

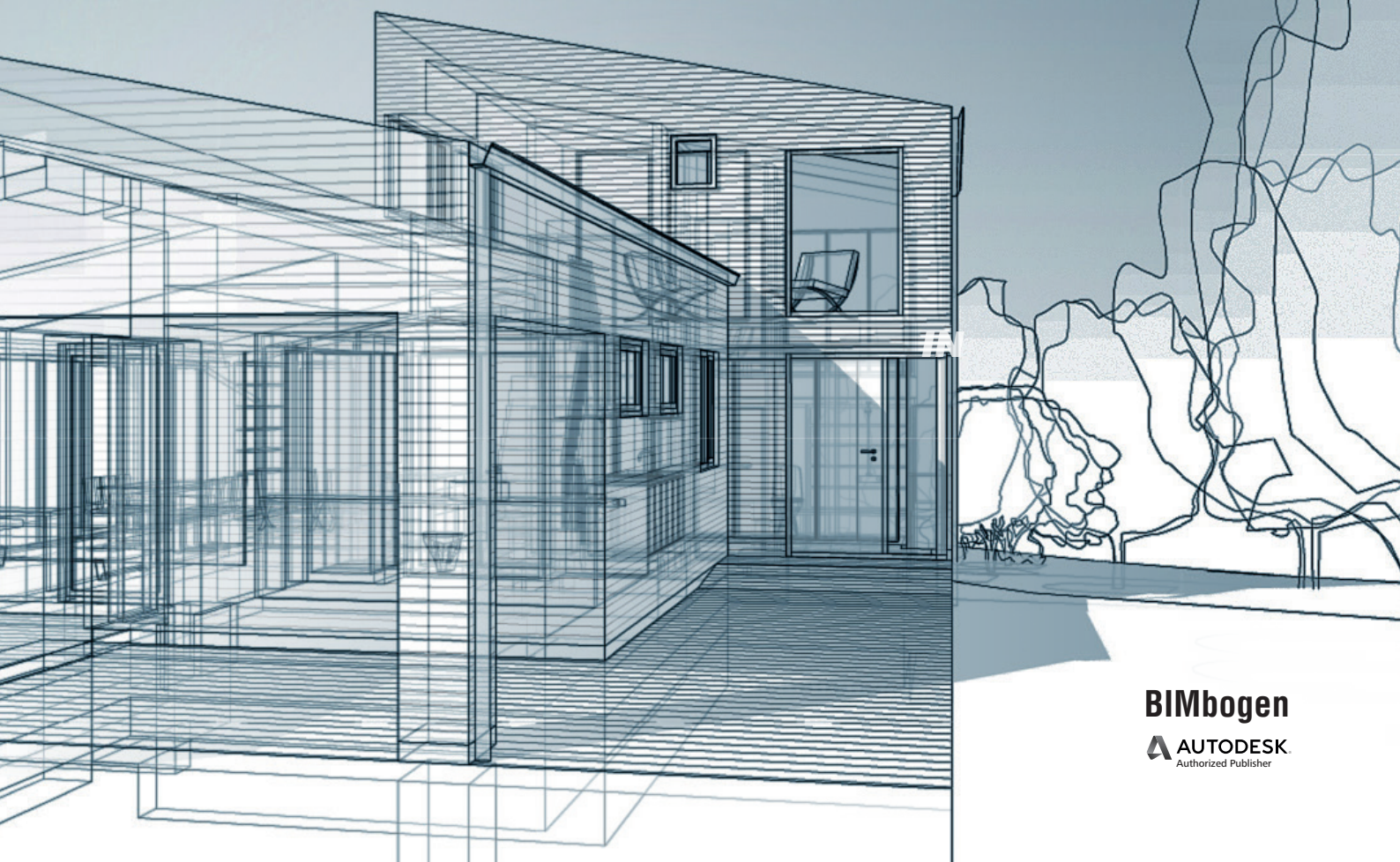
Niels Ole Christiansen
Ask Raun

REVIT®

BIM AND CONCEPT DESIGN

- a case study

Volume II



BIMbogen

AUTODESK
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Revit® - BIM and Concept Design

A Case Study

Volume II

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PREFACE

This is a practical beginners learning guide and reference book to Revit® for professionals and students of the building business. The approach presented is relevant to present or future professionals involved in the building design process; architects and constructing architects in particular.

'Revit - BIM and Concept Design' consists of two volumes, of which this is Volume II. Before starting using this volume, It is assumed that the user has worked through Volume I or achieved Revit knowledge and skills at a corresponding level in other ways.

In essence, the two volumes together are an update to the book 'Revit 2018 - BIM and Concept Design' by the same authors.

Readers already familiar with the concept of the book can skip the rest of this preface.

Throughout the book, the learning process revolves around a case study project; a detached single family house in a rural setting. Like in the real world, changes are brought into the project in the course of the process. To support an even (but steep) learning curve, the development of the project goes from a simple design to one of intermediate complexity.

Volume I demonstrates and trains the most important basic procedures of modeling and documentation used in Revit. At the stage of finishing Volume I, the learner will be ready to apply the acquired skills on a basic level in a professional or educational context.

In *Volume II*, the learner will be working with concepts and chains of commands of gradually increasing complexity.

The point of departure in developing the book and their predecessors was to supply students of Architectural Technology at VIA University Centre in Aarhus, Denmark a base for learning Revit. The book and its case study also form the base of courses of supplementary and in-service training arranged by VIA University College.

This book being an introduction to Revit for beginners, the case sets out at an early design stage, parallel to (but not in detail identical to) *Stage 2: Concept Design* as defined by *RIBA* of the UK, or *Dispositionsforslag* (Outline Proposal) as defined by *Danske Arkitektvirksomheder* and *FRI* of Denmark.

Besides its primary aim - to support learners in forming solid basic Revit skills - this book also seeks to serve as a guide to establishing a meaningful working process. Meaningful to be understood in several ways:

- Revit is a CAD-programme supporting BIM (Building Information Modeling). To benefit from this, so should our way of using it be.

Driven by legislation in many countries, BIM has become more than a theory of facilitating a smooth information flow and increasing the productivity in the building business, but a practical reality. This reality is still quite new and in rapid change, but with 'best practices' slowly emerging, however ambiguously. This book gauges the present state-of-the-art and suggests a robust model for the early stages of the building design process supporting BIM-method also in the later stages.

- At the early stages of building design, an open and smooth method is vital to eventually arriving at a well-designed building proposal. However, in order to efficiently support BIM, Revit is a heavily parametric tool with few of the 'light' qualities of e.g. pencil drawing or other more intuitive computer tools. Therefore, the case study assumes an initial draft design being present before 'going BIM' in Revit¹.

¹ Another possible scenario is a Revit mass model being present at the starting point of this case study. Mass modeling is beyond the scope of this book.

A smooth working method open to new ideas or changes of conditions is however at the core of BIM thinking. This book attempts to establish a practice of exploiting the BIM-potential of Revit by modeling with this in mind: Future project changes should be easy - whenever this can be achieved with little or even no extra effort.

In setting up Revit and preparing for modeling, this book suggests using a template based on *DanEDU*, an open source setup supplied and maintained by BIMlab at DTU (Technical University of Denmark). To get the full advantage of the instructions of this book, the user is advised to install the setup on the computer first.

The template is available for free at www.bimbogen.dk, the website of the publisher. To meet some didactical requirements of the book, and to keep the maintenance of the book at a minimum, the template is a slightly modified version of the original DanEDU template. All modifications are made by the authors.

About the authors

Niels Ole Christiansen is a constructing architect MAK, BA in Architectural Technology and Construction Management from VIA University College in Horsens, Denmark.

Through working in architectural offices and among contractors, he has gained extensive experience and for the last 17 years as self-employed in own practice. He has also experience as an instructor at an Autodesk Authorized Training Center.

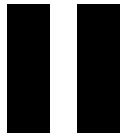
Ask Raun is a MA in architecture with a degree from Aarhus School of Architecture.

Through working in offices in London, UK and Aarhus, Denmark, and through his own practice, he has architectural experience in all project stages, from sketch proposals and competitions to being a project architect and a site supervisor.

Also, he has been teaching architecture and BIM at Aarhus TECH and VIA University College (present), and at Aarhus School of Architecture.

Through his practical and educational experience, he has established a practical knowledge as well as a theoretical interest in the application of CAD programs throughout the stages of building design.

Both authors are Autodesk® Certified Professionals and Associate Professors at the department of Architectural Technology and Construction Management at VIA University College in Aarhus, Denmark.



INTRODUCTION

This is Volume II of 'Revit - BIM and Concept Design'. Using Volume II assumes Revit knowledge and skills acquired through the steps of Volume I or at a similar level.

Briefly on BIM and Revit®

This section is mainly for readers not yet familiar with the concept of BIM. Readers already familiar with this from Volume I can skip this section.

Revit is a CAD¹-programme supporting BIM.

BIM is an abbreviation of *Building Information Modeling*, a certain method of working and collaborating digitally in a building project. The word *Model* refers to the fact that designing with BIM is always *3D modeling*. Using BIM methods in a building project requires using digital object-oriented parametric tools that support BIM. *Parametric* and *object-oriented* here means, that the program operates with objects that are more than plain geometry, but have parameters specific to their nature and function: Windows 'know' they are windows and can be set in Walls or Roofs only, they can have *parameters* like 'width', 'height', 'frame material', 'U-value' etc. *Parametric* also implies that a project can be changed through changing parameters - e.g. the thickness of a certain Wall Type can be changed, and immediately all walls of this type in the project will be displayed in all drawings with the new thickness.

Revit is one such parametric BIM-supporting tool among many.

At the core of BIM is the idea that all information in a project is kept in one single database - The *Building Model* (or sometimes referred to as the BIM, the Building Information Model), a 3D parametric model shared between all participants of the project. All documents in the project - drawings, lists, schedules (and in a wider BIM perspective also budgets and time schedules) are drawn 'automatically' from this model/database.

In order to derive reliable and sufficiently detailed information from the model - drawings, lists etc. - all necessary information needs to be added to the model in the first place - by us, the designers of the building.

In our case, the Revit Project File is this shared database.

The potential benefits of using BIM in a building project can be considerable, especially in medium- to large-scale projects. For educational purposes, BIM is here introduced in a project smaller of scale and in the early stages of design. Some advantages evident even at this scale and stage are:

Consistency - All drawings are generated from the same 3D model.

Ease of change - Many aspects of the project are easily changed², e.g. room dimensions, storey heights, wall thicknesses, surface materials etc.

Control - already very early in the modeling process it is easy to keep track of core project parameters. e.g. gross building area, room areas, storey heights etc. The building model being relatively 'intelligent', it is easy to 'ask' it relevant questions.

¹ CAD: Computer Aided Design

² There are drawbacks, however; at the very early stages, when sketching the building layout, the main focus is on the overall geometry of the building. At this stage, a core demand to a drafting tool will often be swiftness of response to radical change of geometry, allowing the designer to quickly test very different layout scenarios. Most BIM programs available at present may appear unnecessarily bulky and slow to the designer at these first design stages, often asking for input that may not yet be relevant.



Figure I
The Building Model at the stage of
the preliminary proposal in Volume I

The case

In this case study, it is assumed that you are working in a small architects office on designing a detached one family house for private clients. A draft layout of the building plan has been made prior to you setting up the project in Revit. When modeling the building, you start from this initial draft layout, shown on inserts in the back of Volume I.

By the end of Volume II, you will be ready to submit a set of drawings for a full concept design proposal, and during the progress, you will gradually get introduced to the Revit tools needed to create, modify and document the Building Model.

Volume I

Early in the design process, you need to show preliminary drawings to the clients for them to comment. A basic Building Model is created using most of the basic Revit tools, allowing you to generate a first set of drawings in Revit by the end of Volume I (see figure I and II)

Figure II
Cross section at the stage of the
preliminary proposal in Volume I





Figure III
The Building Model at the stage of
the final concept design in Volume II

Volume II (this volume - digital version only)

While generating the preliminary output in Volume I, you have been waiting for the land surveyor to provide a Site Model with exact 3D information about the site. In Volume II, this is now brought into the project, allowing you to refine the design of the building and particularly how the building and the existing physical conditions interact.

You can opt to create the Site Model yourself in various ways. These lessons are found in the back of Volume II in the appendix *Site*.

Based on the detailed 3D information now present in the model, some aspects of the design is reconsidered. Split levels are introduced in the building at this stage.

The clients now return to you with changes to the brief. This requires some remodeling and involves the use of many of Revit's Editing tools and functionalities as well as introducing some more advanced Revit tools. At this stage, an extra storey is added to the building. Finally, drawings for the client of the finished concept design proposal is generated from the Revit building model.

Found as an appendix to Volume II is also a chapter on advanced presentation techniques - renderings, video clips and interactive panoramas etc.

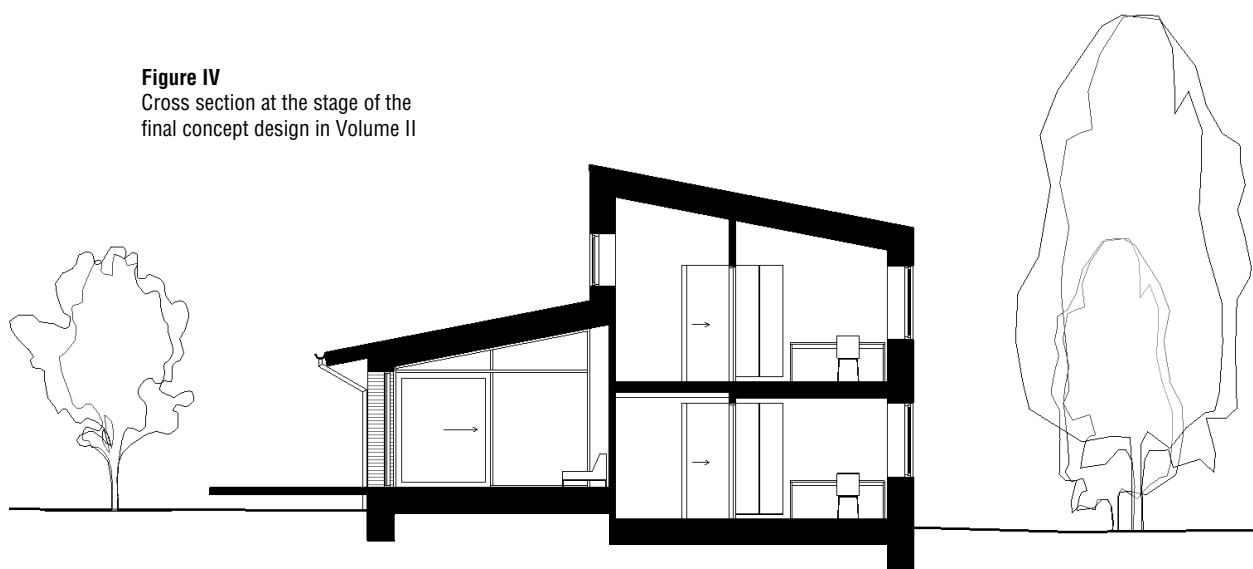


Figure IV
Cross section at the stage of the
final concept design in Volume II

How to use this book

The book is structured as a practical learning guide and a reference book.

