

Exploring Autodesk Revit MEP 2014

CADCIM Technologies

*525 St. Andrews Drive
Schererville, IN 46375, USA
(www.cadcim.com)*

Contributing Author

Sham Tickoo

*Professor
Purdue University Calumet
Hammond, Indiana, USA*





CADCIM Technologies

Exploring Autodesk Revit MEP 2014
Sham Tickoo

Published by CADCIM Technologies, 525 St Andrews Drive, Schererville, IN 46375 USA.
© Copyright 2013 CADCIM Technologies. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in the database or retrieval system without the prior permission of CADCIM Technologies.

ISBN 978-1-936646-42-5

NOTICE TO THE READER

Publisher does not warrant or guarantee any of the products described in the text or perform any independent analysis in connection with any of the product information contained in the text. Publisher does not assume, and expressly disclaims, any obligation to obtain and include information other than that provided to it by the manufacturer.

The reader is expressly warned to consider and adopt all safety precautions that might be indicated by the activities herein and to avoid all potential hazards. By following the instructions contained herein, the reader willingly assumes all risks in connection with such instructions.

The publisher makes no representation or warranties of any kind, including but not limited to, the warranties of fitness for particular purpose or merchantability, nor are any such representations implied with respect to the material set forth herein, and the publisher takes no responsibility with respect to such material. The publisher shall not be liable for any special, consequential, or exemplary damages resulting, in whole or part, from the reader's use of, or reliance upon this material.

DEDICATION

*To teachers, who make it possible to disseminate knowledge
to enlighten the young and curious minds
of our future generations*

*To students, who are dedicated to learning new technologies
and making the world a better place to live in*

SPECIAL RECOGNITION

*A special thanks to Mr. Denis Cadu and the ADN team of Autodesk Inc.
for their valuable support and professional guidance to
procure the software for writing this textbook*

THANKS

*To the faculty and students of the MET department of
Purdue University Calumet for their cooperation*

To employees of CADCIM Technologies for their valuable help

Online Training Program Offered by CADCIM Technologies

CADCIM Technologies provides effective and affordable virtual online training on various software packages including Computer Aided Design and Manufacturing (CAD/CAM), computer programming languages, animation, architecture, and GIS. The training is delivered 'live' via Internet at any time, any place, and at any pace to individuals as well as the students of colleges, universities, and CAD/CAM training centers. The main features of this program are:

Training for Students and Companies in a Classroom Setting

Highly experienced instructors and qualified Engineers at CADCIM Technologies conduct the classes under the guidance of Prof. Sham Tickoo of Purdue University Calumet, USA. This team has authored several textbooks that are rated "one of the best" in their categories and are used in various colleges, universities, and training centers in North America, Europe, and in other parts of the world.

Training for Individuals

CADCIM Technologies with its cost effective and time saving initiative strives to deliver the training in the comfort of your home or work place, thereby relieving you from the hassles of traveling to training centers.

Training Offered on Software Packages

CADCIM Technologies provides basic and advanced training on the following software packages:

CAD/CAM/CAE: CATIA, Pro/ENGINEER Wildfire, SolidWorks, Autodesk Inventor, Solid Edge, NX, AutoCAD, AutoCAD LT, Customizing AutoCAD, AutoCAD Electrical, EdgeCAM, and ANSYS

Computer Programming: C++, VB.NET, Oracle, AJAX, and Java

Animation and Styling: Autodesk 3ds Max, 3ds Max Design, Maya, and Alias

Architecture and GIS: Autodesk Revit Architecture, AutoCAD Civil 3D, Autodesk Revit Structure, AutoCAD Map 3D, Autodesk Navisworks, and Autodesk Revit MEP

For more information, please visit the following link:

<http://www.cadcim.com>

Note

If you are a faculty member, you can register by clicking on the following link to access the teaching resources: ***<http://www.cadcim.com/Registration.aspx>***. The student resources are available at ***<http://www.cadcim.com>***. We also provide **Live Virtual Online Training** on various software packages. For more information, write us at ***sales@cadcim.com***.

