CHAPTER 1

Understanding BIM

A great building must begin with the unmeasurable, must go through measurable means when it is being designed and in the end must be unmeasurable.

—Louis Kahn

Building information modeling (BIM) is an emerging approach to the design, analysis, and documentation of buildings. At its core, BIM is about the management of information throughout the entire lifecycle of a design process, from early conceptual design through construction administration, and even into facilities management. By information we mean all the inputs that go into a building design: the number of windows, the cost of materials, the size of heating and cooling equipment, the total energy footprint of the building, and so on. This information is captured in a digital model that can then be presented as coordinated documents, be shared across disciplines, and serve as a centralized design management tool. With a tool like Revit, you will reap the benefits of fully coordinated documents, but this represents just the tip of the BIM iceberg.

In this chapter, we'll present the basics of BIM and summarize how BIM differs from traditional 2D drafting–based methodologies. We will explain the key characteristics of Revit and how Revit is truly designed to deliver the benefits of building information modeling.

Topics we'll cover include:

- **A brief history of architectural documentation**
- **Advantages of a BIM approach**
- **How BIM is different from CAD**
- **Why Revit?**
- **Revit concepts**
- **Types of elements in Revit**
- **Tips for getting started in Revit**

A Brief History of Architectural Documentation

The production of design documents has traditionally been an exercise in making drawings to represent a building. These drawings become instruction document sets: an annotated booklet that describes how the building is to be built. The plan, section, and elevation—all skillfully drafted, line by line, drawing by drawing. Whether physical or digital, these traditional drawing sets are composed of graphics where each line is part of a larger abstraction meant to convey design intent so that a building can eventually be constructed. When Filippo Brunelleschi drew the plans for Santa Maria del Fiore (Figure 1.1) in Renaissance Italy, the drawings represented ideas of what the building would look like. They were simplified representations of a completed project, used to convey ideas to the patron. In those days, the architect also played the role of builder, so there was no risk of losing information between the documentation of the building and the actual building of it. This was the age of the master builder, where architect and builder shared the same responsibility and roles. Even so, Brunelleschi still needed to communicate his vision to his patrons and his workers, and he not only produced beautiful drawings but also built elaborate scale models so that others could easily visualize the project.

Figure 1.1

Santa Maria del Fiore; ***image courtesy of Laura Lesniewski***

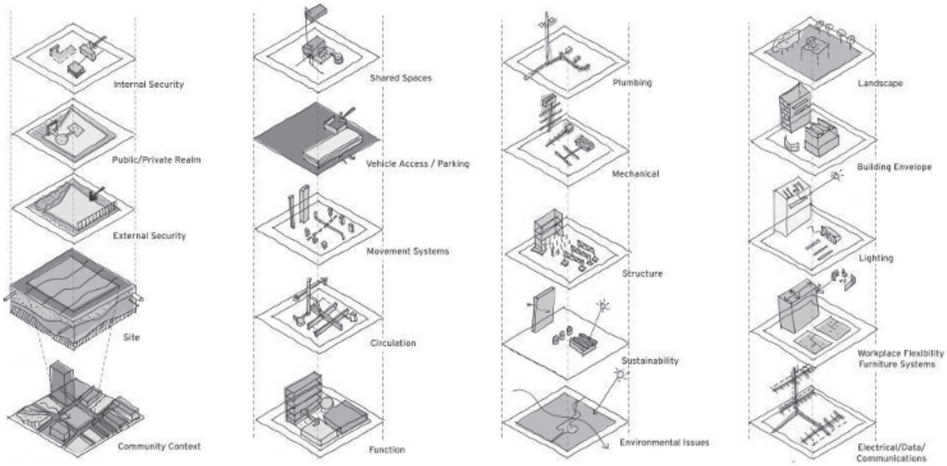
As buildings became increasingly complex, specialization in the design and construction process emerged. In turn, this led to the need for more elaborate forms of information exchange. One person was no longer responsible for both the design and construction phases, so it became necessary for designers to convey design intent with richer amounts of information and instructions.

Jump ahead in time to the twentieth century. The use of steel had been fully embraced, thus allowing buildings to reach higher than ever before; the age of the skyscraper and modern construction was in full force. The Power and Light Building (Figure 1.2) was erected in Kansas City, Missouri, in only 19 months. An Art Deco testament to the boldness of the times, the building was built without the use of modern earthmoving machinery or other heavy equipment. The drawing set for a building of this size in the 1930s would have been about 35 pages long. The Power and Light Building was more complex than its predecessors but far simpler than today's large commercial projects. There were no data or telecom systems, no air conditioning other than operable windows, and no security systems other than locks on the doors.

Figure 1.2
Power and Light Building, Kansas City, MO

Fast-forward to late twentieth century buildings. Buildings are more complex than ever before. Documentation sets span all disciplines and are hundreds of pages long. The number of people who will touch a set of drawings—to produce them, evaluate them, or use them to build the building—has become huge. Integrated building systems continue to expand with the growth of technology. Today, we have more security, electrical, data, telecom, HVAC, and energy requirements than ever before (see Figure 1.3). The quality and quantity of information that goes into a documentation set can no longer be thought of as abstract approximations—the cost of error is far too high, and fully coordinated drawings are expected. The use of computer-based technology has replaced pen and paper, yet documents are still largely generated in 2D. Drawing and editing lines has become faster and more efficient, but in the end, they are still collections of manually created, nonintelligent lines and text.

Figure 1.3
Layers of design



The year 1998—dawn of the Internet boom. Technology companies are flourishing, and start-ups are a dime a dozen. In the suburbs of Boston, a new approach to architectural documentation is about to be launched. The premise is simple: model the building once, and let architects view, edit, and annotate the model from any point of view, at any time. A change to the model from any view simultaneously updates all other views. Drawings cease to be separate, uncoordinated collections of lines and become by-products of a model-based design approach. Revit is born, and with it the foundation for a new approach to how buildings are designed, evaluated, represented, and documented (see Figure 1.4). In 2002, Revit Technology is acquired by Autodesk and continues to be developed. Welcome to the world of building information modeling.