The progression of the case study is similar to that of many real life projects.

The titles of the main chapters frame the overall topic of the progress at the given stage of the development of the project.

The introduced progression can be seen here:

Volume I

- | | |
|--------------------|----------------------|
| 1. preparations | BEFORE MODELING |
| 2. building I | BASIC MODELING |
| 3. documentation I | PRELIMINARY DRAWINGS |

Volume II (digital version only)

- | | |
|---------------------|-----------------------|
| 4. building+site | GROUNDING THE PROJECT |
| 5. building II | PROJECT CHANGES |
| 6. documentation II | FINAL DRAWINGS |

Appendices to volume II

- | | |
|---------------------|--------------|
| A the context | SITE |
| B documentation III | PRESENTATION |

The page opposite is an example of how a page in the book is structured, explaining in general terms how to use the book as an instruction while working in Revit to learn the program.

The case study can be approached in different ways:

- Chapter by chapter, from the beginning to the end
- A single chapter or section at a time, one by one, in any order

To work through single chapters or sections can be helpful if one specific Revit technique needs to be learned or tested. In this case, please go to the associated website www.bimbogen.dk to download the Revit models available here.

These are models of the case study at different stages of progression. By opening one of these, the user can work from a certain point without having to complete the previous chapters or sections. Whenever a model is available, the file name of the model will be highlighted in the procedure text (see '*A typical page*' opposite).

As well as being a case study for learning Revit, the book can be used for future reference.

The index in the back of the book refers where *Revit tools*, *themes* and *overviews* are introduced. Only tools, themes and overviews introduced in this volume are referred in the index. For basic tools, themes and overviews, see the index in Volume I.

It is presupposed that the user of this volume has basic Revit skills and general basic computer experience. Thus, the text may refer to basic Revit routines explained in Volume I and basic mouse actions (*Double-click*, *Click and drag* etc.) without further explanation.

A capital letter in the beginning of a word (like *Wall*) indicates that the word refers to a Revit term.

How to use Volume II

To use this digital volume as a learning guide while working in Revit on a computer, it is handy to have it open on a separate screen, e.g. a tablet, rather than on the same screen as Revit.

A *Reference Sheet* showing the final revised project to be elaborated in chapter 5 is available for download on bimbogen.dk in the same location as this present volume. Whenever needed, the sheet is referred in the text of chapter 5.

For ease of use, please download the Reference Sheet and print it.

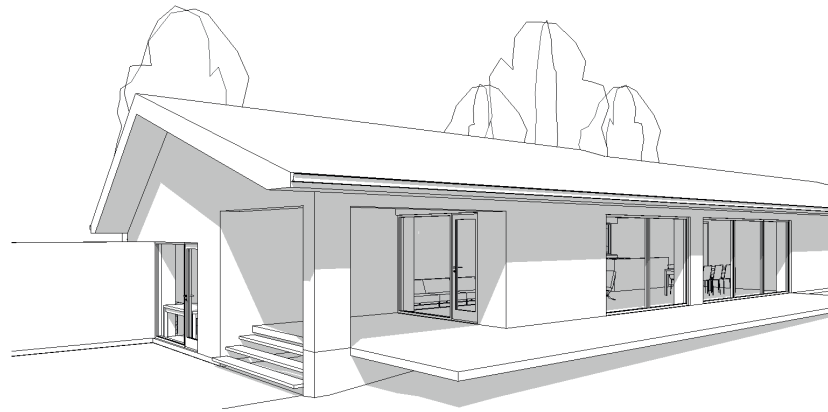
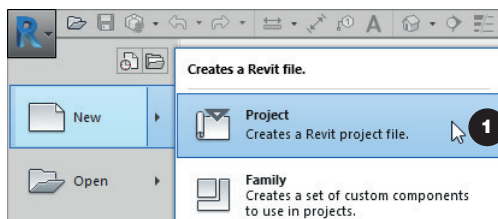
A typical page

Here, the subject of this stage in the overall procedure is being introduced. This can be a sub-procedure in the overall design process, a Revit command or a routine of commands: Its general purpose and its purpose in the case study, the overall method in a design process in general and in Revit in particular, wider application, advice and some aspects that may need special attention.

For ease of reference, introductions will sometimes be followed by an overview in bullet points (see below).

OVERVIEW/ For reference

- This summarizes a series of routines spanning several pages, or even a whole chapter.
- The overview is for reference and not detailed. For more detail, go to **Procedure** below.
- The topic of each overview is listed in the index in the back of the book.



Figures

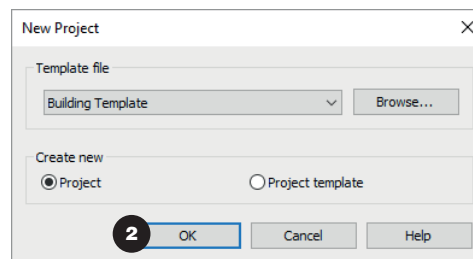
Figures provide an overview of the overall progression of the building model at the given stage.

Themes

Text formatted in italics on grey background explain some core themes in Revit. This can be important functionalities or aspects of Revit that need explanation to supply an overall understanding.

The themes explained are topics of a wider Revit relevance than the specific context in which it is shown.

For ease of reference, these themes are listed in the index in the back of the book.



PROCEDURE/ Detailed instructions step by step

The procedure title above introduces the overall objective of the work procedure described here.

Procedure step 1

For overview, the procedure text is broken into *steps*. Each step is introduced by a subtitle, like the one above.

In general, the text will tell you exactly what to do. Revit **Commands** and Revit-technical terms will be shown in **Bold**.

When a new command is introduced it is referred in the margin.

1 A number in the text refers to an illustration from the Revit user interface shown above. The referred illustration will have the same number shown in a black circle.

2 In the first part of the book, all steps and commands will be thoroughly described. Along the progress, commands and

routines already familiar will not be explained in detail.

File: Revit Case Study 2.2 pXI

Highlighted text like the above in the procedure text indicates that a Revit model elaborated to this exact point of progression is available for download on www.bimbogen.dk/models. The filename of the Revit model is shown in the box and refers to the relevant chapter, section and page in the book.

Revit command introduced in the text

4

building+site

GROUNDING THE PROJECT

This chapter picks up the building project where we left it in Volume I.

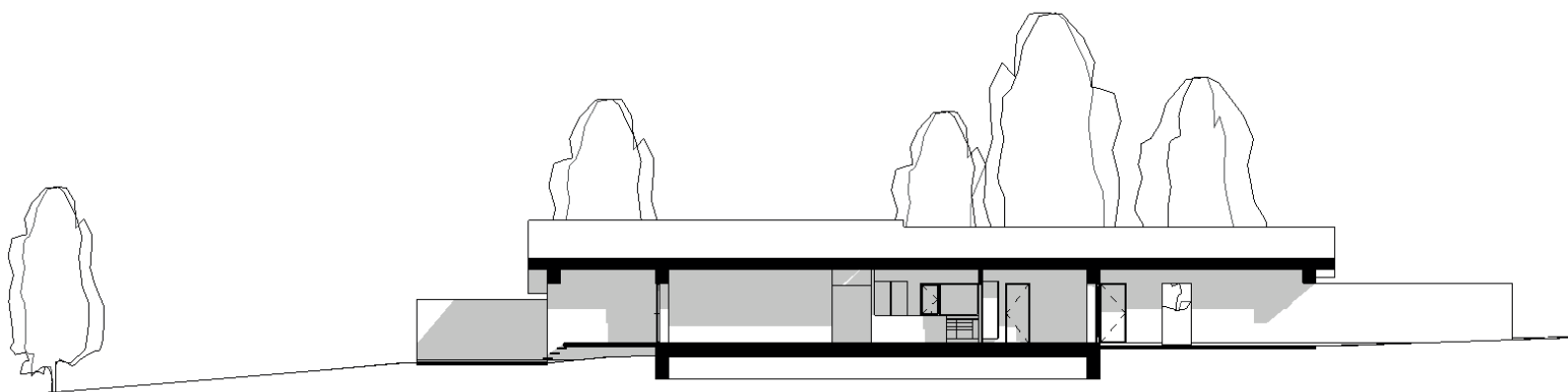
We assume that detailed 3D information about the existing conditions of the site is now made available. This enables us to design in response to the site in a more qualified way. A more precise knowledge of topography, plantation and other contextual elements of the site may influence our thoughts on how to place a building here. Thus, we will make some changes to the project in order to achieve the optimal interaction between building and site.

First, we will establish the relation between the building and the site in a BIM environment. Then, considering the terrain, we will introduce split levels in the building. This in turn affects room heights, so we reconsider also the roof.

Revit-wise, **Site** tools and **Stairs** will be introduced, and we will also look into some new tools for creating **Roofs**.

By now, following the step-by-step instructions in Volume I, the basics of Revit® have been introduced and some routines may start to feel familiar.

At this point in your progress in Revit skills, the written instructions in the *procedure bar* will be less detailed. Whenever Revit tools introduced in Volume I are needed, they will be referred to only briefly with no full explanation.



4.1/ SETTING THE BUILDING

Depending on how deep you need to go into learning about modeling topography in Revit, select one of the following scenarios:

Scenario 1

A land surveyor has sent an AutoCAD file (.DWG) with 3D site information.

Go to *APPENDIX A: SITE*, section *A.1* and follow the procedure to generate a Revit Site Model based on the AutoCAD model. Return to this chapter after completing the model.

Scenario 2

Only 2D cadastral data is available, either hard copy or as a digital image from a web platform.

Go to *APPENDIX A: SITE*, section *A.2* and follow the procedure to create a Revit Site Model from scratch based on the 2D site data. Return to this chapter after completing the model.

Scenario 3

A land surveyor has sent a Revit Site Model. Download the file *Revit Case Study SITE SURVEY* on *bimbogen.dk* and continue in this chapter.

Our newly acquired detailed site information needs to be communicated into the Building Model. This is done by **Linking** the Site Model into the Building Model.

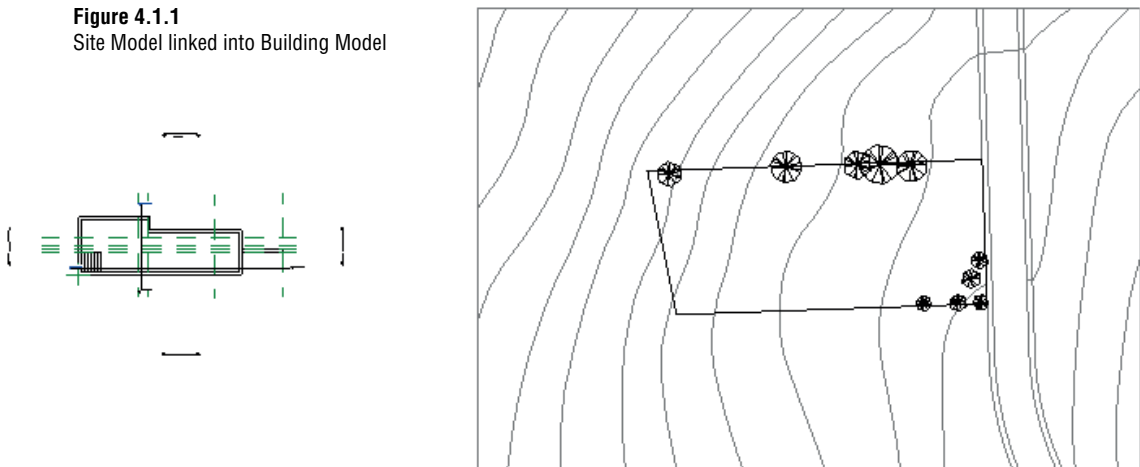
We will then establish the relation between building and site - decide exactly where to place the building on the site.

OVERVIEW/

Setting the building

- While in the Building Model, **Link** the Site Model
- In the Building Model, relocate the site in relation to the building as desired (horizontally and vertically)
- **Acquire Coordinates** from Site Survey Model
- In the Building Model, **Bind** the Site Model

Figure 4.1.1
Site Model linked into Building Model



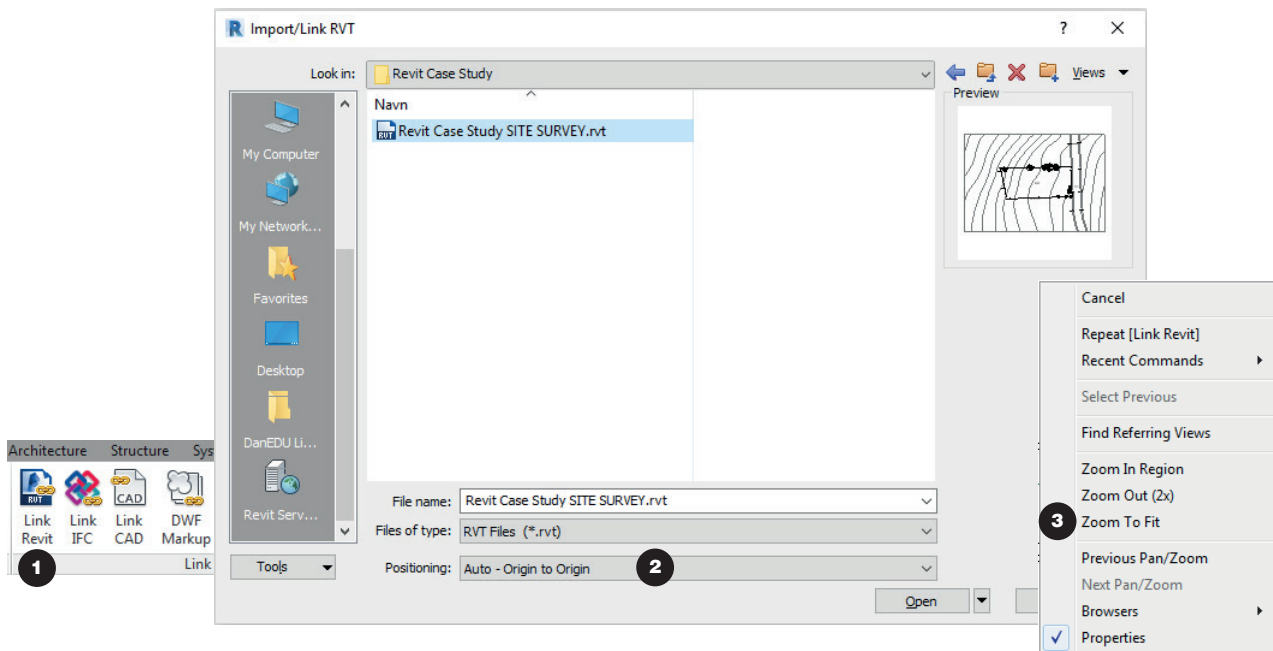
Link Models together

To communicate site information into the Building Model, the Site Model is **Linked** into the Building Model.