Table of Contents

Dedication	iii
Preface	xiii

Chapter 1: Introduction to Autodesk Revit MEP 2014

Introduction to Autodesk Revit MEP	1-2
Mechanical Discipline	1-2
Electrical Discipline	1-2
Plumbing Discipline	1-2
Autodesk Revit MEP as a Building Information Modeler (BIM)	1-3
Basic Concepts and Principles	1-3
Understanding the Parametric Building Modeling Technology	1-5
Terms Used in Autodesk Revit MEP	1-5
Creating an MEP Model Using Parametric Elements	1-7
Visibility/Graphics Overrides, Scale, and Detail Level	1-8
Extracting Project Information	1-8
Creating an MEP Drawing Set	1-9
Creating an Unusual Building Geometry	1-9
Flexibility of Creating Special Elements	1-9
Creating Services Layouts	1-9
Working on Large Projects	1-10
Working in Large Teams and Coordinating with Consultants	1-10
Starting Autodesk Revit MEP 2014	1-10
User Interface	1-12
Title Bar	1-12
Ribbon	1-13
Application Frame	1-15
Status Bar	1-17
View Control Bar	1-17
Options Bar	1-17
Type Selector	1-18
Drawing Area	1-18
Project Browser	1-18
Keyboard Accelerators	1-19
Properties Palette	1-19

Dialog Boxes	1-20
Multiple document Environment	1-20
Interoperability of Autodesk Revit MEP	1-21
Building Information Modeling and Autodesk Revit MEP 2014	1-22
Worksharing using Revit Server	1-22
Autodesk Revit MEP Help	1-24
Using the Local Revit MEP 2014 Help	1-24
Using the Autodesk WikiHelp	1-25
Using the Context Sensitive Help	1-26

Chapter 2: Getting Started with an MEP Project

Overview of an MEP project	2-2
Essentials for an MEP Project	2-2
Starting a New Project in Revit MEP	2-3
Project Units	2-4
Common Unit Type	2-5
HVAC Unit Type	2-8
Electrical Unit Type	2-9
Piping Unit Type	2-10
Project Templates	2-11
Creating a Custom Project Template	2-11
Settings for the Project Template	2-12
Linking Revit Models and Sharing Coordinates	2-19
Linked Revit Models in the Project Browser	2-21
Converting Linked Models to Groups - Binding Links	2-21
Controlling the Visibility of Linked Models	2-22
Managing Links	2-23
Including Elements of Linked Models in Schedules	2-23
Copying Linked Model Elements	2-24
Copying and Monitoring Linked Model Elements	2-25
Snaps tool	2-25
Dimension Snaps Area	2-25
Object Snaps Area	2-26
The Temporary Overrides Area	2-27
Saving an MEP project	2-28
Using the Save As Tool	2-28
Using the Save Tool	2-28
The Options Dialog Box	2-29
General Tab	2-30
Graphics Tab	2-31
File Locations Tab	2-32
Rendering Tab	2-33
Check Spelling Tab	2-33

SteeringWheels Tab	2-34
ViewCube Tab	2-36
User Interface Tab	2-37
Closing an MEP Project	2-38
Exiting an MEP Project	2-38
Opening an existing MEP project	2-38
Opening an Existing Project Using the Open Tool	2-38
Using the Windows Explorer to Open an Existing Project	2-40
Tutorial 1 - Office Space	2-40
Self Evaluation Test	2-50
Review Question	2-50
Exercise 1 - Power Plant	2-51

Chapter 3: Creating Building Envelopes

Introduction	3-2
Levels	3-2
Understanding Level Properties	3-4
Adding Levels	3-7
Modifying Level Parameters	3-10
Controlling the Visibility of Levels	3-10
Working with Grids	3-11
Creating Grids	3-11
Modifying Grids	3-14
Grid Properties	3-15
Reference Planes	3-17
Work Planes	3-17
Setting a Work Plane	3-17
Controlling the Visibility of Work Planes	3-18
Working with Project Views	3-18
Viewing a Building Envelope	3-18
Overriding the Visibility/Graphic of an Element	3-19
Overriding the Visibility/Graphic of Element Category	3-21
Making Elements Transparent	3-22
Using the Temporary Hide/Isolate Tool	3-22
Plan Views	3-23
Elevation Views	3-25
Section Views	3-27
Using the Scope Box Tool	3-30
Understanding Wall Types	3-32
Exterior Wall Type	3-32
Creating Architectural Walls	3-33
Specifying Architectural Wall Properties	3-33
Sketching Walls	3-38

