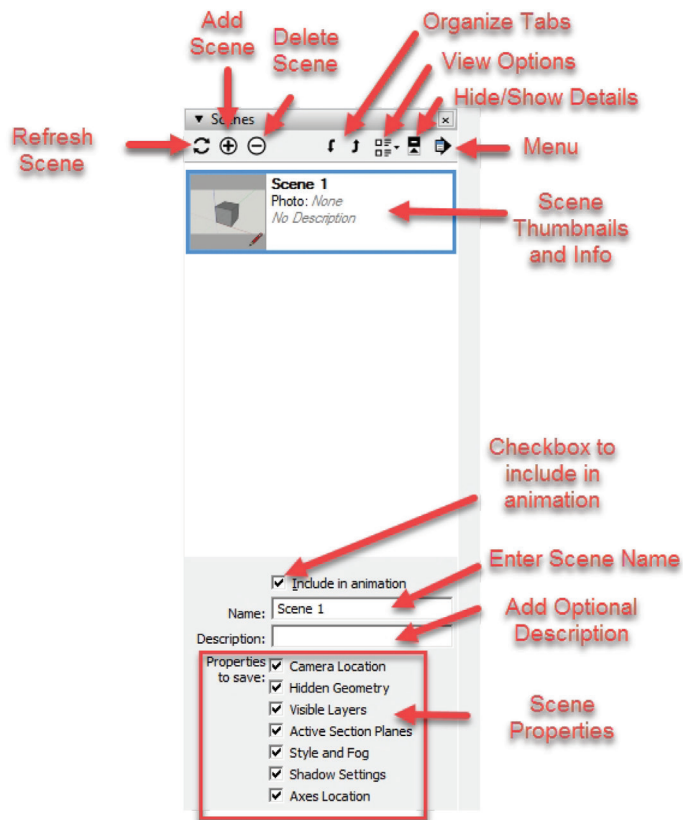


Figure 3.2 Scenes.

SCENES

Scenes provide a great way to capture as many saved views of your model as you wish. By creating scenes, saved with desired parameters we will discuss later, you may switch from various views of the model using the Scenes tabs. For example, I will be creating scenes for various phases of construction in this book. Scenes are a great way to control visibility of the various phases, cutting layers off and on, etc. Let's take a look at the Scenes Window in Figure 3.2.

LAYERS

Layers in SketchUp are used primarily to **control visibility**, but I will also be discussing the use of Layers for estimating purposes later in this book. For now, just understand that assigning objects to layers helps control visibility and organization.

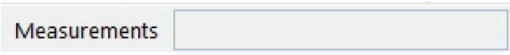


Figure 3.3 Measurements Box.

TIP *Always model on Layer0! You may think you are saving time by selecting the radio button next to the current layer you are modeling on, but you may forget or later group something and lose track of the item if that layer is off. We will be discussing layers in detail throughout this book.*

MEASUREMENTS BOX

Notice the box in the lower right corner of your screen. This is known as the Measurements Box (formerly known as the VCB—Value Control Box). This is where you will be able to view and enter parameters. The name of this box will change depending upon what you are modeling. For example, if you were to draw a line (discussed below), the name would change to length. We will discuss this later in this chapter, but for now be aware of its location and general purpose. Figure 3.3 features the Measurements Box.

BASIC TOOLS

Now that you have taken a look at the interface and have reviewed navigation, scenes, etc., let's take a look at some of the basic tools.

Select

The Select icon lets you choose an object in your model. Pressing the keyboard spacebar will invoke the Select tool as well. You will use this often!



SELECT: Click on icon or press spacebar—left-click to select an object. Whatever is selected will be highlighted in blue. To select multiple items, hold down the Ctrl key while selecting additional items. To remove an item from this current selection, hold down the Shift key while selecting items to remove from the current selection. To select items using your mouse, there are two methods you need to understand. Holding down the left mouse button and dragging downwards and to the right (notice the rectangular box outline) will select any item fully in that box *only*. Holding down the left mouse button and dragging upwards and to the left, will select anything it touches. There are times when you will use both of these options and it will become second nature.