The linked file is referenced and can be seen in the Building Model, but not edited here. Often, the Building Model and the Site Model will remain two separate models throughout the design process.

However, since this is a relatively small project, we will break the link to the Site Model by **Binding** it in order to be able to edit the site while working in the Building Model.

Linking a number of models together is often done in large projects, enabling complex model environments to be established while still keeping file sizes to a minimum. Linking is also widely used to keep the Building divided between different *disciplines* with each their separate fields of responsibility. Each Model (Architecture Model, Landscape Model, Systems Model, Structural Model etc.) will then hold only building elements belonging to one discipline, and the complete building can be seen only by linking them all together, e. g. in one Master Model.



PROCEDURE/ Linking the Site Model

Download the file 'Revit Case Study SITE SURVEY' from BIMbogen.dk and unpack it - or create a Site Model following the instructions in chapter A.1 or A.2.

Make sure to place the Site Model in your project folder (BIM Projects/Revit Case Study).

Leave the file here and do not open it. Instead, open your Building Model.

File: Revit Case Study 4.0 p3

Delete site elements

Go to View Site.

In the Drawing Area, Select all preliminary site elements from previous stages: **Plantation**, **Toposurface** and **Detail Lines**. Use any method of selection learned.

Delete all Selected objects.

Link Site Model

1 In the Tab **Insert**, click **Link Revit**.

2 Browse to the project folder and pick *Revit Case Study SITE SURVEY.rvt*. Set **Positioning** to **Auto - Origin to Origin**. Click **Open**.

Review Model

3 Zoom out to see the whole site in a larger scale; **Right-click** and pick **Zoom To Fit** - all elements visible in this view will now be within the Drawing Area. Keyboard shortcut is (ZE).

Site View should look like Figure 4.1.1.

Link Revit

Zoom to Fit

Position the building on site

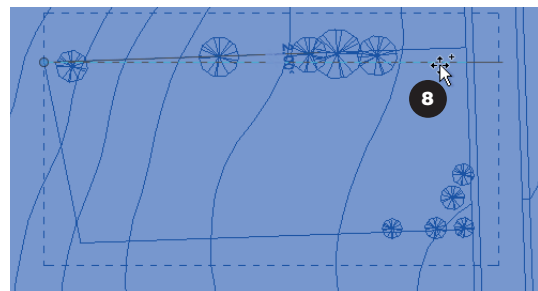
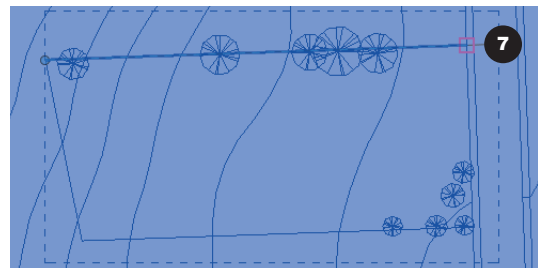
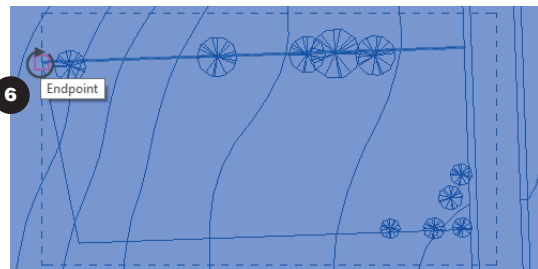
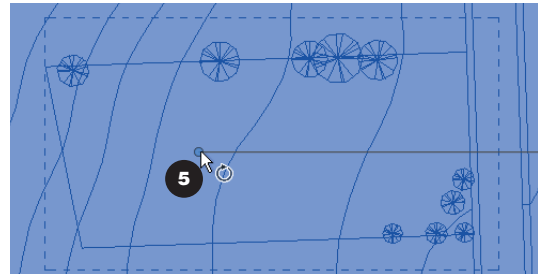
Technically, the process in Revit of positioning the building on site is actually the opposite: We will *not* Move or Rotate the building, instead we Move and Rotate the Linked Site Model! This is important, since Moving or Rotating a building already modeled in Revit's 3-dimensional space would be very complicated.

First, we will Rotate the site correctly according to the building, and then we will Move the site to position the building correctly.

Moving the site must be done in three dimensions: X, Y (horizontally) and Z (vertically).

In the Site View, we adjust the X and Y position, Moving the Linked Site Model. For privacy, the north-facing external Wall is kept at a distance of 4,5 meters from the Site Boundary.

Finally, we will go to a Section View and move the Linked Site Model in the Z-direction.



PROCEDURE/ Positioning the building on site

Rotate

Rotate Linked Site Model

Select the Linked *Site Model*.

4 Start the **Rotate** command.

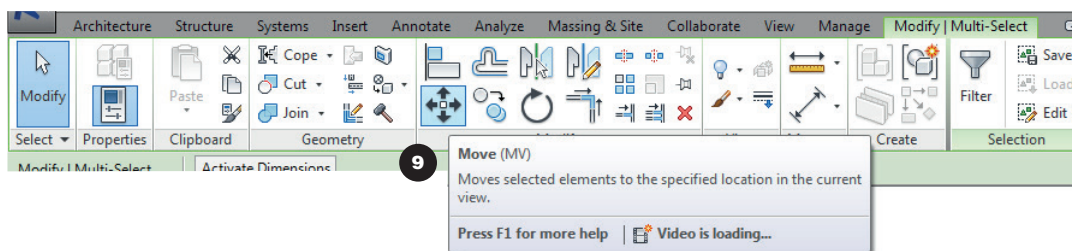
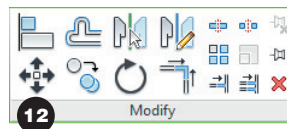
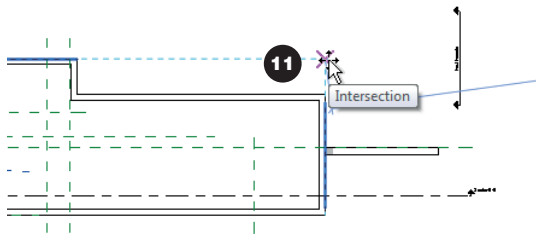
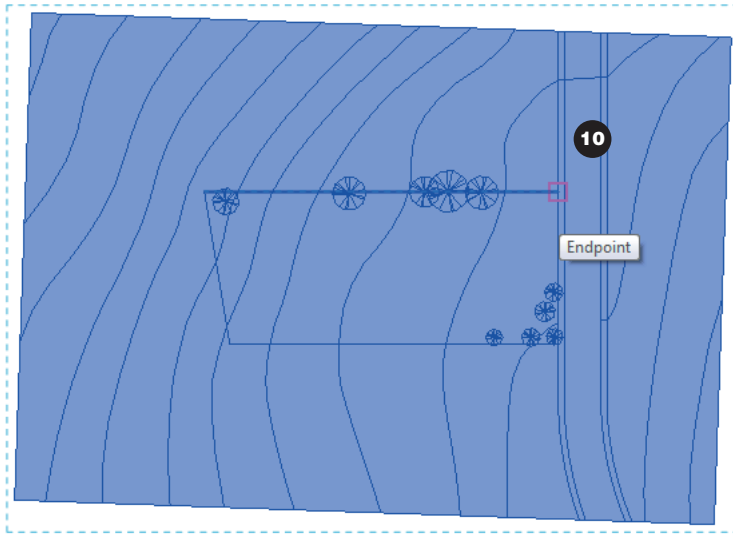
5 Click on the center of rotation (the blue dot) to pick it up.

6 Click on this endpoint of the northern Site Boundary to place the center of rotation here.

7 Click on the opposite endpoint to start rotating from here.

8 Move the cursor down until snapping to horizontal. Click to finish rotating the linked Site Model.

The northern Site Boundary should now be shown horizontal in the View.



Move in X and Y-direction

9 Select the Linked Site Model and start the **Move** command.

10 Click at the endpoint of the two intersecting Property Lines to start moving the Site Model from this specific point.

11 Click on the snap point where the north and east facade intersect. Click to place the Site Model here temporarily.

The building will be hidden under the Site Model. Set the Visual Style to **Wireframe** to see through the Site Model.

12 With the Site Model still Selected, start the **Move** command again (MV).

Move

*Visual Style:
Wireframe*

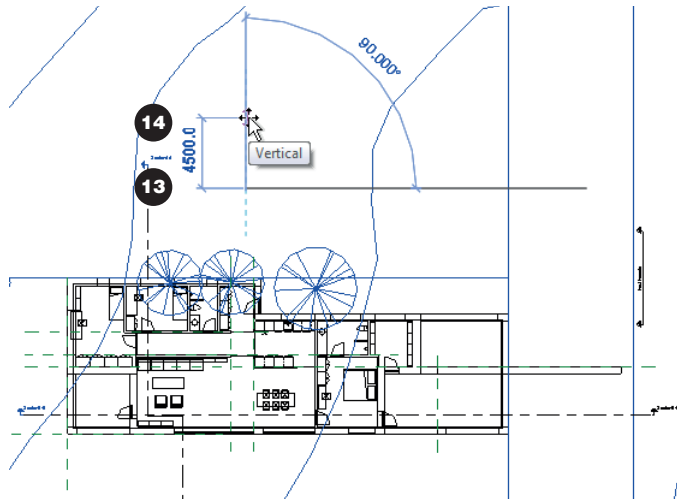


Figure 4.1.2
Moving Linked Site Model in Y-direction

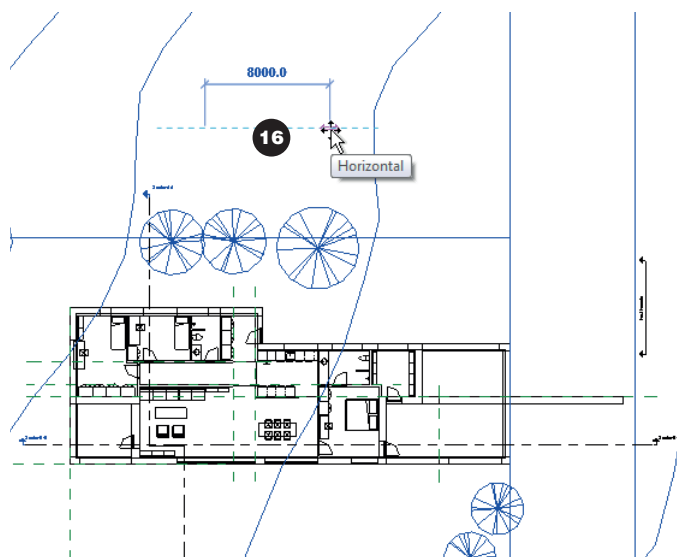
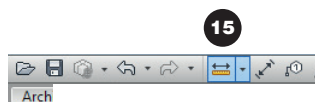


Figure 4.1.3
Moving Linked Site Model in X-direction



Measure

13 Click in a random spot to start Moving the Site Model from here.

14 Drag the cursor upwards, snapping to vertical, and type **4500**.

End the command.

The building should now be positioned correctly in the Y-direction - 4,5 meters from the northern Site Boundary. We will now control if this is the case.

15 In the Quick Access Bar, activate the **Measure** tool to check if the distance is correct: Click first anywhere on the northernmost external Wall, then on the northern Site Boundary.

The measured distance will display both in the Drawing Area and in the Options Bar.

16 Carry out a similar thread of actions to position the building correctly in the X-direction (horizontally). The east-facing wall should be positioned 8 meters from the eastern Site Boundary.

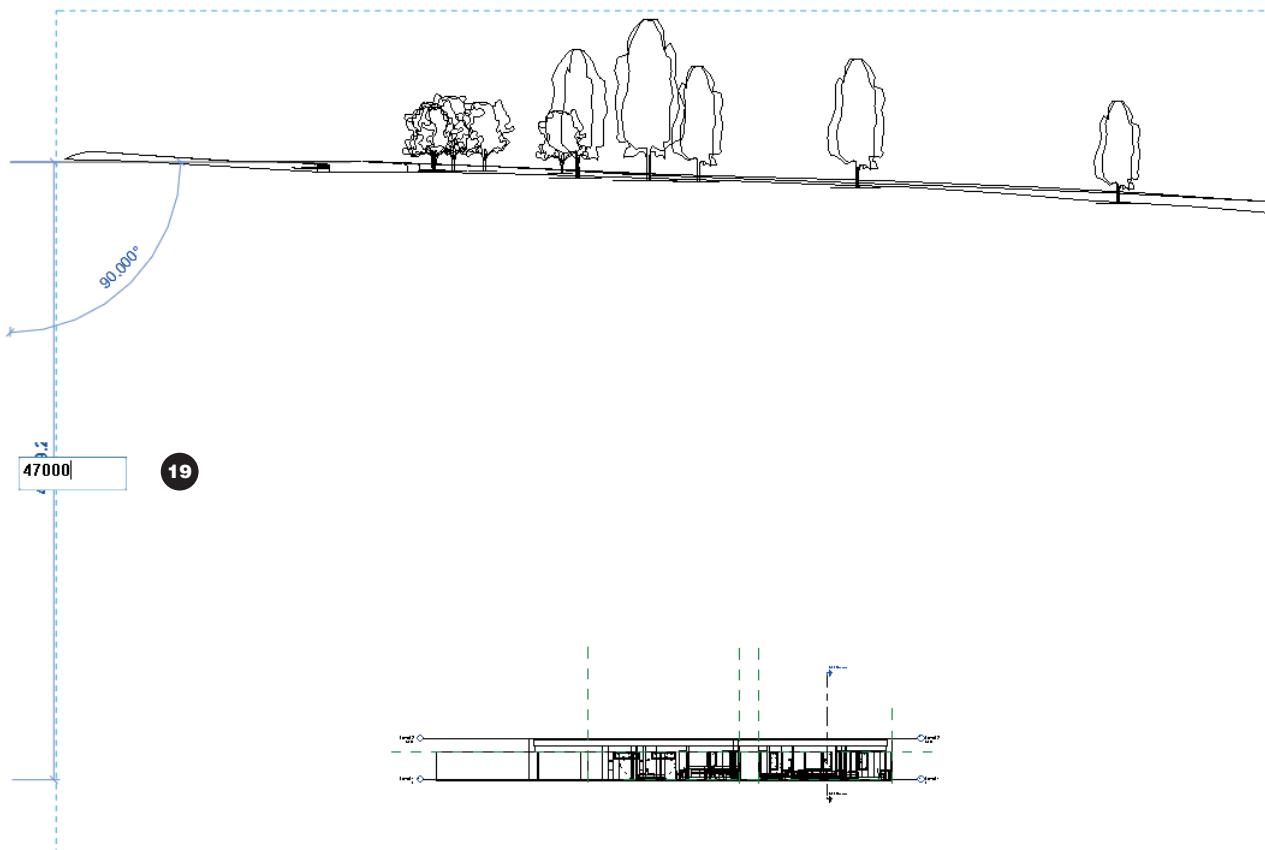
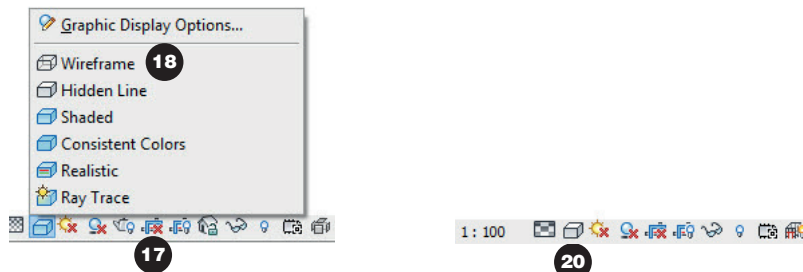


Figure 4.1.4
Moving Site Model down



Move in Z-direction

Now we need to adjust the elevation of the building. First, we need to estimate the height of the ground floor (above sea level). Our first estimation based on viewing the survey plan is **47 meters** - this can be adjusted later.