Using Doors In a Building Model	3-42
Adding Doors	3-42
Understanding Door Properties	3-43
Adding a Door to a Wall	3-46
Adding Windows In a Building Model	3-48
Adding Windows	3-49
Understanding Window Properties	3-49
Adding a Window to a Wall	3-51
Doors and Windows as Wall Openings	3-52
Openings In the Wall	3-53
Creating Architectural Floors	3-53
Sketching the Floor Boundary	3-54
Placing Ceilings	3-56
Creating an Automatic Ceiling	3-56
Sketching a Ceiling	3-57
Using the Pick Walls Method	3-58
Modifying a Ceiling	3-59
Creating Rooms	3-59
Adding Rooms	3-60
Calculating Room Volumes	3-64
Cutting Openings In a Wall, Floor, and Ceiling	3-65
Tutorial 1 - Building Envelope I	3-67
Tutorial 2 - Building Envelope II	3-83
Self Evaluation Test	3-97
Review Question	3-97
Exercise 1 - Residential Building	3-98

Chapter 4: Creating Spaces and Zones and Performing Load Analysis

Introduction	4-2
Space Modeling for Building Analysis	4-2
Creating Spaces	4-2
Modifying the Spaces	4-8
Color Schemes	4-16
Creating and Editing Color Schemes	4-17
Applying a Color Scheme to the Spaces	4-20
Adding Color Scheme Legends	4-20
Modifying a Color Scheme	4-21
Modifying a Color Scheme Legend	4-21
Creating Zones from Spaces	4-22
Adding and Modifying HVAC Zones	4-22
Performing Heating and Cooling Load Analysis	4-25
Tutorial 1 - Placing Spaces- Office Space	4-29

Tutorial 2 - Creating Zones- Office Space	4-41
Tutorial 3 - Heating and Cooling Load Analysis	4-45
Self Evaluation Test	4-53
Review Question	4-53
Exercise 1 - Creating Spaces	4-54

Chapter 5: Creating an HVAC System

Introduction	5-2
Creating an HVAC System	5-2
Adding Supply Air Terminals	5-2
Adding Air Equipments	5-3
Creating Air Supply System	5-4
Creating Return Air Terminals, Air System, and Air Ductwork	5-7
Inspecting the Duct System	5-7
Checking the Duct System	5-8
Creating Duct Legend	5-8
Different Components In an HVAC Systems	5-8
Recommended Practices for Creating HVAC Systems	5-12
Generating HVAC System Layouts	5-13
Creating Ducts and Duct Fittings	5-16
Creating Ducts	5-17
Tutorial 1 - Placing Air Terminals	5-20
Tutorial 2 - Creating Schedules-Air Terminals	5-27
Self Evaluation Test	5-32
Review Question	5-33
Exercise 1- HVAC System	5-33

Chapter 6: Creating an Electrical System

Introduction	6-2
Adding Electrical Equipment	6-2
Adding Transformers	6-2
Placing Switchboard Components	6-5
Placing the Panel Board or Distribution Board	6-7
Adding Power and System Devices	6-9
Adding Electrical Fixtures	6-10
Adding Lighting Devices	6-12
Adding Communication Devices	6-14
Adding Lighting Fixtures	6-15
Type Properties of a Lighting Fixture	6-16
Specifying the Electrical Settings	6-18
Setting the Wires	6-19
Setting the Voltage Definition	6-25

Setting the Distribution System	6-26
Setting the Load Calculations	6-26
Setting the Panel Schedules	6-28
Creating Power Distribution System	6-28
Performing Lighting Analysis	6-30
Creating Circuits	6-30
Adding wires to the Circuit	6-31
Tutorial 1 - Planning the Electrical Systems	6-32
Tutorial 2 - Analyzing the Illumination Requirement	6-37
Tutorial 3 - Adding the Lighting Fixtures and Switches	6-50
Self Evaluation Test	6-58
Review Question	6-58
Exercise 1 - Placing Lighting Fixtures and Switches	6-59