Geometry

Before you dive into a SketchUp model, you need to understand the basic geometry and attributes in SketchUp. We discuss length, area, and volume attributes throughout this book, as well as how to report

these attributes for takeoffs and estimating. But first, let's take a look at how to create basic geometry in SketchUp. Take time to practice the following draw commands:



LINE: Click on icon or press L (keyboard shortcut)—left-click to start a line and click again to end it. Lines are Edges in SketchUp, a term you will see throughout. As mentioned above, the Measurements Box will now be labeled Length and you can view the length of the line as you draw it, or you can type in the desired length. Notice a line will align to the red, green, or blue axes as you draw, so you may be assured that your lines are on axis, unless you do not want them to be.



ARC: Click on icon or press A (keyboard shortcut)—left-click to start an arc and click again on its endpoint (notice the Measurements box will now be labeled Length and you can enter or view the length), then click again to define the bulge distance (notice that the Measurements box is now labeled Bulge Distance). Arcs are also edges. (*Note:* In SketchUp, arcs are not really curves, they are segments of lines that form a curve; the more segmented, the smoother the curve will appear. You can select the number of segments by typing it into the Measurements box after selecting endpoint and prior to selecting Bulge Distance, for example, 30S for 30 segments.)



CIRCLE: Click on icon or press C (keyboard shortcut)—left-click to start a circle and click again on its desired radius (notice the Measurements box will now be labeled Radius and you can enter or view the Radius). Circles will automatically create a face, a term you will see throughout. (*Note:* The same holds true as for arcs. Circles are really line segments that create the closed circle and you can increase the segments for smoother circle, for example 30S for 30 segments.)



RECTANGLE: Click on icon or press R (keyboard shortcut)—left-click to start the rectangle (notice the Measurements box will now be labeled Dimensions and you can enter or view the X and Y dimensions, separated by a comma), and click again on its desired size (or enter X and Y dimensions). SketchUp will automatically generate a face for this rectangle.

Edges and Faces

As we discussed earlier, lines are edges, and circles and rectangles (and other closed polygons in the same plane/surface) create faces. Faces are bounded by edges. Every **face** in SketchUp has a front face (white) and a back face (blue/gray). It is important that you use the front faces in your model. While you can texture this back face (take it from my experience), many rendering programs ignore the back face and the item becomes invisible in the rendering. To reverse a face, right-click on the face and choose Reverse Faces. There is much discussion throughout this book about faces. For now, just understand the difference between the two faces.

Entity Info

Entity Info is a dialog box and one you need to familiarize yourself with and have handy in your tray (we will discuss trays later). Trays can be accessed in the Window tab of the main menu. Entity Info will display information on your current selection—using the previously mentioned Select tool. Entity Info will be discussed in detail throughout this book, but let's take a look at how to view Entity Info for the edges and faces discussed above:

When you select an edge, the Entity Info dialog box will display the length of the edge selected, as shown in Figure 3.4.

When you select a face, the Entity Info dialog box will display the area of the face selected, as shown in Figure 3.5.

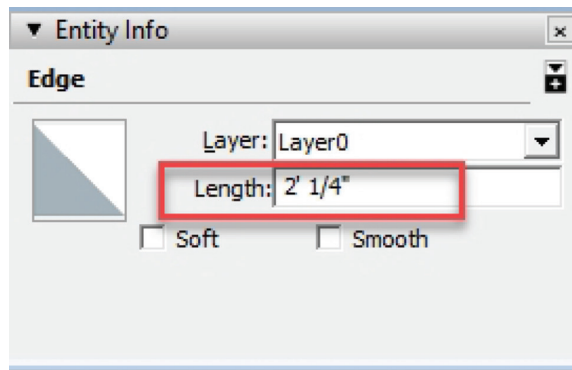


Figure 3.4 Edge Length.