Figure 1.4
The founders and some original members of Revit technology, having a tug-of-war at a release party, circa 2000

Advantages of a BIM Approach

The ultimate benefits of BIM are still emerging in the market and will radically change the way buildings are designed and built. A shift in process and expectation is happening in the construction market, and architects are stepping up to the challenge. The focus is shifting from traditional 2D abstractions to on-demand simulations of building performance, usage, and cost. This is no longer a futuristic fantasy but a practical reality. In the age of information-rich digital models, we can now have all disciplines involved with a project sharing a single database. Architecture, structure, mechanical, infrastructure, and construction are tied together and able to coordinate in ways never before possible. Models can now be sent directly to fabrication machines, bypassing the need for traditional shop drawings. Energy analysis can be done at the outset of design, and construction costs are becoming more and more predictable. These are just a few of the exciting opportunities that a BIM approach offers.

BIM has shifted how designers and contractors look at the entire building process, from preliminary design through construction documentation, into actual construction, and even into postconstruction building management. With BIM, a parametric 3D model is used to generate traditional building abstractions such as plans, sections, elevations, details, and schedules. Drawings produced using BIM are not just discrete collections of manually coordinated lines but interactive representations of a model.

Working in a model-based framework guarantees that a change in one view will propagate to all other views of the model. As you shift elements in plan, they change in elevation and section. If you remove a door from your model, it simultaneously gets removed from all views, and your door schedule is updated. This enhanced document delivery system allows unprecedented control over the quality and coordination of the document set.

With the advent of BIM, designers and builders have a better way to create, control, and display information. Some of the advantages that first-time users can expect to realize are as follows:

- Three-dimensional design visualization improves understanding of the building and its spaces and gives you the ability to show a variety of design options to both the team and the client.
- Integrated design documents minimize errors in documentation cross-referencing and keynoting, allowing clearer, more precise documents.
- Interference checking permits you to immediately see conflicts between architectural, structural, and mechanical elements in 3D and to avoid costly errors on site.
- Automated, always up-to-date schedules of building components (like door and room-area schedules) are data-driven and can drive data and improve the visibility of costs and quantities.
- Material quantity take-offs allow better predictability and planning.
- Sustainable strategies are easier to explore, enabling you to design better buildings and make a better world.

How BIM Is Different from CAD

The key difference between BIM and computer-aided design (CAD) is that a traditional CAD system uses many separate (usually 2D) documents to explain a building. These documents are created separately and have little to no intelligent connection between them. A wall in a plan view is represented with two parallel lines, with no understanding that those lines represent the same wall in a section. The possibility of uncoordinated data is very high. BIM takes the opposite approach: it assembles all information into one location and cross-links that data among associated objects. (See Figures 1.5 and 1.6.)

By and large, CAD is strictly a 2D technology with a specific need to output a collection of lines and text on a page. These lines have no inherent meaning, whether inside the computer or on the printed sheet. CAD drafting has its efficiencies and advantages over pen and paper, but it is really just a simulation of the act of drafting. This form of drawing is how architects and other designers have worked for the last couple of hundred years. Historically, the designer drew a set of plans and then used those plans to manually derive sections, elevations, and details. During the development of a project, if any of those items changed, the designer had to modify each of the other drawings that were affected to take the change into account. For a long time, this meant getting out an eraser and an eraser shield and spending days picking up changes. Today, you can use the Delete key, but the goal is fundamentally the same. This is where BIM makes a significant departure from legacy CAD platforms.

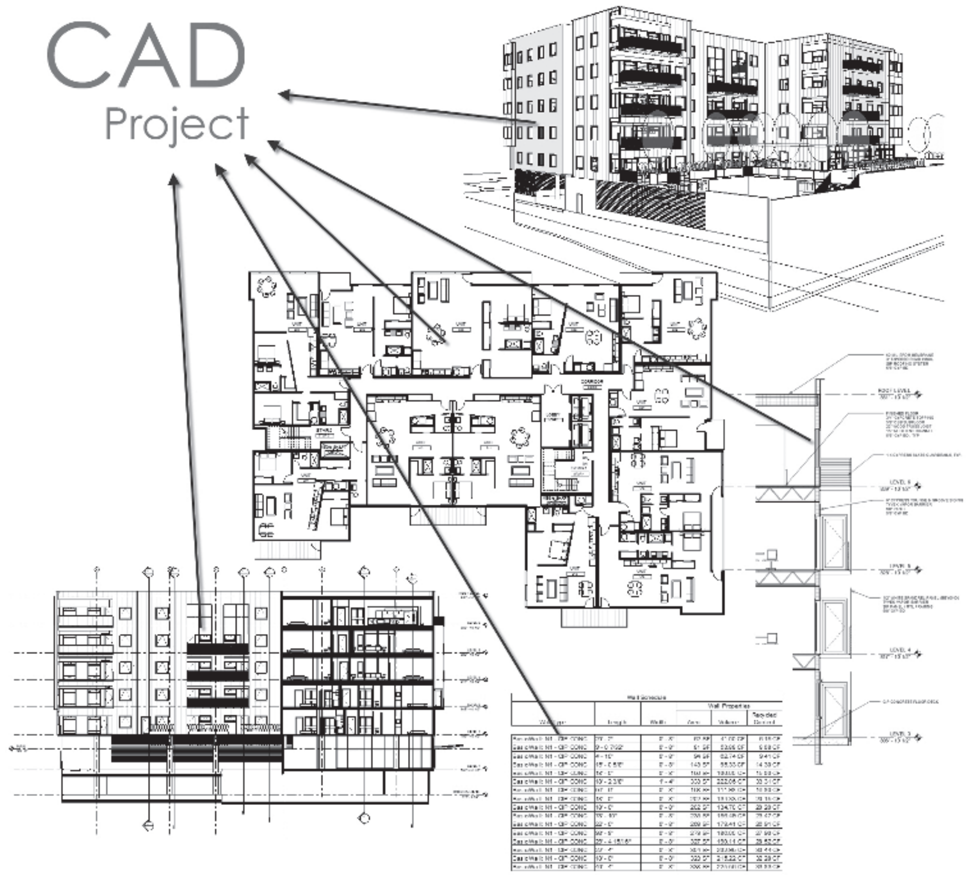
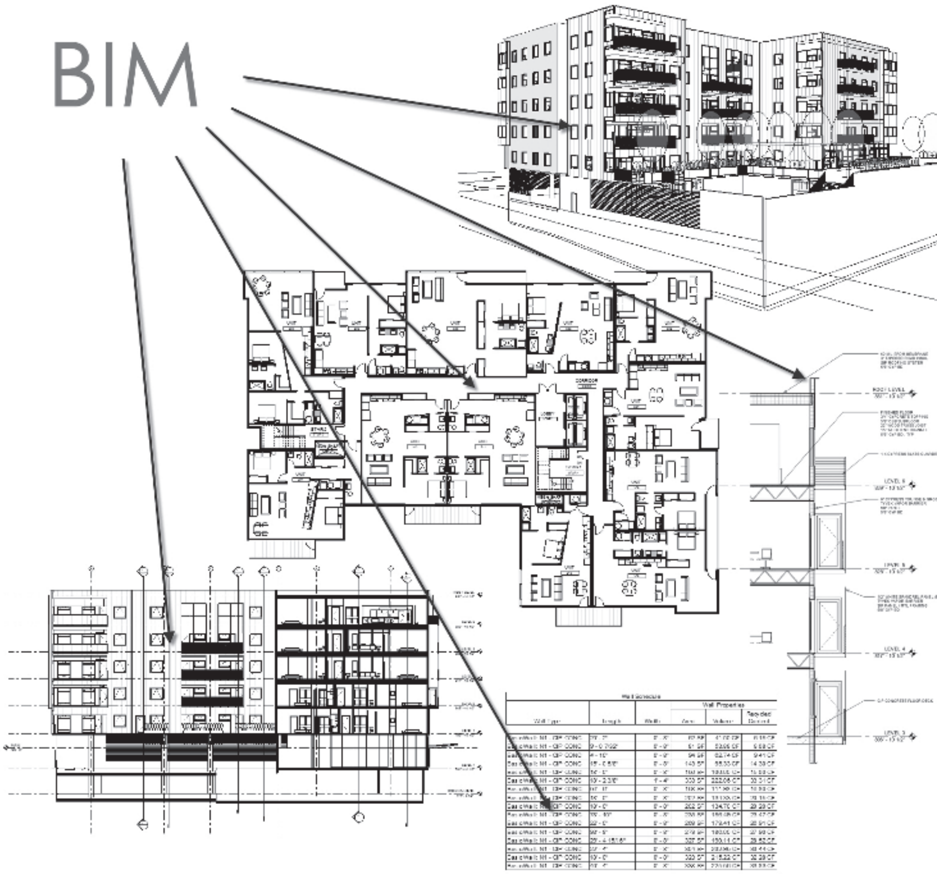