Chapter 7: Creating Plumbing Systems

Introduction	7-2
Creating a Plumbing System	7-2
Adding Plumbing Fixtures	7-2
Specifying the Pipe Settings	7-6
Routing Pipes in the Pipe System	7-13
Modifying a Pipe Segment	7-21
Placing Fittings	7-21
Placing Pipe Accessories	7-23
Tutorial 1 - Office-Space	7-24
Self Evaluation Test	7-38
Review Question	7-38
Exercise 1 - Community-Center	7-39

Chapter 8: Creating Fire Protection System

Introduction	8-2
Fire Protection Systems	8-2
Sprinkler Libraries	8-3
Piping Tools	8-3
Wet and Dry Fire Protection Systems	8-4
Designing the Fire Protection System	8-5
Setting Up a Fire Protection System Project	8-5
Creating the Space Schedule	8-8
Placing Sprinkler Heads	8-9
Connecting the Sprinklers	8-10
Tutorial 1 - Office Space- Fire Suppression	8-12
Self Evaluation Test	8-20
Review Question	8-21
Exercise 1- Fire Protection System	8-21

Chapter 9: Creating Construction Documents

Introduction	9-2
Dimensioning	9-2
Types of Dimensions	9-2
Using Temporary Dimensions	9-3
Entities in a Dimension	9-4
Adding Permanent Dimensions	9-6
Modifying Dimension Parameters	9-12
Locking Permanent Dimensions	9-14
Converting Temporary Dimensions into Permanent Dimensions	9-14
Text Notes	9-15
Adding Text Notes	9-15
Editing Text Notes	9-17
Adding Tags	9-19
Tagging Elements by Category	9-19
Tagging All Elements in a View	9-22
Callout Views	9-23
Creating a Callout Using the Rectangle Tool	9-24
Creating Callout Using the Sketch Tool	9-25
Displaying Callout View	9-25
Modifying the Properties of a Callout View	9-25
Creating Details in a Callout View	9-26
Drafting Details	9-27
Creating a Drafting View	9-27
Drafting a Detail	9-28
Duplicating Views	9-28
Creating Duplicate View as Dependent View	9-28
Sheets	9-29
Adding a Drawing Sheet to a Project	9-29
Adding Views to a Drawing Sheet	9-30
Modifying a Building Model in Sheets	9-33
Adding Schedules to a Drawing Sheet	9-34
Tutorial 1 - Office Space-Tags	9-35
Tutorial 2 - Office Space- Sheet	9-40
Self Evaluation Test	9-46
Review Question	9-46
Exercise 1 - Conference Hall	9-47

Chapter 10: Creating Families and Worksharing

Introduction To Massing	10-2
Understanding Massing Concepts	10-2
Creating the Massing Geometry	10-3
Creating a Massing Geometry in the Family Editor	10-4
Editing a Massing Geometry in the Family Editor	10-12
Creating Cuts in a Massing Geometry Using the Family Editor	10-13

Loading Massing Geometry into the Project	10-14
Placing the Massing Geometry in a Project	10-15
Creating the In-Place Mass in a Project	10-16
Massing in Conceptual Design Environment	10-17
Interface of the Conceptual Design Environment	10-17
Creating Masses in the Conceptual Design Environment	10-18
Worksharing Concepts	10-23
Worksharing Using Workset Tools	10-23
Process of Worksharing	10-23
Saving Methodology in Worksharing	10-29
Element Ownership Concepts	10-30
Tutorial 1 - Dual Duct VAV box	10-31
Self Evaluation Test	10-50
Review Question	10-50
Exercise 1 - Supply Diffusers	10-51

Index**I-1**

Preface

Autodesk Revit MEP 2014 is a Building Information Modeling software developed by Autodesk. This software is primarily used in designing the Mechanical, Electrical, Plumbing, and Piping system of a building. It helps the users to create a Building Information Model (BIM) in which the plans, elevations, sections, schedules, and 3D models can be easily accessed and shared between different users.

The **Exploring Autodesk Revit MEP 2014** textbook explains the concepts and principles of Revit MEP through practical examples, tutorials, and exercises. This enables the users to harness the power of BIM with Autodesk Revit MEP for their specific use. In this textbook, the author explains in details the procedure of evaluating HVAC cooling and heating loads and the usage of tools required for designing HVAC, electrical, and plumbing design. In addition, in this textbook, you will learn tools and concepts for creating families and process to document the final drawings.