Go to Elevation North.

17 In the View Control Bar, click **Do Not Crop View** to turn on the visibility of objects outside the crop region.

The building may be hidden behind the mass of the Topo-surface now visible.

18 Set Visual Style to **Wireframe** to see the building again.

Double-click the scroll wheel on your mouse to **Zoom to Fit**.

Select the Site Model and start the **Move** command.

Click anywhere in the Drawing Area and move the cursor downwards, snapping to vertical direction, and type the desired move distance (**47000**). Press **enter**.

20 Set **Visual Style** to **Hidden Line** on both *Site* and *North Elevation*.

Visual Style:
Hidden Line

Zoom to Fit

Aquire coordinates

The Site Model contains not only information about existing physical objects (topography, plantation etc.), but also information about the whereabouts in the world:

- Direction of the True North
- Height above sea level (Shared Elevation).

We will now transfer this information from the Site Model to the Building Model using the command **Acquire Coordinates**. This is possible only because the Site Model is linked into the Building Model.

True North and Project North

Revit operates with two different directions both called north: **Project North** and **True North**.

By default, all Plan Views are oriented towards **Project North**. Also by default, **True North** is set to be the same direction as **Project North**.

In most cases (when dealing with rectangular building plans), a building is not oriented exactly north/south. When modeling in plan Views, it is practical to have the building oriented towards a direction which is not the true north, but rather a direction close to north, allowing us to view the plan with as many lines as possible parallel to horizontal or vertical. This direction is called **Project North** and is also often a direction of reference shared and agreed on between parties involved in the design process.

Thus far we have been working in Views set to **Project North**. The Site Plan, however, is normally shown with True North orientation. At this point we therefore need to distinguish between Project and True North, and to specify the True North.

One way to do this is to **Acquire Coordinates** from a linked Site Survey Model.

Alternatively, the command **Rotate True North** can be used.

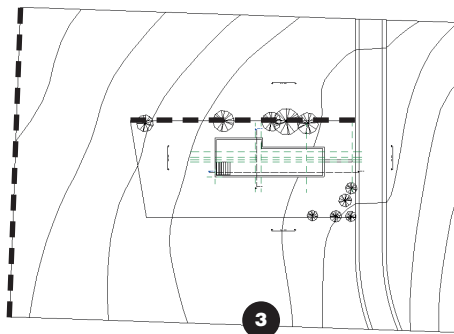
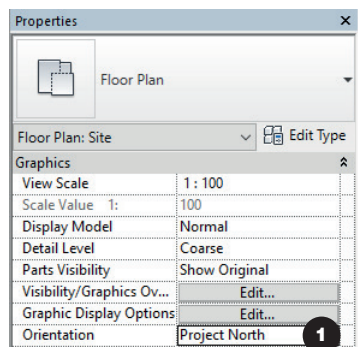


Figure 4.1.5
Site View with Orientation set to Project North

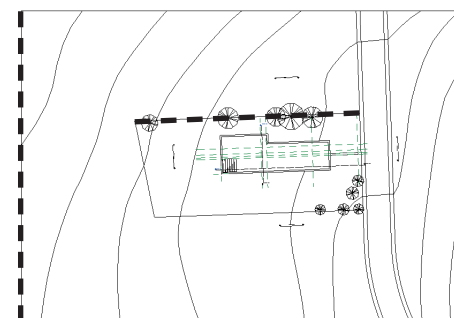
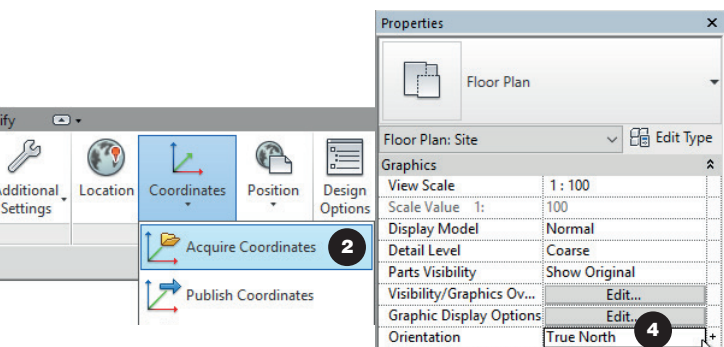


Figure 4.1.6
Site View with Orientation set to True North

PROCEDURE/ Acquiring Coordinates

Acquire Coordinates Orientation

Import information

Go to the Site View.

1 In Properties, notice that the **Orientation** is set to **Project North**. Walls are displayed vertical and horizontal. (see Figure 4.1.5).

2 In the tab **Manage**, click on **Coordinates** and start the **Acquire Coordinates** command.

3 Click on the linked Site Model to take the information from here.

Review Model

4 In Properties, set **Orientation** to **True North**. The View should change and look like in Figure 4.1.6. Switch Orientation back to **Project North**.

Bind the Site Model

The two Models could be left like this - one linked into the other, and changes made individually to both.

In a small project like this it is easier to break the link between the Site Model and the Building Model, making it one single Revit Project file.

When breaking the link, objects from the Site model becomes editable object in the Building Model.

Binding does not affect the original linked file.

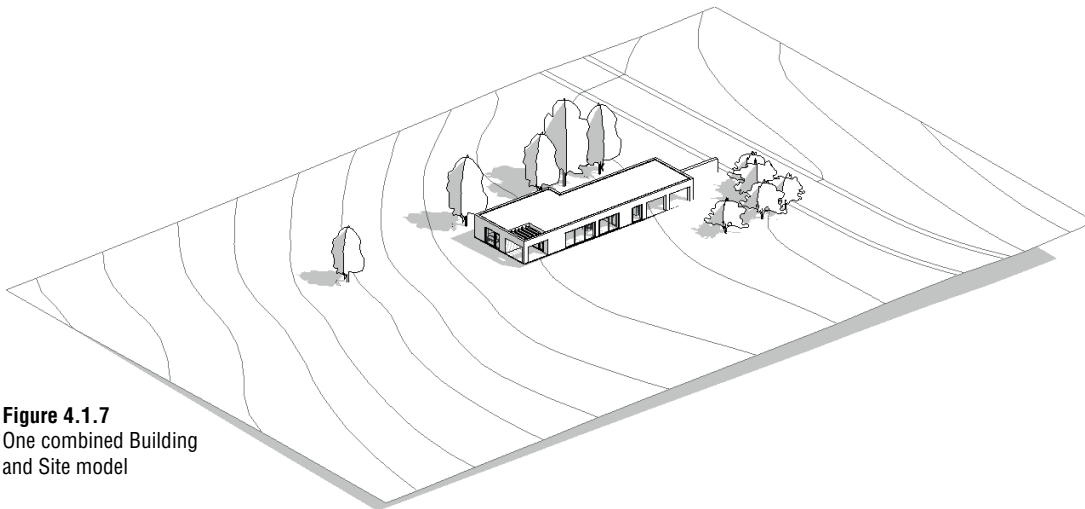
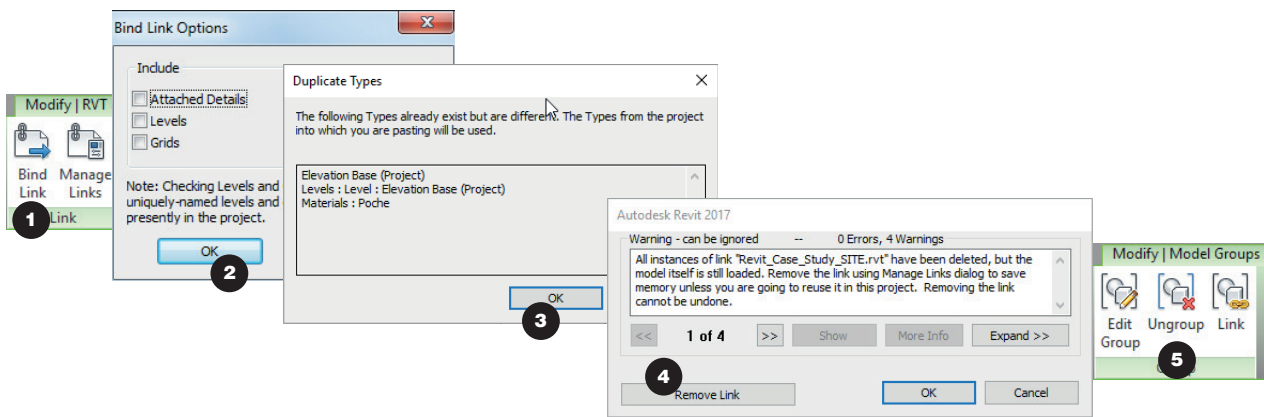


Figure 4.1.7
One combined Building and Site model



PROCEDURE/ Binding the Site Model

Bind Site Model

In the *Site View*, Select the Linked Site Model.

1 Click **Bind Link**.

2 Clear the list and click **OK**.

3 Click **OK** to the Warning (Types from this project will be used).

4 Click **Remove Link** to break the Link to the Site Model. The Linked Site Model is now converted to a **Group**.

Select the Group.

5 Click **Ungroup**. The Toposurface should now be editable.

Bind Link

Ungroup

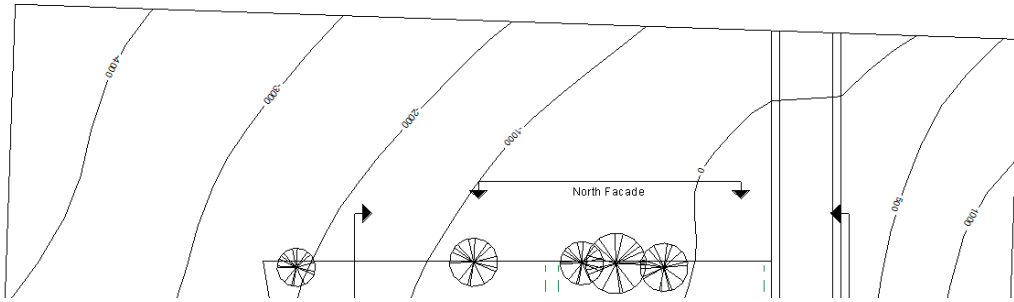


Figure 4.1.8
Contour Label showing Project Elevations

Elevation coordinates

In this project, **Shared Elevation** is set to refer to the height above sea level acquired from the Survey Model. **Project Elevation** is set to reflect elevation above the finished floor surface. Levels in Elevation and Section Views are set by default to reflect **Project Elevation**.

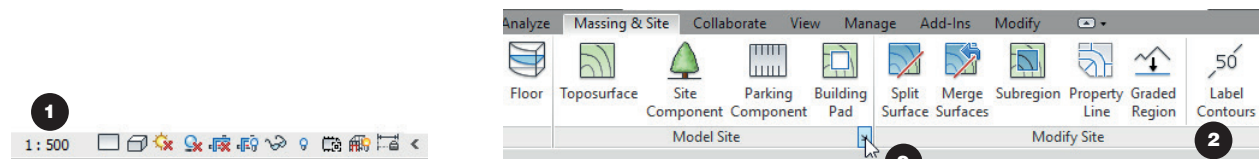
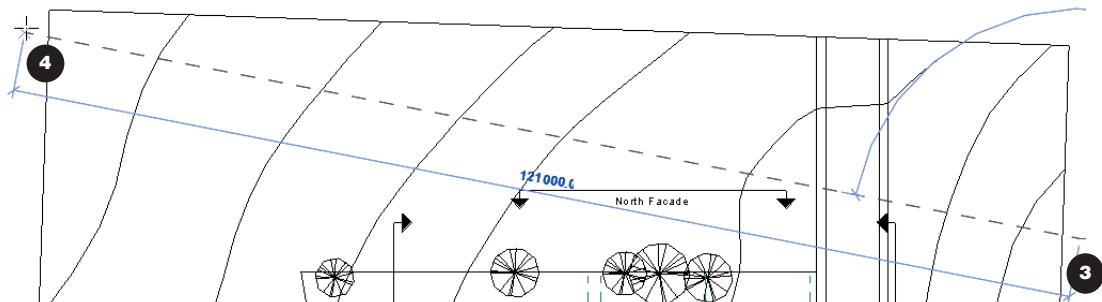
Project Elevation is already set correctly because the Elevation of the Ground Floor was set to 0 when we started modeling.

The correct setting for Shared Elevation was acquired from the Site Survey Model when we used the command **Acquire Coordinates**.

Elevations - Project vs. Shared

Just like Revit operates with several norths - True and Project - also several parallel systems of elevations are used. At this point we need to distinguish between two: Shared Elevation and Project Elevation.

Like it is the case for Project and True North, Project and Shared elevation is set by default to be the same at the outset of a project.