Figure 1.5
Typical CAD outputs

The beauty of BIM is that it manages change for you. Unlike CAD, the intent of BIM is to let the computer take responsibility for interactions and calculations (something computers are good at), providing you—the designer—with more time to design and evaluate your decisions. A core feature of BIM is that it allows you to create and modify everything in one design context. When a change to a project is done by the user in one place, the system will propagate that change to all relevant views and documents of the project. As you model in plan, the elevations, sections, and details are also being generated. Where you make the change is up to you, and the system will take care of the rest. With a BIM tool such as Revit, if you change the size of a window opening in elevation, this change is made throughout the entire model: sections, floor plans, schedule tables, and quantity take-offs.

Figure 1.6
Typical BIM outputs



Here are a few other big differences between BIM and CAD:

BIM adopts a task-oriented rather than an object-oriented methodology. In 2D drafting CAD, you draw two lines (objects) to represent a wall. In BIM, the task of creating a wall is presented in the form of an interactive tool named Create Wall. This wall has properties like width, height, bearing or nonbearing, demolished or new, interior or exterior, fire rating, and materials (such as boards or brick). The wall interacts with other walls to automatically join geometries and clean up connections, showing how the walls will be built. Similarly, if you add a door, it's more than four lines and an arc; it's a door in plan and elevation. Adding it to the wall automatically creates an opening in the wall in all views where the door is visible. As we will discover, the tools available for walls are specific to walls, allowing you to attach walls to roofs and floors, punch openings, and change the layered construction of the wall. Again, all of these interactions are not just properties; they are focused on specific tasks associated with architectural walls.

BIM keeps you honest. An additional advantage of a BIM methodology is that you can't cheat your design. Because the elements have properties based on real-life properties, you'll find it difficult to fake elements within the design. If you have a door in plan, it automatically appears in the other associated views such as elevation or section. In a CAD-based system this can be easy to overlook because the door has to be manually transcribed from plan to section and elevation and is easily forgotten or drawn at a wrong location. Because BIM is based on actual assemblies, it's difficult to misrepresent dimensions or objects within the model.

BIM is more than a modeler. Other software packages, like SketchUp, Rhinoceros, and 3ds Max, are excellent modeling applications. However, these modeling applications don't have the ability to document your design for construction or to be leveraged downstream. This is not to say these tools don't play a part in a BIM workflow. Many architects use these tools to generate concept models, which can then be brought into a BIM application and progress through design, analysis, and documentation.

BIM is a data-driven design tool. BIM lets you create custom content and libraries throughout the course of your project. This content contains rich amount of data that will inform schedules, quantity take-offs, and analysis. Again, it's not just 3D—it's 3D with intelligent information (metadata).

BIM is based on an architectural classification system, not "layers." Because a building model is an assembly of meaningful, to-be-built objects, you control visibility and graphics of objects using a rational list of well-understood categories. This is different from CAD, where every line belongs to a layer, and it is up the user to manage all these layers. For example, in Revit there is no way to accidentally place a window into the "wall" layer. In a BIM world, layers become obsolete; after all, in the real world buildings are not made of abstract color-coded layers.

Potential Hazards

One of the powers of Revit is the ability to work in a single-file environment where the design and documentation of the building happens on a holistic model. This can also be a disadvantage if you do not take it seriously and give it full consideration. Users who may be quick to make changes without thinking how such a change will ripple through the model can cause unintended problems if they're not careful. Revit is a parametric modeler: it creates relationships between building elements in order to streamline the design process. For example, if you delete a level from your model, then all the walls, doors, and furniture on that level will also be deleted. Likewise, if you delete a wall, all the doors and windows in that wall will be deleted. If you underlay the roof in your second floor so that you can see the extents of the roof overhang, deleting the lines that represent the roof overhang actually means deleting the roof! These are basic mistakes that new users might encounter as they readjust their mental model and come to see the model as not just lines but actual building elements. A nice consequence of this is that Revit will not let you leave elements floating around in an abstract 3D vacuum. You will not have views cluttered with fragmented geometry from some other file, exploded blocks, or mysterious lines. At the same time, you must take care when making large-scale changes to a model, especially the further along in the design process you go.