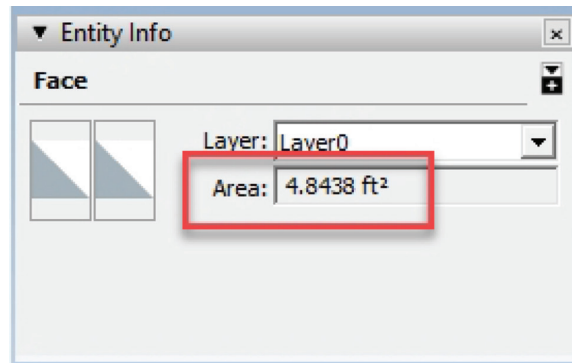


Figure 3.5 Face Area.

Tools

Now that we have learned how to draw geometry, there are a number of tools for manipulating and working with the geometry and objects you model.



MOVE: Click on icon or press M (keyboard shortcut)—left-click on the item to move it. The move tool is also the COPY tool.



COPY: Perhaps confusing at first, but to copy an item, click on icon or press M (keyboard shortcut)—then press Ctrl (or Command on Mac) to toggle move/copy. You will notice a + added to the move icon. Copy the item to desired location.

Note: If you wish to make multiple copies, simply type in * # (# = number of copies) if you want to fill a space with a set number of copies in between, use /# (# = number of equal spaces).



ROTATE: Click on icon or press Q (keyboard shortcut) and hover over the point you wish to rotate the object upon—you will then be able to choose the axis for rotation (you can change the axis using the arrow keys—left-click on the desired point, and then align the protractor choosing the other point of rotation by left-clicking on it, then rotate to desired position).

Note: You may also enter the angle desired in the Measurement box, which will now be labeled Angle.) Similar to Move/Copy, you can toggle a copy of the item to be rotated by pressing Ctrl (or Command on a Mac) to toggle rotate/copy—you will notice a + added to the Rotate icon. Rotate to desired angle.



SCALE: Click on icon or press S (keyboard shortcut)—you will notice a series of green control points. You may select any control point to transform/scale an object. You may also enter a scale factor in the Measurements box, which is now labeled Scale. A best practice with an object is to study how each control point functions.



PUSH/PULL: The most iconic tool in SketchUp. Click on icon or press P (keyboard shortcut)—Push/Pull is used to extrude a face by pulling it or pushing it a desired distance.

Note: You may also enter the desired distance in the Measurement box, which will now be labeled Distance.) This tool also allows you to keep a face in place *before* you Push/Pull, by pressing Ctrl (or Command on Mac) to toggle this feature.



OFFSET: Click on icon or press F (keyboard shortcut)—Offset is used on faces to offset edges to subdivide/create new faces. (*Note:* You may also enter the desired distance in the Measurement box, which will now be labeled Distance.) A good example of this would be a building outline/face—you could offset the outside wall by the thickness of the wall and it will create a face for the wall to be extruded using Push/Pull.



FOLLOW ME: The follow me tool will extrude a face along a given path.



TAPE MEASURE: click on icon or press T (keyboard shortcut)—The tape measure tool is a quick and easy way to measure between two points in a model. The length will be displayed in the Measurement box, now labeled Length. The tape measure tool can also be used to create guides for offsetting from existing lines or guides. Guides will be discussed later in this book.



PROTRACTOR: The Protractor Tool will create angular guides; it is similar to the Rotate tool in functionality. Select the Protractor icon and left-click on a desired axis point, then click an endpoint, then rotate the desired angle (or enter an angle in Measurements box, now labeled Angle) to create a angle guide.

Keyboard Shortcuts

SketchUp allows users to assign keyboard shortcuts, which are customizable to the user. SketchUp comes with numerous shortcuts already assigned, as detailed above. But you can change these shortcuts as well as create your own for just about any function. Go to *Windows > Preferences > Shortcuts* to view and customize. Once you get up to speed, jot down some of your most used or favorite commands, or even plugins, and assign it to a shortcut! You will likely add quite a few of these as you progress.

TIP *Right-click anywhere in the toolset area to view all of your available tools to open. This saves space in your toolbar and allows you to easily open extensions or tools as you need them.*