PROCEDURE/ Documentation of coordinates

Label Contours

Label Contours

1 Set the **Visual Scale** of the Site View to 1:500.

2 In the Tab *Massing and Site*, click **Label Contours**.

3 Click in one end of the Toposurface to start a line of Contour Labels here.

4 Draw a line perpendicular to the contour lines. Click in the opposite end of the Toposurface to end the Contour Labels here.

Looking at the Contour Labels, we can see that they show the *Project Elevation* (see Figure 4.1.8)

Adjust Contours

In the Drawing Area, click to Select the Contour Label.

5 In Properties, click **Edit Type**. Duplicate the Type.

6 Name the new Contour Label Type 1.5mm Arial - Survey Point. Click **OK**.

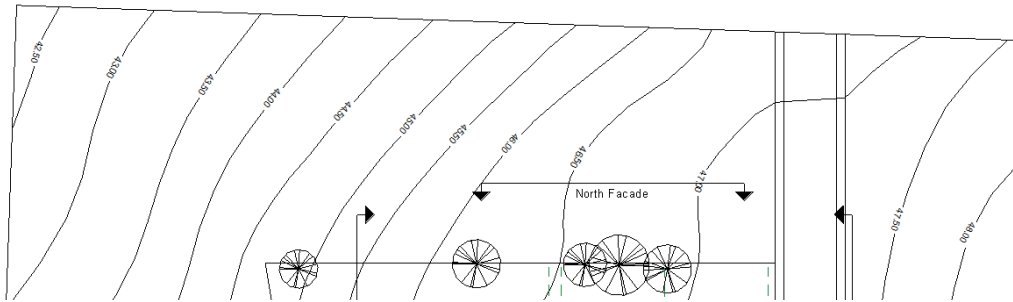
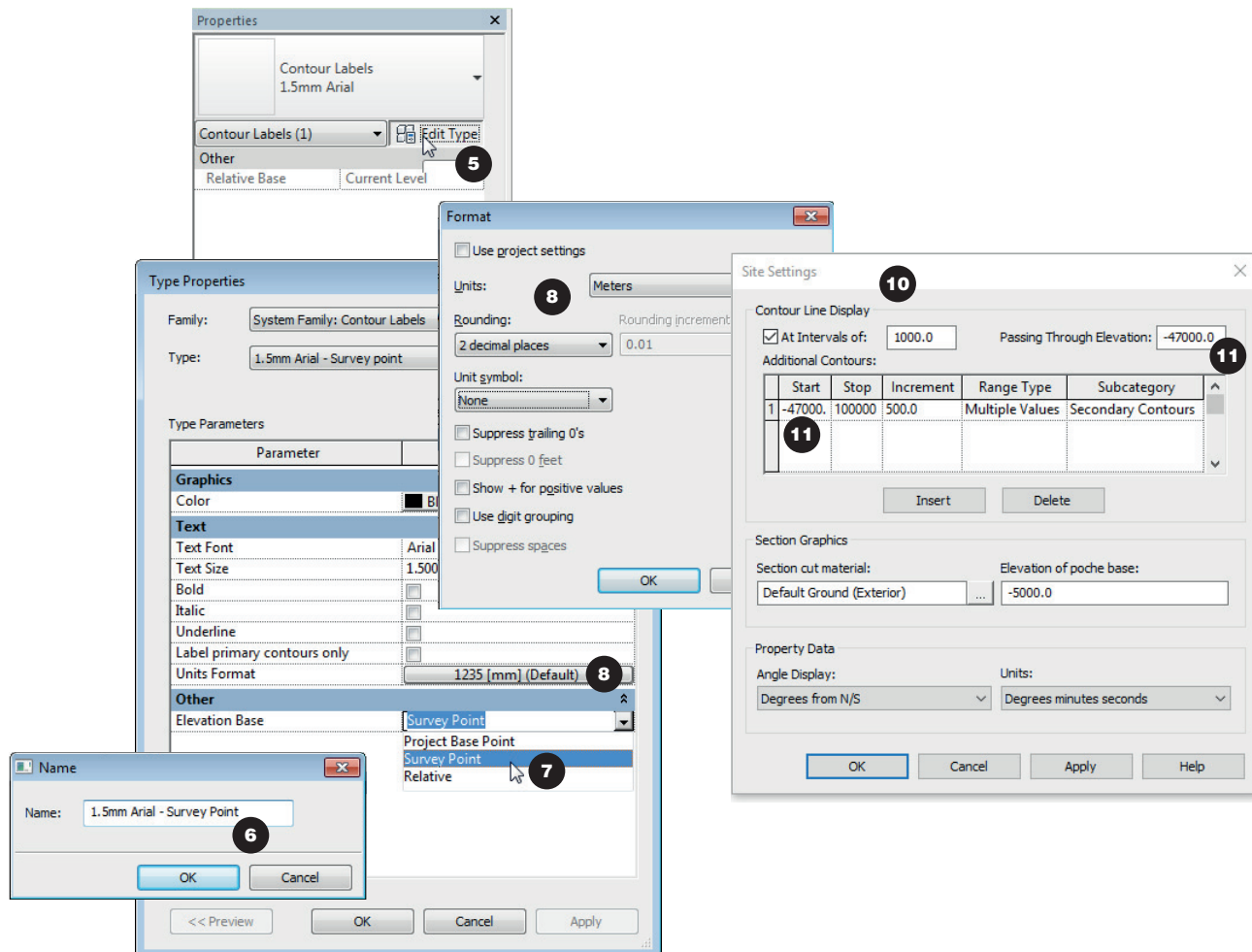


Figure 4.1.9
Contour Label showing Shared Coordinates (in this case height above sea level)



7 Click on the arrow to set the **Elevation Base** to **Survey Point**.

8 Now click to **Edit Unit Format**. First, uncheck **Use Project Units** and then set **Units** to **Meters** and **Rounding** to **2 decimal places**. Click **OK**.

9 In the **Massing & Site** tab, go to the **Model Site** group and click on the small arrow to see **Site Settings**.

10 Adjust settings as shown. All elevations shown are **Project elevation**.

11 We want all Contour Lines to set out from sea level (47 m below Project Elevation origin) - type **-47000** in these fields.

Review Model

The Contour Labels should now display the **Shared Elevation** as in Figure 4.1.9.

Units Format

Site Settings

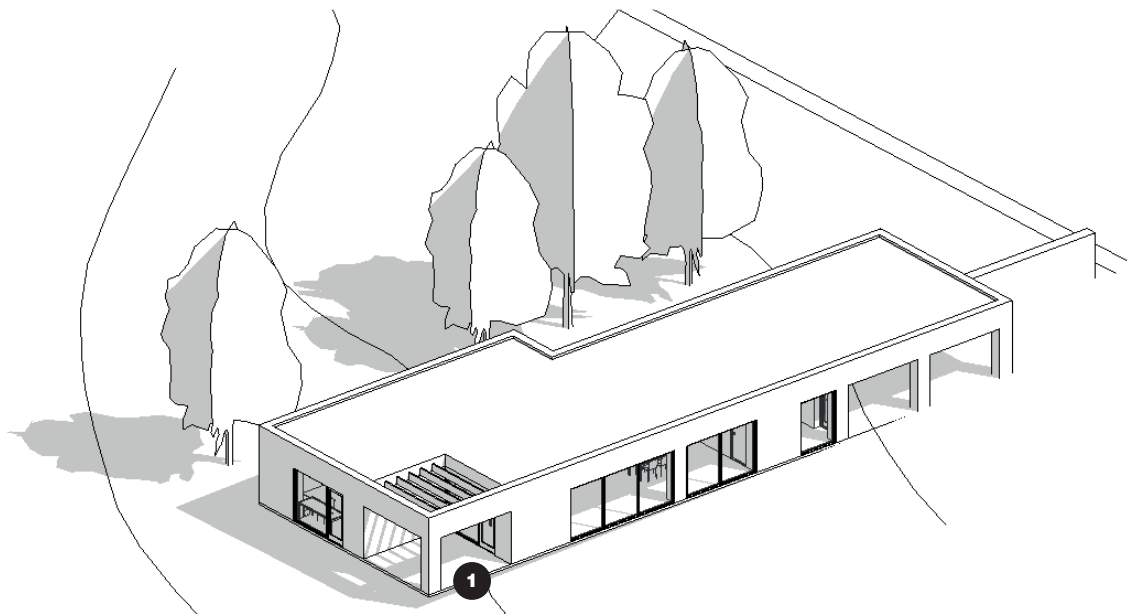


Figure 4.1.10

The building with the original Floor, before adding the Building Pad.
One part of the building appears to be floating in the air, another is submerged.

Building Pad

We have now positioned the existing terrain relative to the building. Still, it is not evident in 3D View how the terrain and the building interact. One part of the building is floating in air, another seems to be submerged in earth with no clear intersection lines. A clear meeting between the two needs to be established.

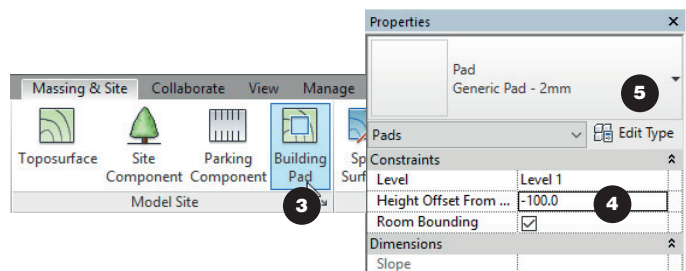
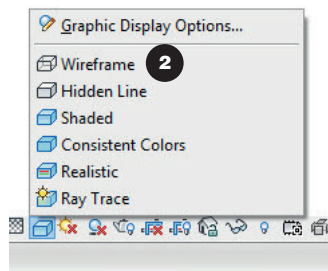
To bring terrain and building together in a project like our case study, designing a 'heavy' building appearing to rest on a base (i.e. with linear foundations, not supported on piles etc.), we place the building on a **Building Pad**.

In Revit, a Building Pad is a horizontal planar object, much like a Floor, used for placing in or above a Toposurface.

Unlike a Floor, however, it will 'carve out' a void in the Toposurface from its underside and upwards. If the underside of the Pad is placed above terrain level, the in-between space will be 'filled up'.

Thus, the Building Pad can be conceived as a planar excavation or gradation lined with gravel or sand, preparing for the placement of a building.

At a Concept Design stage, we are only interested in the 'levelling' properties of the Pad, not yet its structure or thickness. Therefore, we will create it with minimal thickness.



PROCEDURE/ Building Pad

Building Pad

Preparations

1 Go to the View **3D**. Select the Floor. Go to the Type Selector and change the Floor Type to **Generic - 400mm (Ground)**.

Set up Type

Go to **Site**.

2 Set **Visual Style** to **Wireframe**.

3 In the tab **Massing and Site**, start the **Building Pad** command. Edit Mode is now active. Before drawing, adjust these settings:

4 In Properties, set **Height Offset From Level** to **-400**.

The top of the Pad will be positioned 400 mm lower than **Level 1** - right under the Floor.

5 In the Type Selector, make sure that **Generic Pad - 2mm** is selected.

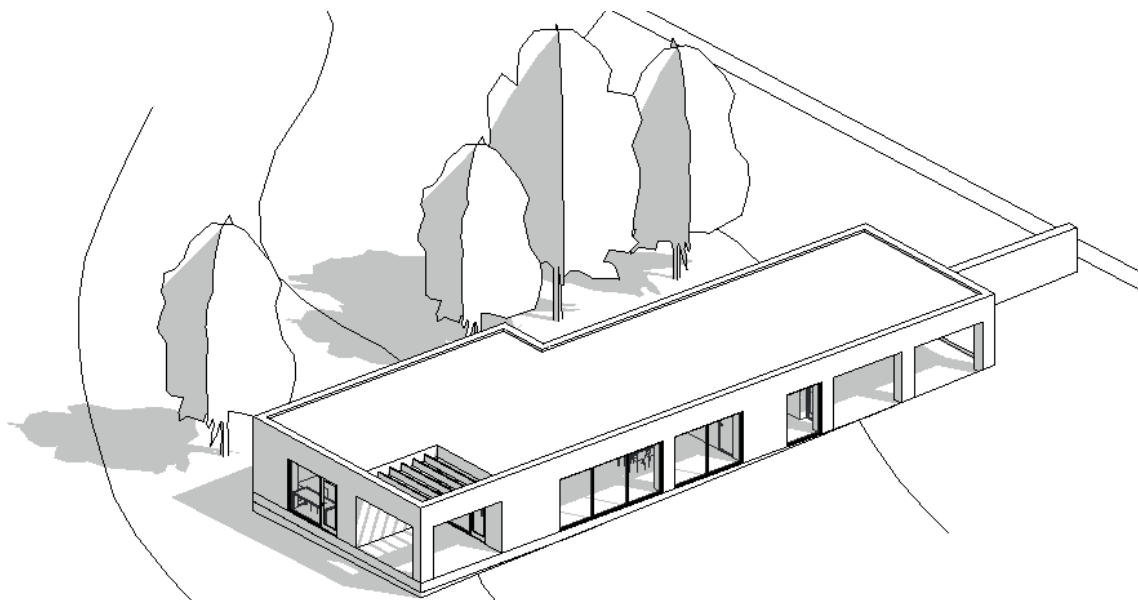
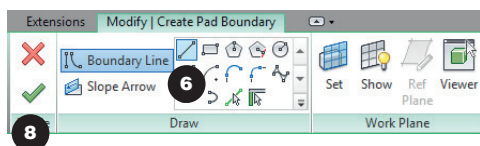
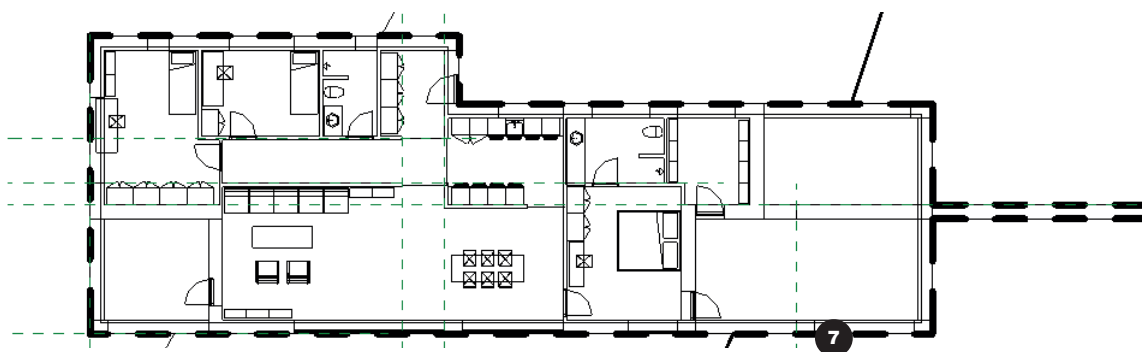


Figure 4.1.11

The building with Building Pad added, cutting the terrain and forming a base. It is now easier to see the position of the Floor in relation to the terrain.