Anticipate that tasks will take different amounts of time when compared to a CAD production environment. It isn't an apples-to-apples equation. You'll perform tasks in Revit that you never had in CAD; conversely, some of the CAD tasks that took weeks (chamfering and trimming thousands of lines to draw walls properly or making a door schedule) take almost no time using Revit.

If you've never worked in a 3D model–based environment, it can be frustrating at first to move from a strictly 2D world into the 3D BIM. At the same time, it's really quite nice to have immediate access to perspective views at any time! The Revit world is one with a white screen, no layers, and no x-references. This often leads to generic comparisons and some growing pains—but just stick with it, be patient, and you'll be hooked in no time at all. With any transition there is a learning curve; as you begin to use Revit, you'll quickly see the benefits.

Why Revit?

Revit is the newest and most technologically advanced BIM application. Currently, a number of BIM applications are on the market, provided by a host of different software vendors. Although most other products in today's market are based on technology that is 20-plus years old, Revit was designed from the ground up as a BIM platform to specifically address problem areas of the architecture, engineering, and construction (AEC) industry: communication, coordination, and change management. As you complete more projects with Revit, you'll begin to understand some of its advanced functionality. Being able to go direct to fabrication with your designs, provide digital shop drawing submittals, and execute 4D construction planning are just a few of the possibilities.

Revit is a technological platform that currently supports architectural, structural, and mechanical disciplines, but the possibilities for extending these are immense. It's supported by a patented parametric change engine that is unmatched in sophistication within the AEC world of applications. It's also the leading software package in the international market.

Revit Concepts

The name Revit comes from "Revise Instantly"; Revit is built for managing change, something that we architects have to do in our practice all the time.

Parametric Objects and Parametric Relationships

We all hear about *parametric objects*, but what makes an object parametric? A parametric object is a smart object that can change its size, materials, and graphic look but is consistently the same object. For example, think of a door. A single flush door can be 32″, 34″, or 36″ (70, 75, 80, 85, or 90cm). It can also be painted or solid wood. All of these sizes and colors can be part of the same door family, with different parametric values applied.

Or consider a table: it can be the same shape but made out of wood or metal, with a glass or wood top, and with the top extending over the legs or flush with them. Again, they're all in the same table family; only the parametric values are different. The parameters are meaningful ways to create variations of an element. And most importantly, this information is always accessible, reversible, editable, and schedulable.

In most CAD systems, to accommodate all the types of doors mentioned previously, you need to make not only a separate block for each representation (thus, plan, elevation, and section typically comprise 7 or 8 blocks) but also as many blocks as sizes you need. If you then wish to make a table that is 4′-0″ square (50/50) to 5′-0″ square (70/70), you use the Scale command, which unfortunately makes the table legs bigger than needed because they resize along with the table top! A parametric object allows you to effect a change on each parameter without affecting the others unless desired. So, you can change the size of the table legs independent from the table top, and so on.

Bidirectional Associativity

Objects with parameters that can be edited are nothing new in the world of software. But what makes Revit unique is its ability to create relationships within objects and *between* objects. This ability has been referred to as the *parametric change engine*, and is a core technological advantage built into Revit. Walls, for example, can be attached to roofs, so when the roof changes to a new shape or size, all walls attached to the roof automatically adapt to the new roof shape. Walls, floors, roofs, and components all have explicit relationships to levels. If a level changes height, all elements associated with that level will update automatically: the walls below the level will extend to the new height of the level above, and so forth. When you change the size of a room by moving a wall, you are changing not only the wall, but everything that wall affects in the model as well: the size of the room, color-fill diagrams, ceilings, floors, the doors and windows in the wall, and any dimensions to that wall, area, volume.

The parametric relationships are extended to annotations and sheet management as well. Tags are not simple graphics with a text notation; they are interactive graphical parameters that read the information directly from the characteristics and parameters of the element being tagged. To edit a tag is to edit the element, and vice versa. When you're laying out sheets and a section view is placed onto a sheet, the section key automatically references the sheet number and detail number on the sheet. Change the sheet number, and the section tag updates instantly. *This* is what a real parametric engine is and what ensures total coordination of your documentation. This parametric engine guarantees that a "change anywhere is a change everywhere."

Embedded Relationships

Revit has embedded logical relationships among elements, so that when one is modified, all related objects follow the change. To illustrate this, let's try a *smart move.* Look at Figures 1.7 and 1.8. To make one of the rooms smaller and move the south wall 3´-0˝ (1m), you select the wall and drag it. The four walls perpendicular to and intersecting this wall adapt themselves, and the room area updates automatically. All you do is move the one wall. There is no need to create a complex series of selections; no need to use trim and extend tools, and no need to recompute room areas. Revit does all of this for you with a few mouse clicks.