In this textbook, special emphasis has been laid on the concepts of space modeling and tools to create systems for all disciplines(MEP). Each concept in this textbook is explained using the detailed description and relevant graphical examples and illustrations. The accompanying tutorials and exercises, which relate to the real world projects, help you understand the usage and abilities of the tools available in Autodesk Revit MEP. Along with the main text, the chapters have been punctuated with tips and notes to make the concepts clear, thereby enabling you to create your own innovative projects.

The main features of this textbook are as follows:

- **Project-based Approach**

The author has adopted the project-based approach and the learn-by-doing theme throughout the textbook. This approach guides the users through the process of creating the designs given in the tutorials.

- **Real-World Designs as Projects**

The author has used real-world building designs and architectural examples as projects in this textbook so that the users can correlate them to the real-time designs.

- **Tips and Notes**

Additional information related to various topics is provided to the users in the form of tips and notes.

- **Learning Objectives**

The first page of every chapter summarizes the topics that are covered in that chapter.

- **Self-Evaluation Test, Review Questions, and Exercises**

Every chapter ends with a Self-Evaluation test so that the users can assess their knowledge of the chapter. The answers to the Self-Evaluation Test are given at the end of the chapter. Also, the Review Questions and Exercises are given at the end of each chapter and they can be used by the Instructors as test questions and exercises.

- **Heavily Illustrated Text**

The text in this book is heavily illustrated with about 200 line diagrams and screen capture images.

Symbols Used in the Text

Note



The author has provided additional information to the users about the topic being discussed in the form of notes.

Tip



Special information and techniques are provided in the form of tips that help in increasing the efficiency of the users.

Formatting Conventions Used in the Text

Please refer to the following list for the formatting conventions used in this textbook.

- Names of tools, buttons, options, browser, palette, panels, and tabs are written in boldface.
Example: The **Duct** tool, the **Modify** button, the **HVAC** panel, the **Systems** tab, **Properties Palette**, **Project Browser**, and so on.
- Names of dialog boxes, drop-downs, drop-down lists, list boxes, areas, edit boxes, check boxes, and radio buttons are written in boldface.
Example: The **Options** dialog box, the **Wire** drop-down in the **Electrical** panel of the **Systems** tab, the **Name** edit box in the **Name** dialog box, the **Chain** check box in the **Options Bar**, and so on.
- Values entered in edit boxes are written in boldface.
Example: Enter **4"** (**100mm**) in the **Offset** edit box.
- Names of the files saved are italicized.
Example: *c03_Office-Space_tut2.rvt*
- The methods of invoking a tool/option from the ribbon, Application Menu, or the shortcut keys are given in a shaded box.
Ribbon: Systems > Electrical > Wire drop-down > Arc Wire
Application Menu: New
Shortcut Keys: CTRL+N
- When you select an element or a component, a contextual tab is displayed depending upon the entity selected. For Example: **Modify | (Elements / Components)**.
Ribbon: Modify | (Elements / Components) > Modify > Move
Shortcut Keys: MV

Naming Conventions Used in the Text

Tool

If you click on an item in a panel of the ribbon and a command is invoked to create/edit an object or perform some action, then that item is termed as **tool**.

For example:

Duct tool, **Air Terminal** tool, **Isolated** tool

Filled Region tool, **Trim/Extend to Corner** tool, **Rotate** tool

If you click on an item in a panel of the ribbon and a dialog box is invoked wherein you can set the properties to create/edit an object, then that item is also termed as **tool**, refer to Figure 1.

For example:

Load Family tool, **Duct** tool, **Wall** tool

Plumbing Fixture tool, **Visibility/Graphics** tool

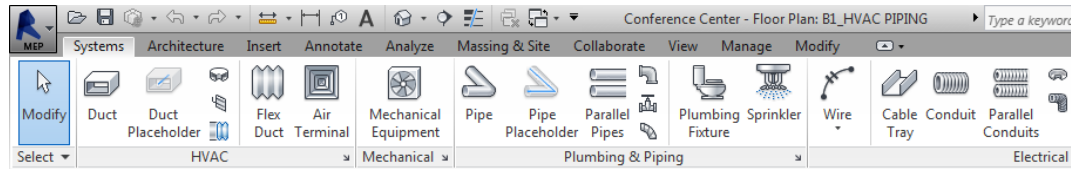
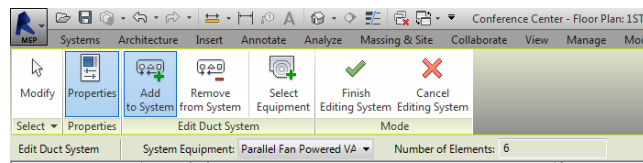