Draw Building Pad

6 Start drawing the Pad Boundary. Use drawing tools learned earlier: **Pick Lines** or **Line**.

7 The Pad Boundary lines should be aligned to the outer edge of the external Walls. Remember that the Boundary Lines must form a closed loop.

8 In the tab **Modify**, click the green tick to finish the Pad Boundary. Go to **3D View** and check the result - it should look like *Figure 4.1.11*.

4.2/ ADJUSTING BUILDING TO SITE I

The first step in the process of adapting the building and the site to each other will be to adjust the building to the terrain.

We will try to accommodate the Floor Level of the building to the terrain by lowering the floor in some rooms, splitting the levels of the house. This requires some adjustments to Walls and Floor.

In Volume I, we used the Floor element as a simple base for the building, extending

under the external Walls. In this chapter, we will model proper foundation walls under the external Walls.

We will also use the Floor tool for modeling terraces outside.

Before setting out to modify the model, we will sharpen our viewing tools to get better orientation while working.

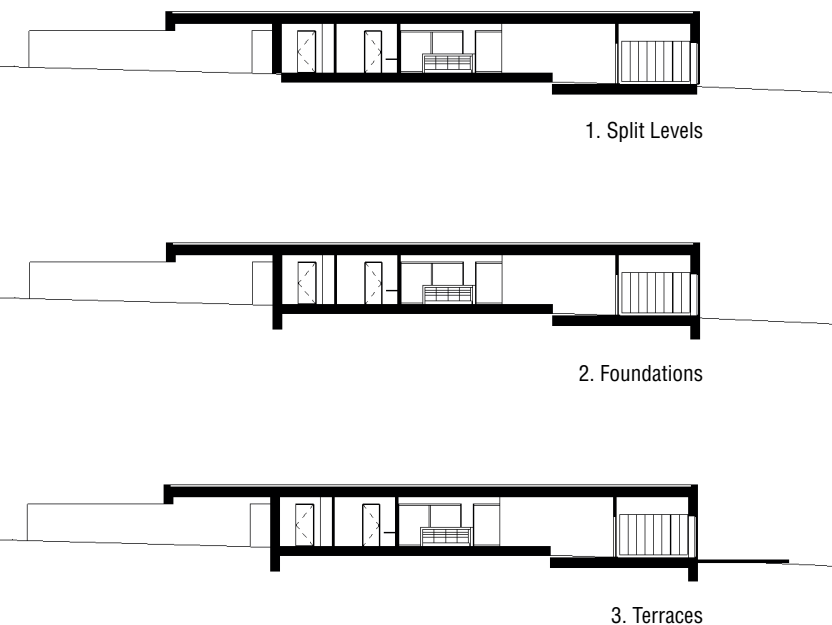


Figure 4.2.1
Stages of the development of the Building
Model in chapter 4.2

OVERVIEW/ Splitting Levels

- Set up new **Level**
- Create new **Floors** or edit the existing
- Split and adjust existing **Walls**
- Create Foundation Walls
- Review model and make corrections as necessary
- Adjust Furniture and Casework to new Levels

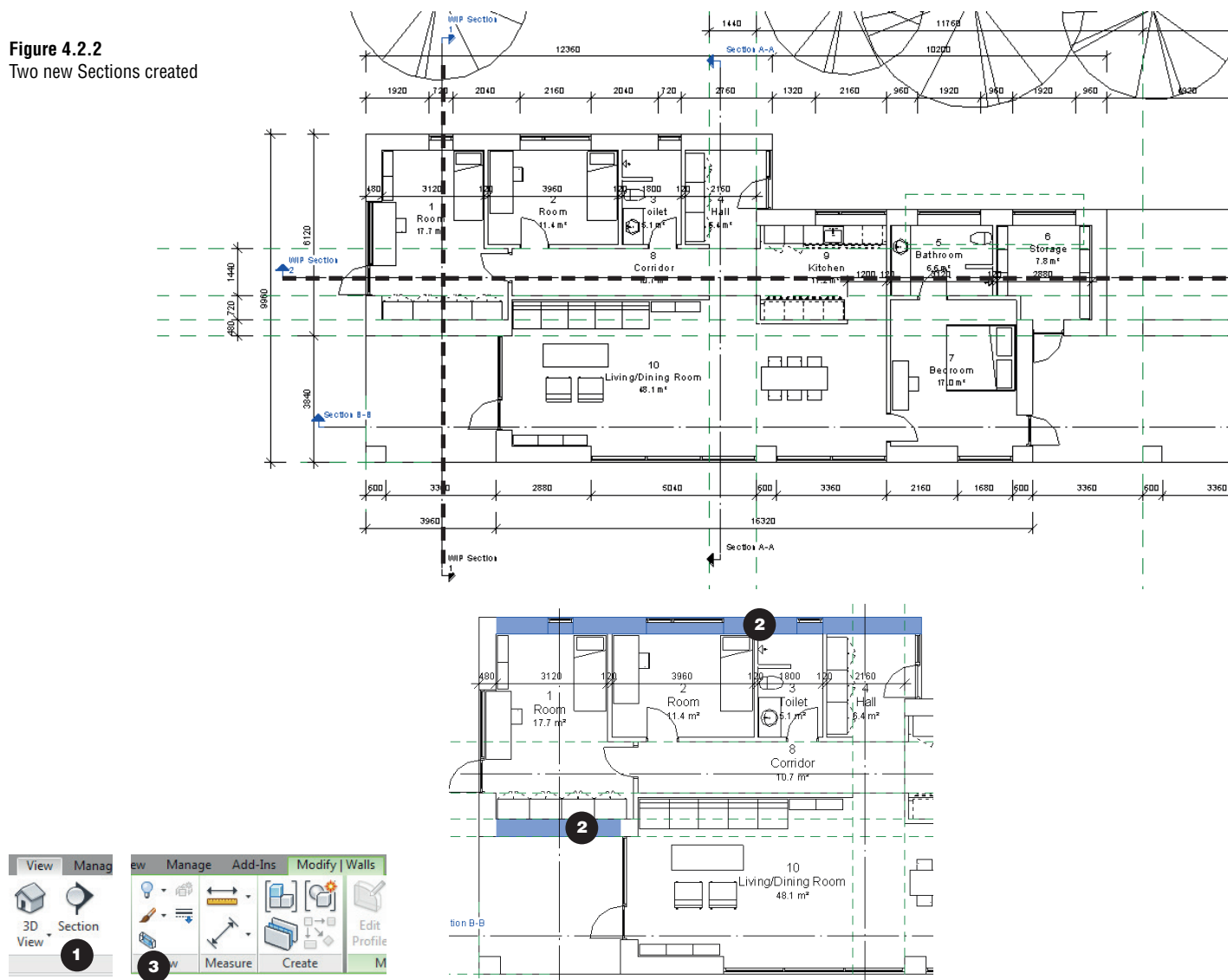
WIP Views: Generating a better overview

As the model becomes more complex, it becomes increasingly important to organize our means of viewing it in order to see properly the impact of our modeling and editing actions.
For this, we will set up some *WIP Views*

to better enabling us to watch the model in detail.

WIP is short for **Work In Progress**, indicating that the Views are not Output Views, but only for inspecting the model while working.

Figure 4.2.2
Two new Sections created



PROCEDURE/ **Generate overview**

File: Revit Case Study 4.2 p15

Create WIP Section Views

1 Go to *Level 1* and create two new Sections: **View > Section**. They will automatically be named *Section 1* and *Section 2*. See *Figure 4.2.2*.

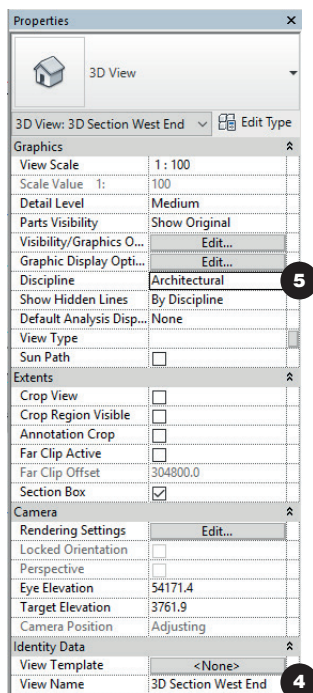
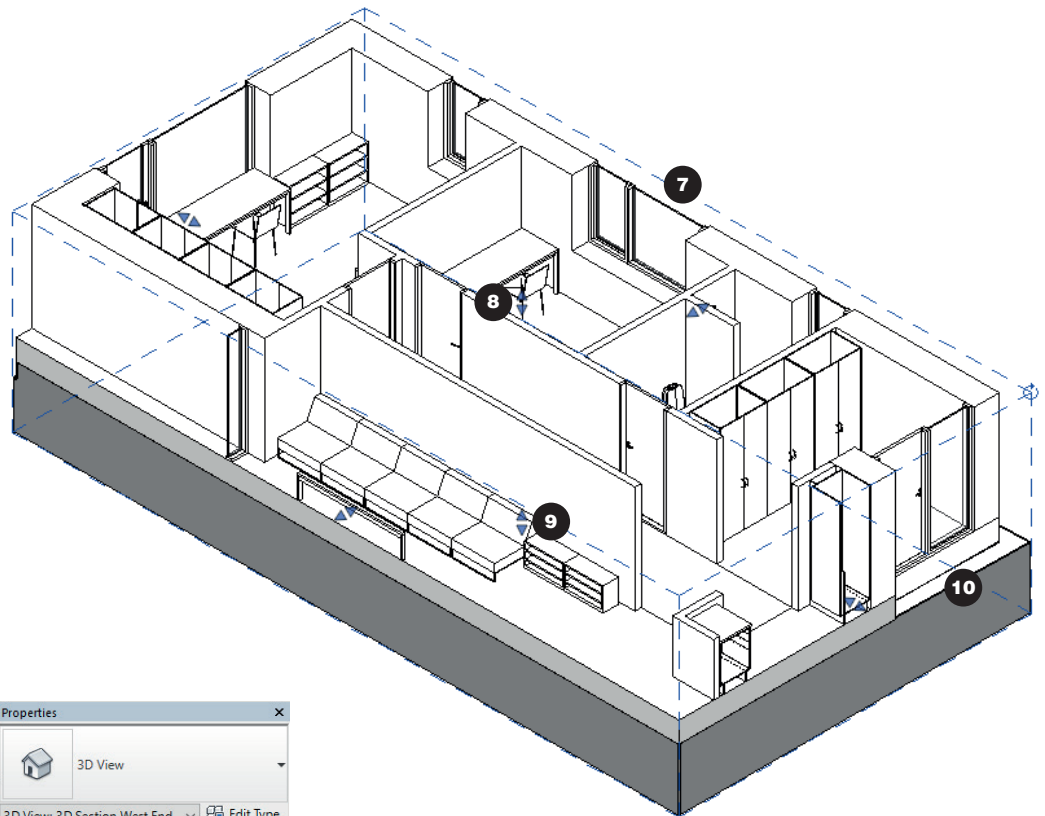
Rename *Section 1* to *WIP Section 1* and *Section 2* to *WIP Section 2*.

Create 3D WIP Section

2 Select these two Walls.

3 In the **Contextual Modify** Tab, start the **Selection Box** command.

A new 3D Section View is generated. Press **ESC** to Deselect the two Walls.



4 In **Properties**, rename the View to *3D Section West End*.

5 Set the **Discipline** to *Architectural*. This will move the View to the correct folder in the Project Browser.

6 Set the **Visual Style** to *Hidden Line*.

7 Click on the edge of the 3D Section Box to Select it.

8 Drag the top **Control** down to cut back the Roof.

9 Drag the bottom **Control** down to display topography under the building.

10 Select the Topography and press **VH** to hide the Category Topography.

11 Turn on Shadows. If shadows are too dark, go to page 35 of *Volume I* to see how to adjust them.

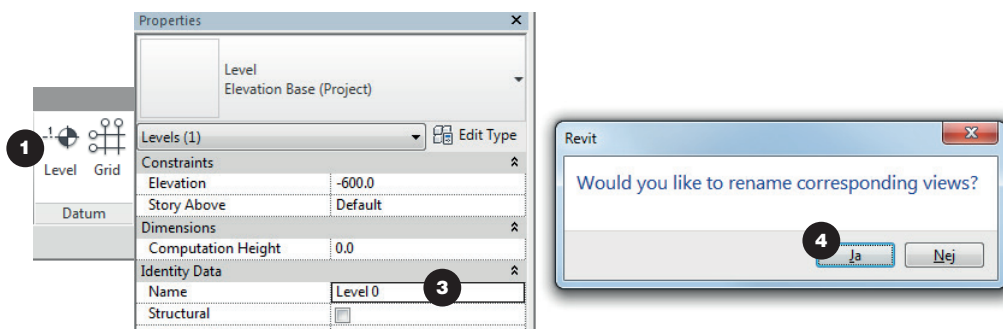
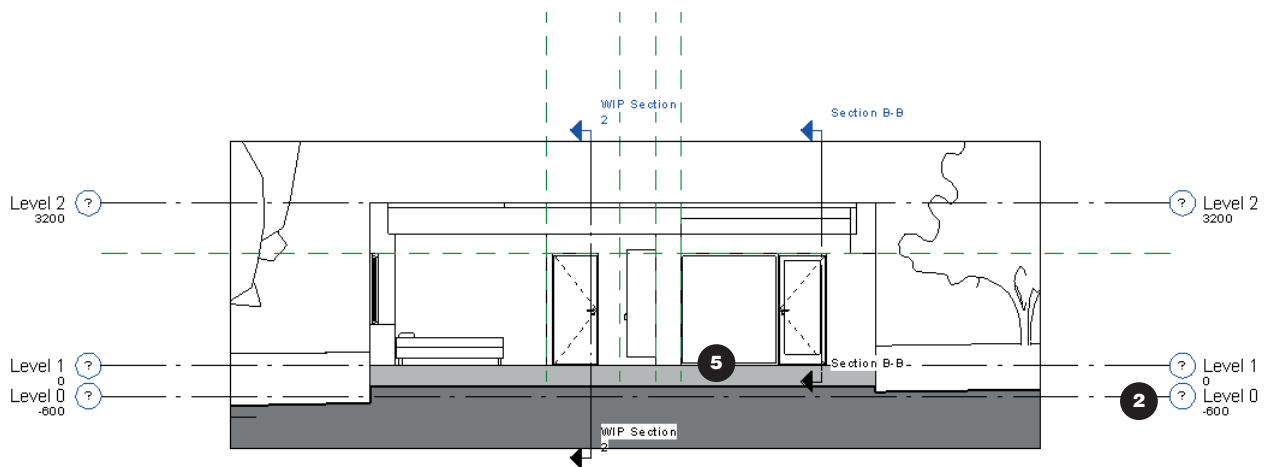
Split Levels I

Seeing the building set in the terrain and considering the slope under the building, it now seems reasonable to try to make the design respond more closely to the terrain.