Figure 1.7
The floor plan before the change

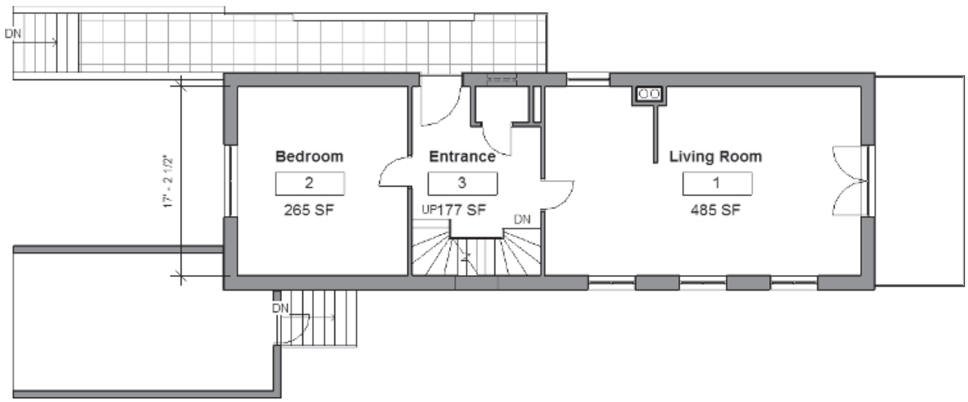
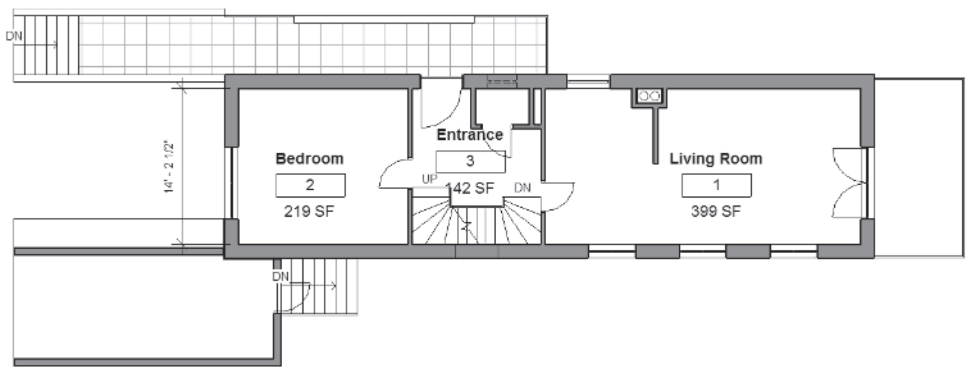


Figure 1.8
The same floor plan after moving the wall



If for some reason this automatic behavior is not to your liking—for example, when you are dealing with a renovation project and do not want to have existing conditions be affected by new construction—this is not a problem. Revit will not force you to do something you don't intend to: it allows you to break the "smart" relationships if needed by disallowing the joins between the walls. Hover the mouse over the end of a selected wall, right-click, and choose Disallow Join from the context menu. Only that one wall will be modified, and the others will not be affected.

You can also lock elements in place to prevent unintended consequences. You'll notice locks when aligning elements or selecting dimensions; these locks allow you to create hard constraints between elements in the model. For the most part, you'll find the default embedded behaviors make sense, and you'll not have to lock everything with explicit dimensions.

User-Defined Rules

During the design phase, you may want to maintain some dimensional rules and make sure these are not violated. Requirements like keeping the structural gridlines fixed (pin) or keeping a hallway a fixed width (lock) are some typical examples. You want to lock this rule down and keep it persistent as the design evolves. Such design rules are used all the time, but not many software applications let you capture this design intent and apply it in the model. For instance, you may want your door jamb always positioned 4″ (25cm) from the wall corner, or you may want three windows in a room to be always positioned at equal distances and the sill height for your windows to always be 4′-0″ (1.20m) above the floor. You want the rules and relationships to be remembered regardless of how many changes occur in the design process. Revit allows you to define and *lock* these relationships with *constraints*: explicit dimensional rules that keep elements locked to one another.

Types of Elements in Revit

Every parametric object in Revit is considered a *family*. In this section, we'll discuss how Revit organizes all these families and the data associated with them. Then we'll explain the available types of families, the principles of their behavior, how to create them, and where to find them. The categories are divided into two primary buckets: *model* categories and *annotation* categories.

How Revit Organizes Data

Revit organizes all the data in the model using building-industry–specific classifications. This system of organization manages relationships among classes of elements as well as their graphical display. At the top of this organization is a fixed list of categories into which all elements ultimately belong and a generic category to which unusual, nonstandard elements can be assigned. Every element you select in Revit belongs to one of these fixed categories.

Model Categories

Model categories include all physical object types typically found in buildings. All 3D families will use one of these categories, making them easy to schedule and control graphically. Also included are 2D elements that need to be represented in 3D views and that are used to add more detail to the model, such as floor patterns, ceiling hatch, and construction details. For elements that don't fit into the Revit categorization system, the generic model category can be used.

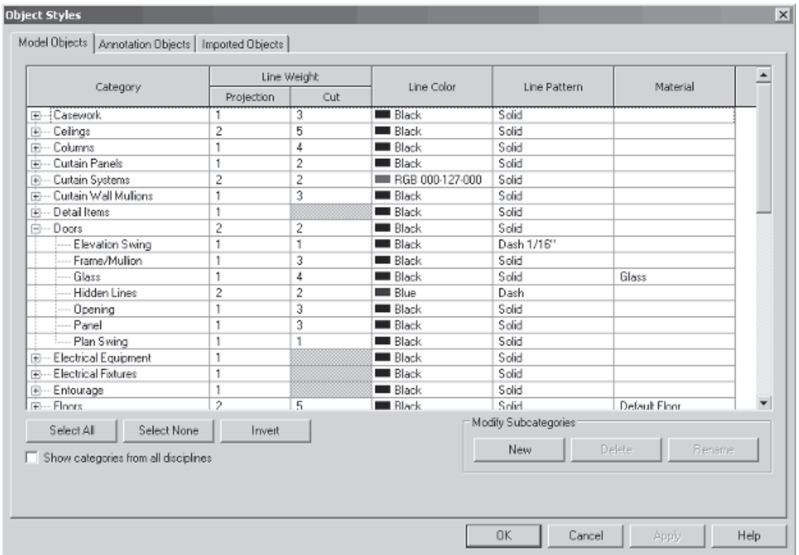
Annotation Categories

Annotation categories are all the annotations, symbols, text, and other 2D data added to a view to describe how the building is to be constructed. For example, all wall tags are members of the annotation category Wall Tags. Annotation categories also include 2D graphics overlaid on the model to convey additional information about the model. These annotations are view-specific and appear only in the view they were created in. The one exception to this rule is entities created in dependent views. Examples include dimensions, tags, callouts, section marks, and text notes.

To view all the model and annotation categories, select Settings → Object Styles. The table of categories is shown in Figure 1.9.

Figure 1.9

In the Object Styles dialog box, you set the graphics for all categories and subcategories in the project.



Annotation categories don't appear in 3D views.