Figure 1 Tools in the ribbon

Button

The item in a dialog box that has a 3d shape like a button is termed as **button**. For example, **OK** button, **Cancel** button, **Apply** button, and so on. If the item in a ribbon is used to exit a tool or a mode, it is also termed as button. For example, **Modify** button, **Finish Editing System** button, **Cancel Editing System** button, and so on; refer to Figure 2.



*Figure 2 Choosing the **Finish Edit Mode** button*

Dialog Box

The naming conventions used for different components in a dialog box are mentioned in Figure 3.

Drop-down

A drop-down is the one in which a set of common tools are grouped together for creating an object. You can identify a drop-down with a down arrow on it. These drop-downs are given a name based on the tools grouped in them. For example, **Wall** drop-down, **Component** drop-down, **Region** drop-down, and so on; refer to Figure 4.

Drop-down List

A drop-down list is the one in which a set of options are grouped together. You can set various parameters using these options. You can identify a drop-down list with a down arrow on it. For example, **Type Selector** drop-down list, **Units** drop-down list, and so on; refer to Figure 5.

Options

Options are the items that are available in shortcut menu, drop-down list, dialog boxes, drop-down lists, and so on. For example, choose the **Zoom In Region** option from the shortcut menu displayed on right-clicking in the drawing area; refer to Figure 6.