We will change the design and split the floor levels, introducing a new floor level below the current in the western end of the building.

Revit-wise, this is done by creating two Floors instead of one. We will set up a new Level in Revit to control the new Floor.

The edge of the Floor already created could be adjusted to accommodate the new design. Instead, we will Delete it and create a new Floor in its place - this will sometimes be easier than editing.



PROCEDURE/ Splitting Floors

Set up Levels

Go to *WIP Section 1*.

1 To create a new Level, go to the tab **Architecture > Datum** and start the **Level** command.

2 In the Drawing Area, click to draw a new Level 600 below Level 1.

3 Select the new Level and rename it *Level 0*.

4 Click **Yes** to rename the corresponding view.

Along with the new *Level 0*, a new Floor Plan has automatically been created (see the Project Browser).

5 Select the Floor and press **DELETE**.

Level

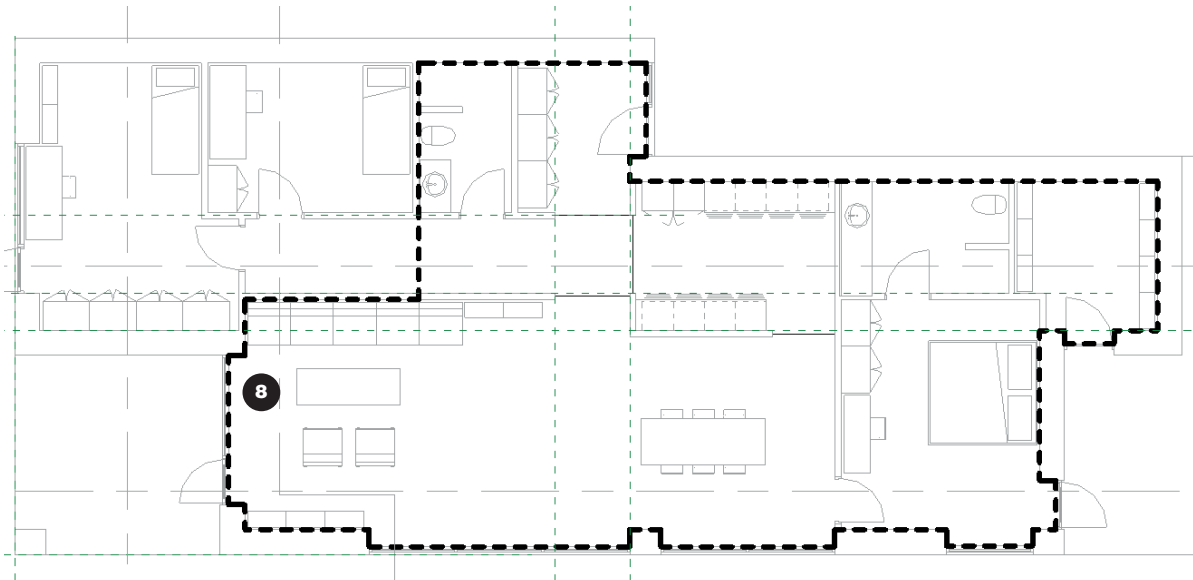
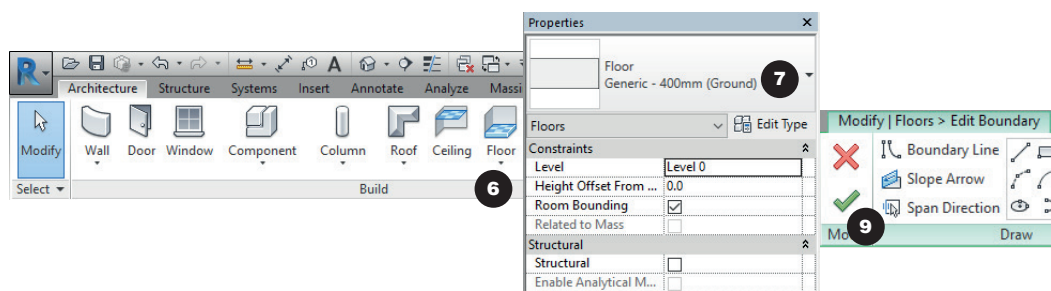


Figure 4.2.4
New floor boundary Level 1



Floor - Level 1

Go to *Level 1*.

6 Go to **Architecture > Floor** to start the Floor command. Start creating a new Floor of the Type *Generic - 400mm (Ground)* using the same method as before.

7 In the **Type Selector**, pick Floor Type *Generic - 400 mm. (Ground)*.

8 The floor boundary must be drawn according to *Figure 4.2.4*.

9 When finished, click **Finish Edit Mode**.

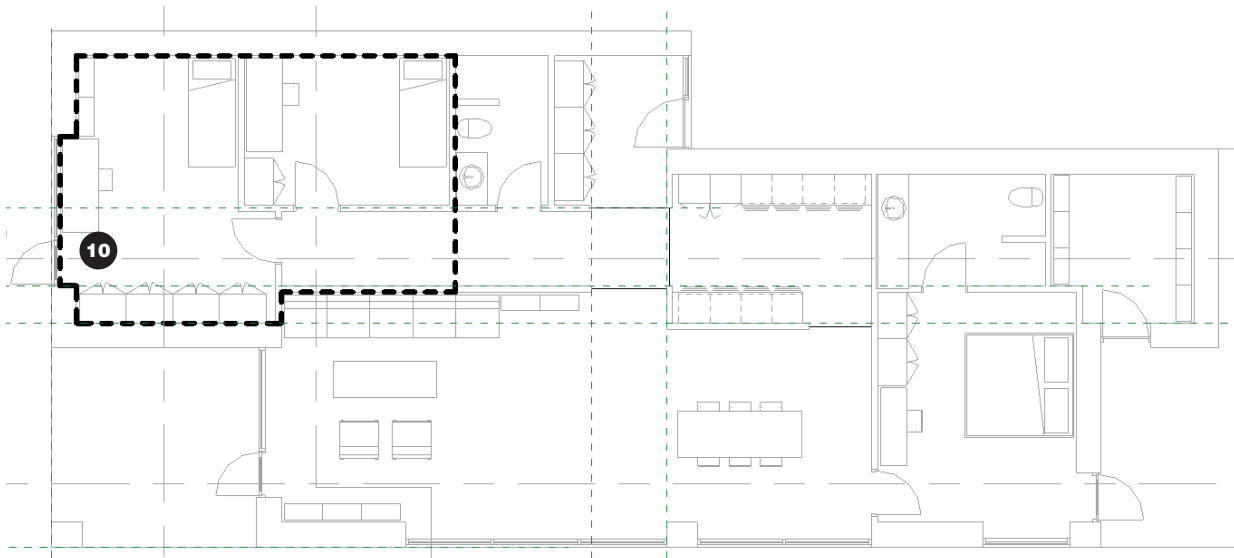
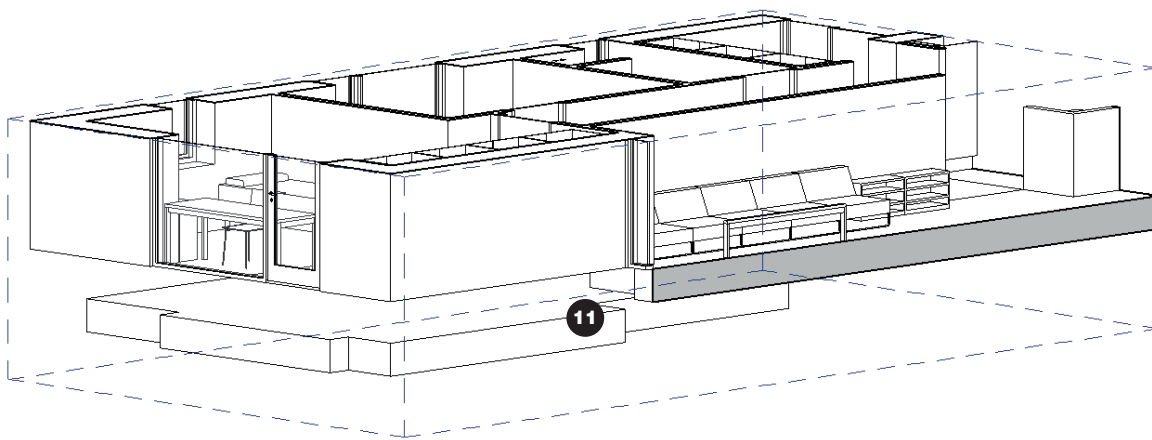


Figure 4.2.5
New floor boundary on Level 0



Floor - Level 0

Go to *Level 0* and zoom in on the west end of the building (see *Figure 4.2.5*). Start creating a Floor.

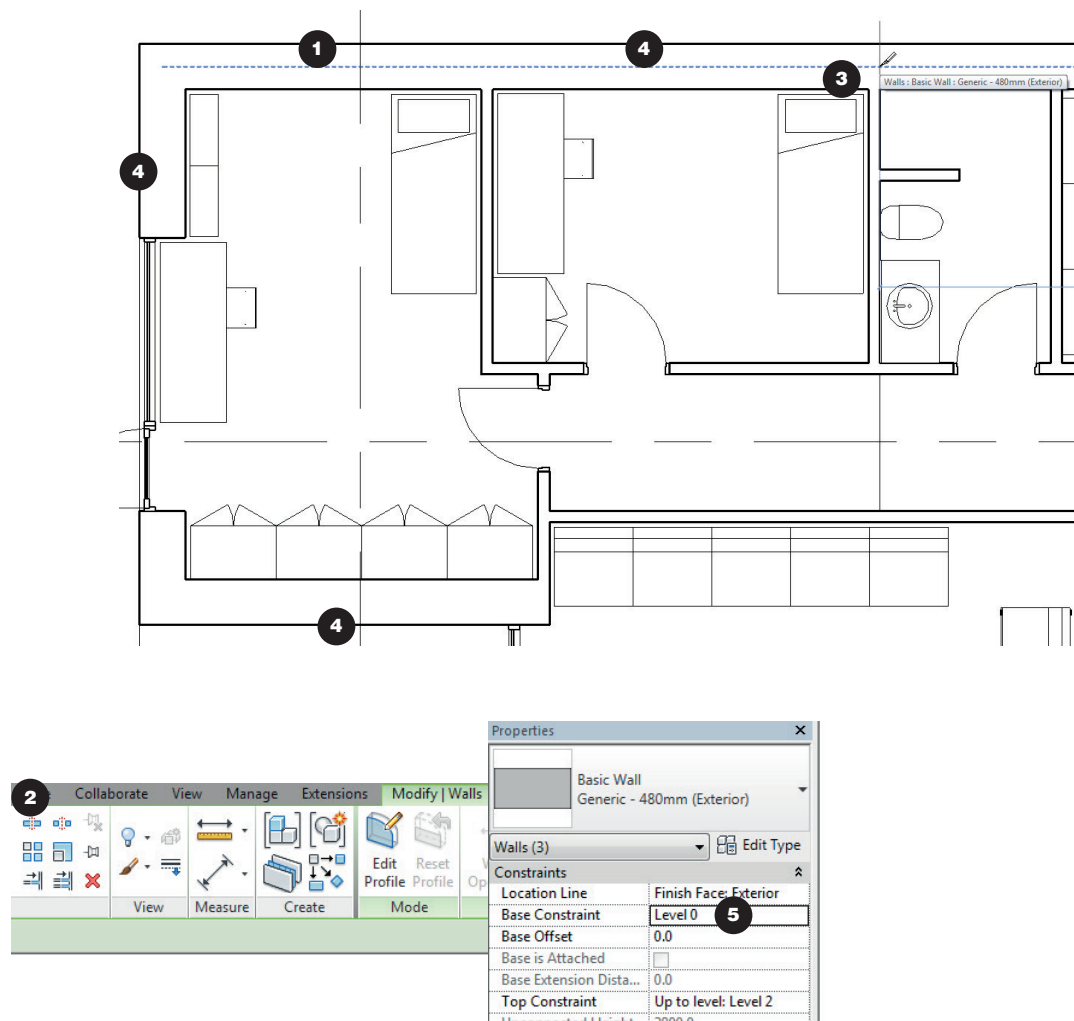
10 Draw a boundary according to *Figure 4.2.5*. Note that the boundary must be aligned to Wall and Door faces.

Review Model

11 Go to *3D Section West End*. Orbit in the View to inspect the two Floors from different angles.

Split levels II

Finally, elements such as Walls, Windows, Fixtures and Furnitures must be adjusted to correspond to the changes in floor level.



PROCEDURE/ Split levels II: Walls

Split Element

Split External Wall

1 Go to floor plan *Level 0*. Select the northern Wall.

2 From the **Modify Contextual Tab**, select **Split Element Tool**.

3 Move the scalpel over the wall until a tooltip appear; *Walls: Basic Wall: Generic - 480 mm (Exterior)*. Click to split the Wall in two - aligned to the right side of the Internal Wall. Zoom in for precision. We will adjust the cut on the next page.

4 Select these three Walls.

5 Set **Base Constraint** to *Level 0*. Press ESC to Deselect the Walls.

Go to the View *3D Section West End* and review the changes. Go back to *Level 1* again.