Subcategories

Below each category can be many subcategories. Within the Door category you'll see subcategories for elevation swing, frame/mullion, glass, opening, panel swing, and other user-defined elements. You can add or remove subcategories when creating or editing families. The beauty of this system is that you can control the visibility and graphics of each subcategory independently. This allows you to use different line weights for different subcomponents of families. So, in our door example, you can independently control the graphics for the door leaf, frame, mullions, and glass. Figures 1.10 through 1.12 show how different subcomponents of a door can be turned on and off in a view.

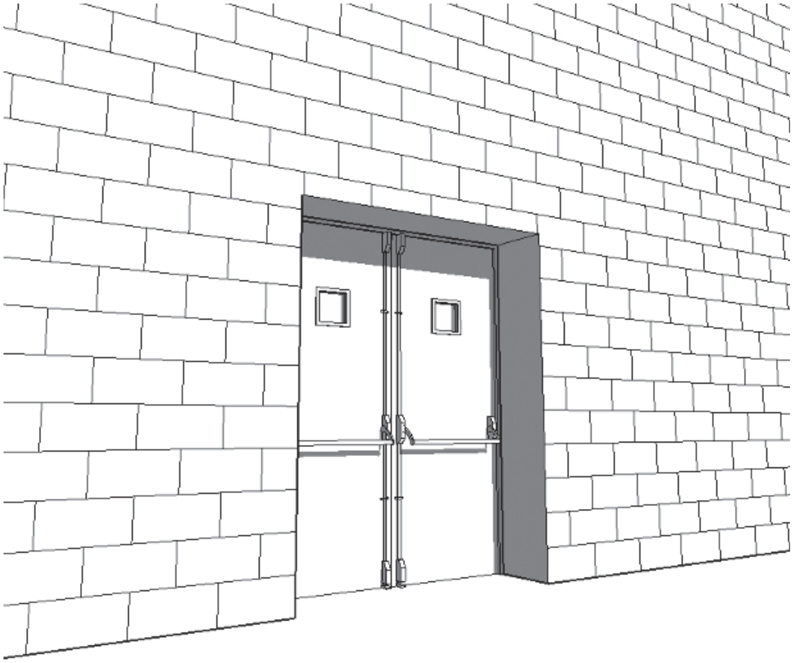


Figure 1.10
A door family at fine level of detail

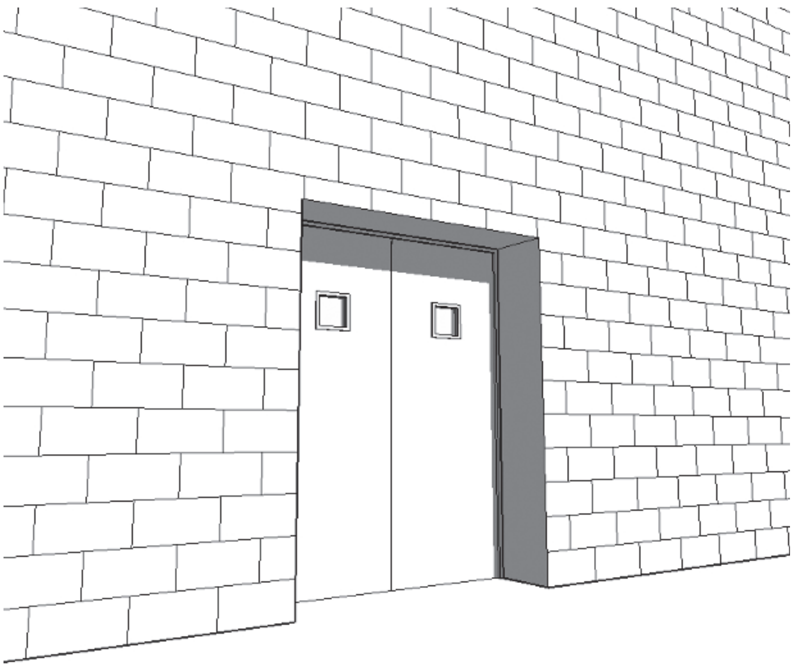


Figure 1.11
The same door with hardware not visible at medium level of detail

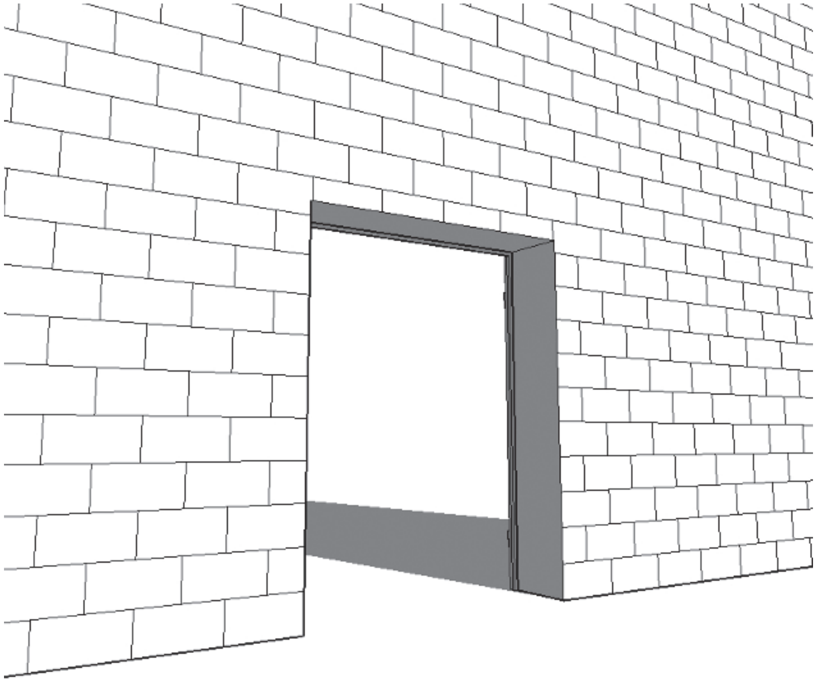


Figure 1.12
The entire door reduced to an opening at coarse level of detail

Controlling the Visibility of Elements in Revit

As you learned earlier in this chapter, there are no layers in Revit. You may be asking yourself, "Just a second! How will I live without layers? How will I control the visibility of what I want to present in different drawings at different scales?"