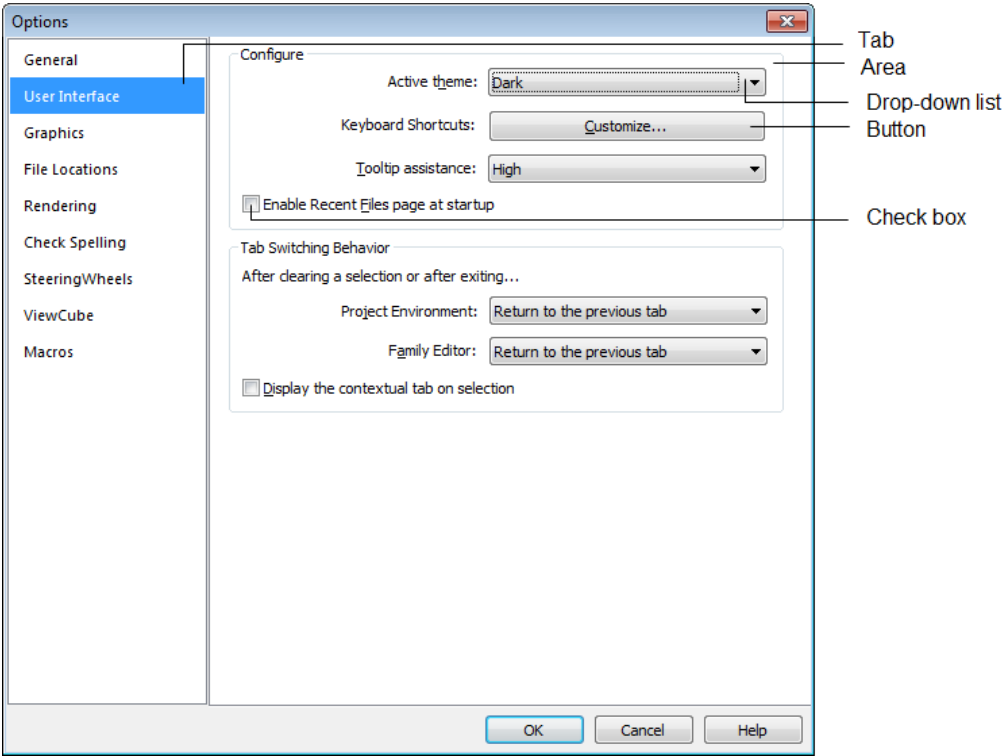


Figure 3 Different terminologies used in a dialog box

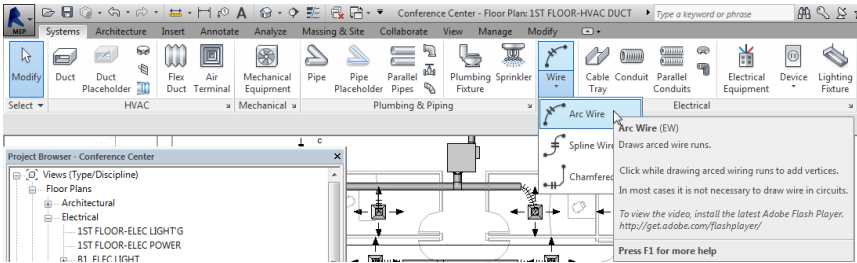


Figure 4 Choosing a tool from the drop-down

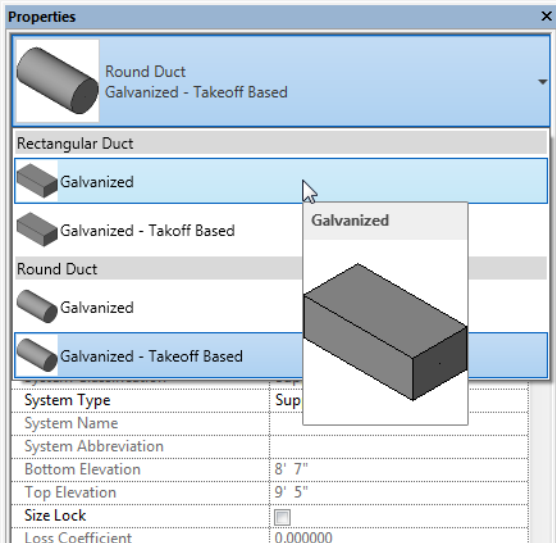


Figure 5 Selecting an option from the Type Selector drop-down list

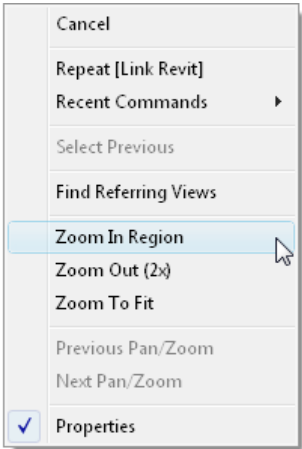


Figure 6 Choosing an option from the shortcut menu

Free Companion Website

It has been our constant endeavor to provide you the best textbooks and services at affordable price. In this endeavor, we have come out with a Free Companion website that will facilitate the process of teaching and learning of Autodesk Revit MEP 2014. If you purchase this textbook, you will get access to the files on the Companion website.

To access the files, you need to register by visiting the **Resources** section at www.cadcim.com. The resources available for the faculty and students in this website are as follows:

Faculty Resources

- **Technical Support**

You can get online technical support by contacting techsupport@cadcim.com.

- **Instructor Guide**

Solutions to all review questions and exercises in the textbook are provided in this link to help the faculty members test the skills of the students.

- **PowerPoint Presentations**

The contents of the book are arranged in PowerPoint slides that can be used by the faculty for their lectures.

- **Revit Files**

The Revit files used in illustration, examples, and exercises are available for free download.

Student Resources

- **Technical Support**

You can get online technical support by contacting techsupport@cadcim.com.

- **Revit Files**

The Revit files (.rvt) used in illustrations and examples are available for free download.

- **Learning Resources**

Additional learning resources at <http://revitxperts.blogspot.com> and <http://youtube.com/cadcimtech>

Stay Connected

You can now stay connected with us through Facebook and Twitter to get the latest information about our textbooks, videos, and teaching/learning resources. To get such updates, follow us on Facebook (www.facebook.com/cadcim) and Twitter (@cadcimtech). You can also subscribe to our YouTube channel (www.youtube.com/cadcimtech) to get the information about our latest video tutorials.

If you face any problem in accessing these files, please contact the publisher at sales@cadcim.com or the author at stickoo@purduecal.edu or tickoo525@gmail.com.