Let's look at the origin of layers. In the predigital era (and still, in some offices) projects were drawn manually on translucent paper called *trace*. Multiple layers of that trace paper were stacked and shuffled to create different representations of the same plan. Furniture might be drawn on one sheet of trace paper, mechanical systems on another, and so forth. In a paper-based workflow, to make a change you erased something on one sheet and redrew it on another.

CAD applications use layers as a digital version of trace paper to control the visibility of elements. These digital layers let you control the visibility of the elements representing your designs.

Instead of using layers, Revit uses object categories' view-specific settings to control how a drawing looks (see Figure 1.13). For example, instead of putting door handles on their own layer so they show only in high-scaled detailed views, Revit has commands to control the visibility of elements per view. If you don't want to show the fine-grain details of an element, such as door handles and hardware, you can change the level of detail for your view, as shown earlier in Figure 1.10 and Figure 1.11.

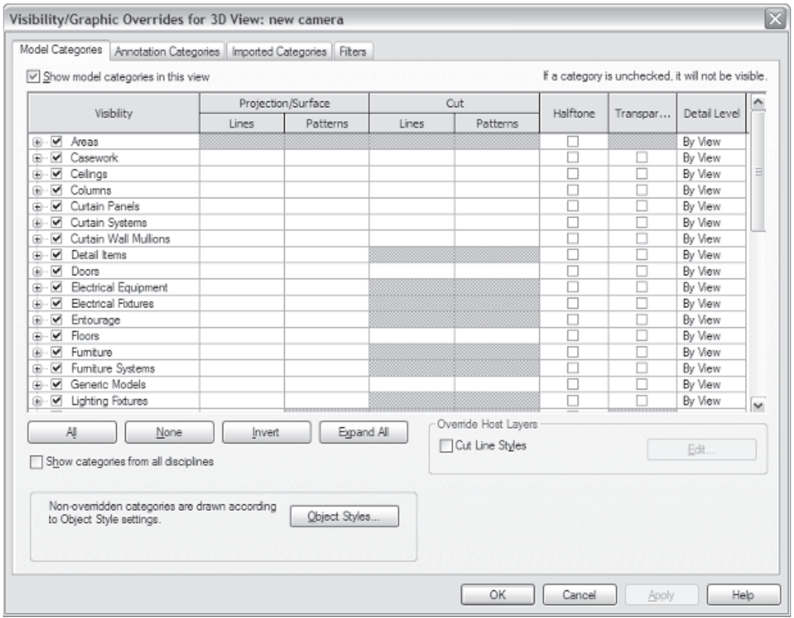


Figure 1.13

The Visibility/Graphic Overrides dialog box lets you control visibility of categories on a view-by-view basis.

Families in Revit

Independently of whether it's a model or annotation category, a Revit family can be a *system family*, a *standard family*, or an *in-place family*.

System Families

Examples of system families are walls, roofs, stairs, railings, ramps, and mullions. To create such a family, you must be in the project environment (you will not be able to create system families in the Family Editor). To make additional types of these families, you need to duplicate an existing family of the same type and modify it. So to create a new wall type, for example, you must duplicate an existing wall, change its name, and then change the properties of the wall.

This method of duplicating a type to create new types is used frequently in Revit, so get used to this concept. While you cannot save a system family to a shared library as a standalone component, it is possible to transfer these families between projects. To reuse system families from one project to another, select File → Transfer Project Standards, then choose the category you want to transfer. We'll go into more detail about creating and using system families later in this book.

Standard Families

Standard families are created outside of the project environment—still in Revit, but in a specific environment called the Family Editor. Standard families have their own file format extension (.rfa) and can be stored or edited as separate files independent of a model and then loaded at any time into a project.

To see how Revit organizes standard families, choose File → Load from Library → Load Family. You'll see the folders in which these families are stored.

To create a new standard family, you can either duplicate an existing one in Windows Explorer and modify it in the Family Editor or create a new one in the Family Editor, using the family templates included with each copy of Revit. An important advantage to using Revit is that you are not required to know any programming or scripting language to create new smart, parametric families. This is an important advantage of Revit.

To open a template, choose File → New → Family. Embedded in each template are smart behavior characteristics of the family you're creating. Doors, windows, balusters, casework, columns, curtain wall panels, entourage, furniture, massing elements, generic objects, and plantings are all examples of standard Revit families.

In-Place Families

In-place families are custom objects that are specific to a certain context within the model. A complex sweep, such as a railing fence on a site, is an example of an in-place family. These families use the same functionality available in the Family Editor, but are made available in the context of a project file. Avoid making in-place families if you plan to reuse the family, or have multiple instances of it in the project.

Tips for Getting Started in Revit

Knowing how and where to begin your journey can be a challenge, and we want to give you a few pointers to help you get started. Although this list isn't complete by any means, it should help steer you in the right direction:

Begin with the end in your mind. When you begin any project, planning is always a good way to start. You can set yourself up for a successful implementation from the beginning by using a bit of forethought about your process, workflow, and desired outcome.

Get your project and office standards in place early. As design professionals, we have a tendency to develop unique graphic conventions and styles for our documents. This is a specific area where good planning leads to a good project. If possible, get your standards in place before you begin a project. Revit does an excellent job of getting you started with a good template of graphic standards to work with. However, if you're like most architects, an application right out of the box is never quite nice enough. Revit provides a good starting point for customization, and with some up-front time, you soon can have your project and office standards up and running. Once you nail down your standards, they can be easily applied to your project using Transfer Project Standards.

Remember that the first project you do in Revit is a change in methodology. You're leveraging technology to help you change the way you approach design and documentation. Don't expect the process to have the same workflow as it did in a CAD-based system. Try to stay flexible in your expectations and schedule and allow yourself time to adapt to the change.

Don't try to conquer the world on the first project. There are many advantages to using BIM as a design and documentation methodology. As this process becomes more mainstream within the industry, those benefits will only increase. All of these things and more are possible with the use of Revit, but it will take a couple of projects to get there. Tailor the use of BIM to the project, and use the features that will maximize the benefits of using BIM. Choose your goals realistically based on the expertise of your project team, and plan ahead so those goals can be met successful. Consider a project that is less complex for your initial pilot.

> One of the most important rules to follow as you begin your project is to model the building as it will be built, but keep in mind that you do not need to model every condition three-dimensionally. Use Revit to get the essential dimensions and building form coordinated. You can then embellish the model with 2D details to convey the fine grain.

Model correctly from the beginning. We can't stress this enough. As you refine your design, it's critical to model correctly right from the beginning so you don't have to fix things later. What does this mean? As an example, think of a wall. Does it sit on the floor, or does the floor attach to the wall? If you can begin to think about how your project will be assembled, it will save you a lot of time at the end. It's good practice to plan ahead, but remember that Revit will allow you to make major changes at any stage in the process and still maintain coordination. If you are still in early phase of design and do not know the exact wall type, use generic walls to capture your design intent; changing these later will be simple.

Get information into the project as soon as it is known. A key advantage of using Revit is the ability to change your project schedule. In a traditional design process, most of the effort on a project is realized during the construction-document phase. At that time, a typical project has the most staff working on the project, and it can be fairly difficult to implement major changes to the project design. This is due to the complexity of the documents by this time and the amount of effort for the team to redraw all the changed information. You'll find that with Revit, design change is largely managed by the software itself. This gives you a great deal of flexibility in both your design and documentation. Take advantage of this shift in the process, and add information to your model early. It can be in the form of more detailed content or showing the material construction of your wall system. Remember that you can change all this information much more quickly and easily than you ever could in CAD, so don't assume you're locked into the information you displayed early in the design process.

Plan for better communication among team members early in the process. Communication within a team is critical for understanding a project and documenting it successfully. One of the downfalls inherent in a CAD-based system is that there is no connection among the different files that make up the drawing set. This phenomenon carries through to the project team and is a function of project workflow and project management. In CAD, it's possible for team members to work in some degree of isolation. They aren't forced to immediately reconcile their changes with changes made by their teammates. Revit's single-file environment forces a much higher degree of team communication between not only the architects but also your structural and mechanical engineers.

Don't try to model everything. Most of us have drafted in a 2D environment until now. Moving to a 3D world is a significant change. Do you have to model every single screw? Every mullion? Every stud? That's a good question. The simple answer is no, you don't have to, and in fact you should not attempt to do so. Like any BIM system, Revit isn't 100 percent 3D information. Typical workstations aren't capable of handling all the data of a building in model form. Additionally, few projects have the time in their schedule to model the screws in a sheet of gypsum board or the sealant around all the windows; some of that information is best presented in 2D or in the specifications. This still leaves you with a wide range of options for modeling. In the beginning, err on the side of simplicity. It's far easier to add complexity to your model later on as you gain experience and confidence than it is to troubleshoot overconstrained parameters early in the process. Start with the big ideas: walls, openings, roofs, and so forth. Work your way down to a comfortable level of detail for both you and your computer.

Organize your team. A BIM project team includes three basic technical roles. These roles are interchangeable, especially on smaller projects with fewer team members. However small the team, it's useful to make sure all these roles are filled:

Building designer This is the person or team whose primary responsibility is to figure out what the project will look like and how it will be made. They create walls, floors, and roofs and locate windows, doors, and other building elements.

Content/family creator The family creator's primary role is to create the parametric content in the Revit model. This is typically someone with 3D experience who also has a firm understanding of Revit and Revit families. The families, as you'll see later, have parameters that can control visibility, size, color, proportion, and a number of other things.

Documenter This role supplies the bulk of the documentation. It consists of drafting some of the 2D line work over portions of the 3D model to show detail, adding annotations and keynotes, and creating details.

Ask for help. If you get stuck along the way, don't assume you're alone. There are myriad resources to help you find a specific solution to your problem. Chances are, someone has tried the same thing before. In our digital age, a wealth of information is available online; powerful communities of passionate users are out there willing to help. So before you spend hours trying to work through a particular problem on your own, try tapping some of the existing resources:

Revit Help menu Your first stop, if or when you get stuck, should be the Revit Help menu. It's one of the easier and more robust help menus out there, and it can give you a lot of useful information very quickly. It's also the most accessible help source. As with most applications, it's at the far right of the menu bar.

Subscription Support If you have bought Revit on subscription, Revit Subscription Support offers an exemplary web-based support system. Their responses are speedy, and their advice is top-notch. If you need information more quickly, Revit also has an online knowledge base of FAQs that is available without a subscription. Both of these resources can be accessed at `www.autodesk.com/revit`.

AUGI Autodesk User Group International (AUGI) is also an excellent source for tips and tricks. It's an online user community free to participate in, ask questions, get answers, and share families and examples. To get the benefit of this fantastic online resource, go to `www.augi.com` and look for Revit Architecture as a product. If you never logged in, you will have to registered once; from then on it's easy!

Revit City Looking for content and families? Revit City, another free online service, has a growing database of free families posted by other users. Its address is `www.revitcity.com`.

Autodesk Discussion Groups These pages offer insightful discussions and some great Q&A threads: `http://discussion.autodesk.com/`.

AECbytes A website dedicated to following and reporting on the trends in the AEC industry, with a strong focus on BIM, technology, and the direction of the industry—put together by Lachmi Khemlani: www.aecbytes.com.

Blogs Revit OpEd is a blog with some great information, useful links, and helpful tips and tricks. Put together by a longtime Revit guru, and fellow author, Steve Stafford: `http://revitoped.blogspot.com/`. And there are numerous blogs from passionate, experienced Revit aficionados such as these:

- `www.allthingsbim.blogspot.com/` (James Vandezande)
- `www.bimx.blogspot.com` (Laura Handler)
- `www.dorevit.blogspot.com`
- `www.greenrevit.blogspot.com`

- www.revitbeginners.blogspot.com (Bradley Hartnagle)
- www.revitcoaster.blogspot.com (Troy Gates)
- www.revitfamilies.blogspot.com (Shaun Van Rooyen)
- www.revit-alize.blogspot.com (Bruce Gow)
- www.revitrants.blogspot.com
- www.blog.reviteer.com (Tom Dorner)
- www.revitlution.blogspot.com (Christopher Zoog)
- www.revit-up.blogspot.com (The PPI Group's Revit evangelist)
- www.revitup.co.za (Justin Taylor)
- www.autodesk-revit.blogspot.com (David Light)
- www.auservice-bim.blogspot.com (Simone Cappochin, Italian)
- www.cmotion.net/products/revit-tools.html (Siggi Pfundt and Gotthard Lanz, German and Italian)