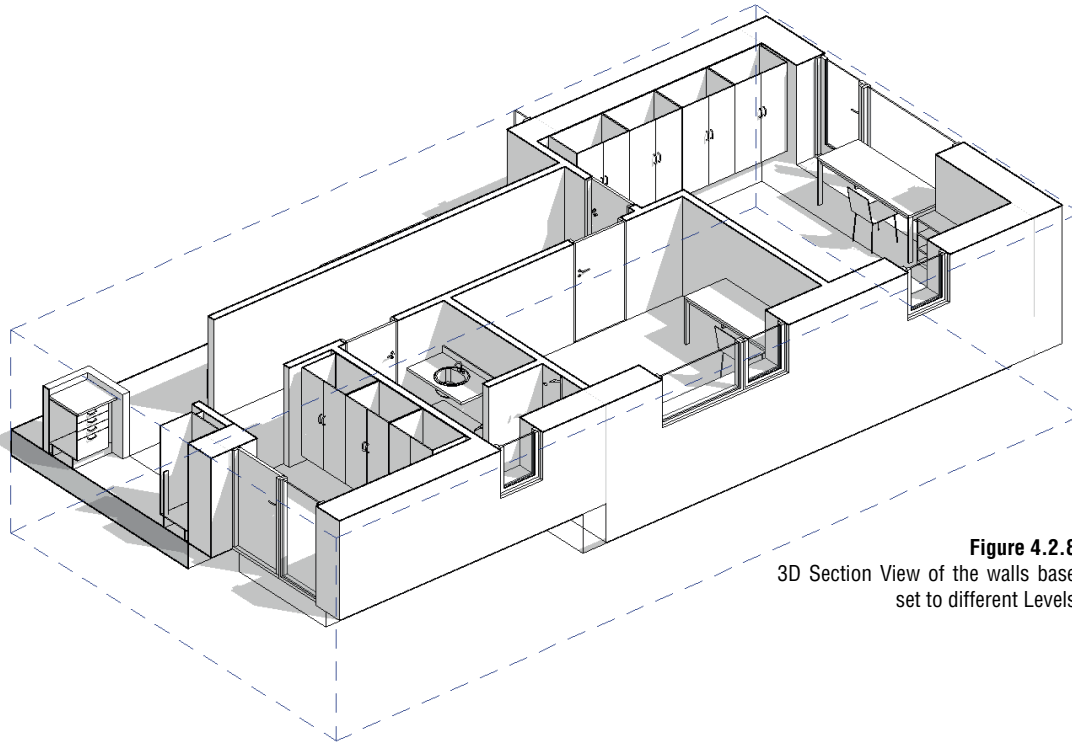
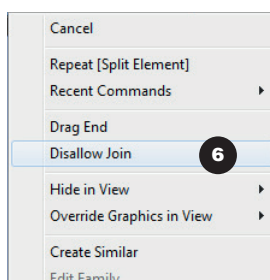
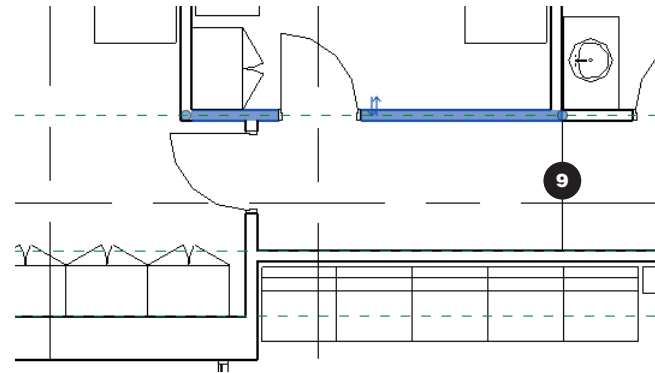
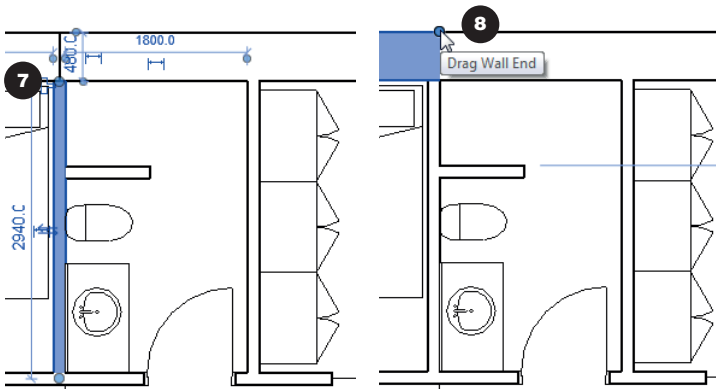


Figure 4.2.8
3D Section View of the walls base
set to different Levels



Adjust Wall Joins

6 A correction is necessary where the north Wall is split. Select the Internal Wall and *right-click* over the blue dot. Pick **Disallow Join**.

7 Drag the Internal Wall end perpendicular to the inside of the outer wall.

8 Drag the External Wall end perpendicular to the right side of the Internal Wall; While dragging, you can hold *SHIFT* to align to the right side of the internal wall face.

Split Internal Wall

9 Split the internal wall using the same methods as described before.

Disallow Join

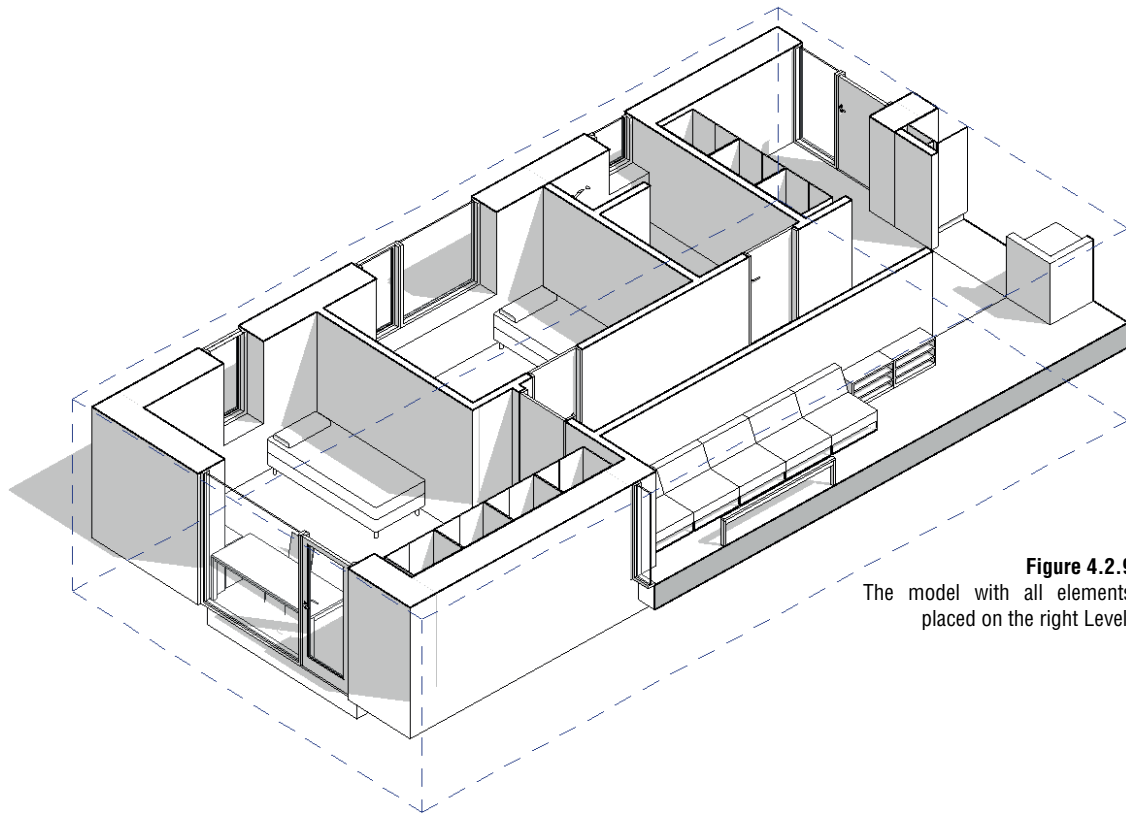
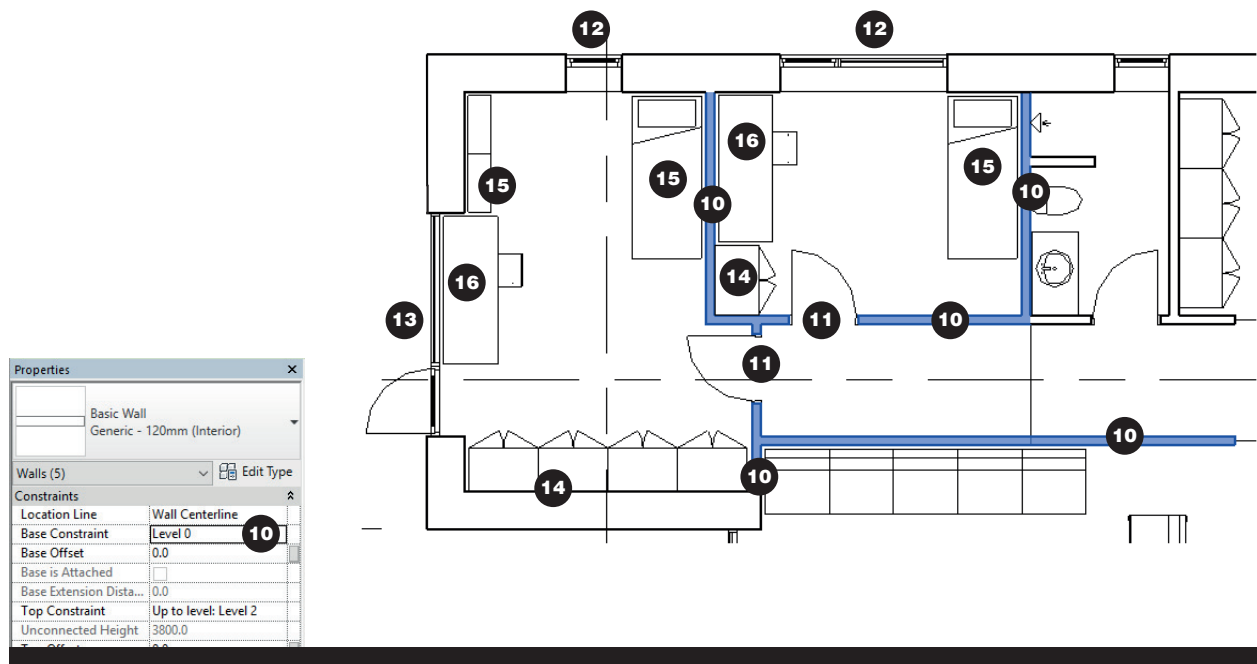


Figure 4.2.9
The model with all elements placed on the right Level.



Place elements on level 0
Go to *Level 1*.

10 Select these five Internal Walls. In Properties, set **Base Constraint** to *Level 0*.

Use same procedure for:

11 Internal Doors

12 Windows

13 Door/Window Assembly

14 Casework

15 Furniture

16 Model Groups

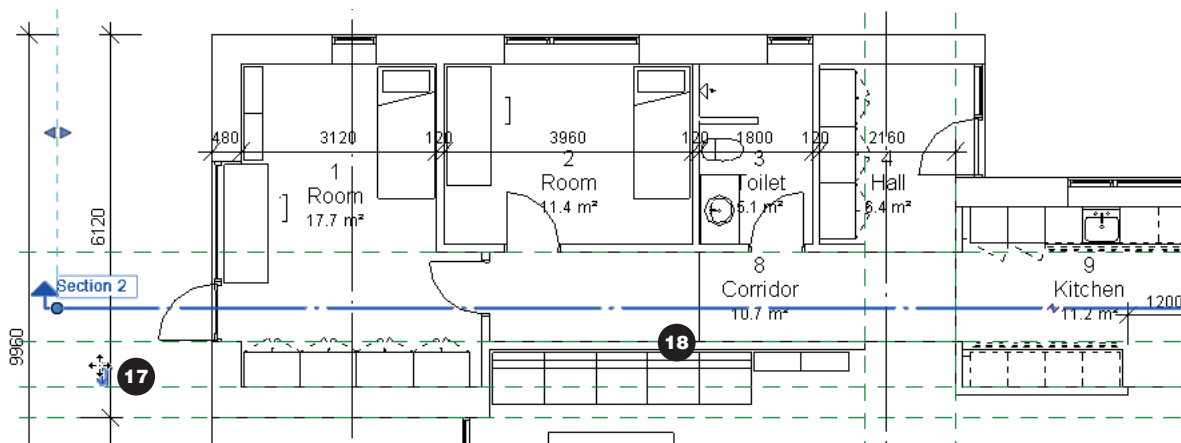
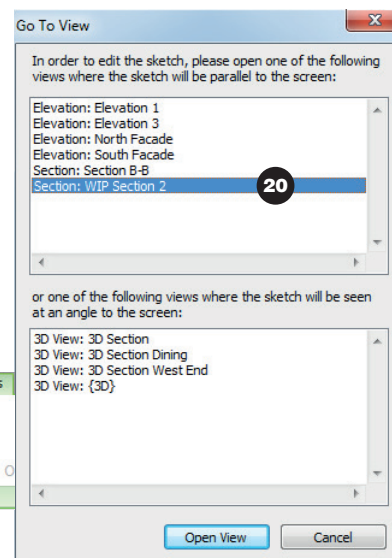
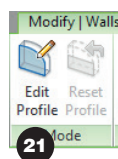
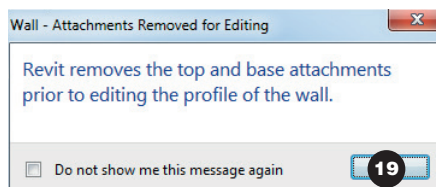
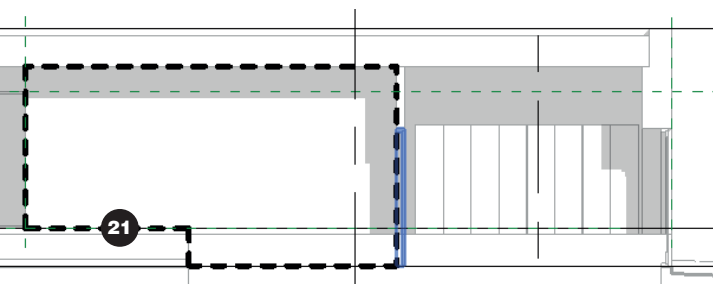


Figure 4.2.10
Adjusting view direction on a Section



Edit Wall Profile

Instead of splitting a Wall, *Edit Wall Profile* is also an option.

17 Select *Section 2* and click on the Flip handle (the double arrow) to view of the internal Wall from the hallway.

18 Select the Wall and click **Edit Profile**.

19 Close the Warning (Top and Base of Wall will be reset).

20 Select *Section 2* and click **Open View**.

21 Adjust the Walls profile according to the sketch. Click **Finish Edit Mode**. Press ESC to Deselect Wall.

Go to *3D Section West End* and take a look at the progression so far.

Flip Section

Foundations

So far we have worked with two Families of Walls: Basic Walls and Curtain Walls. External walls and partitions are both created as Basic Walls but with different functions. In the Type Properties, we can see that the **Function** is set to *Interior* (inner wall) and *Exterior* (outer wall).

In Revit, Foundations are Basic Walls with the Function *Foundation*.

The behavior of a Foundation function is that the default Height is determined as Depth!

Foundations Walls are normally modeled after the external Walls. At this stage, we will model them having the same thickness as the Wall above.

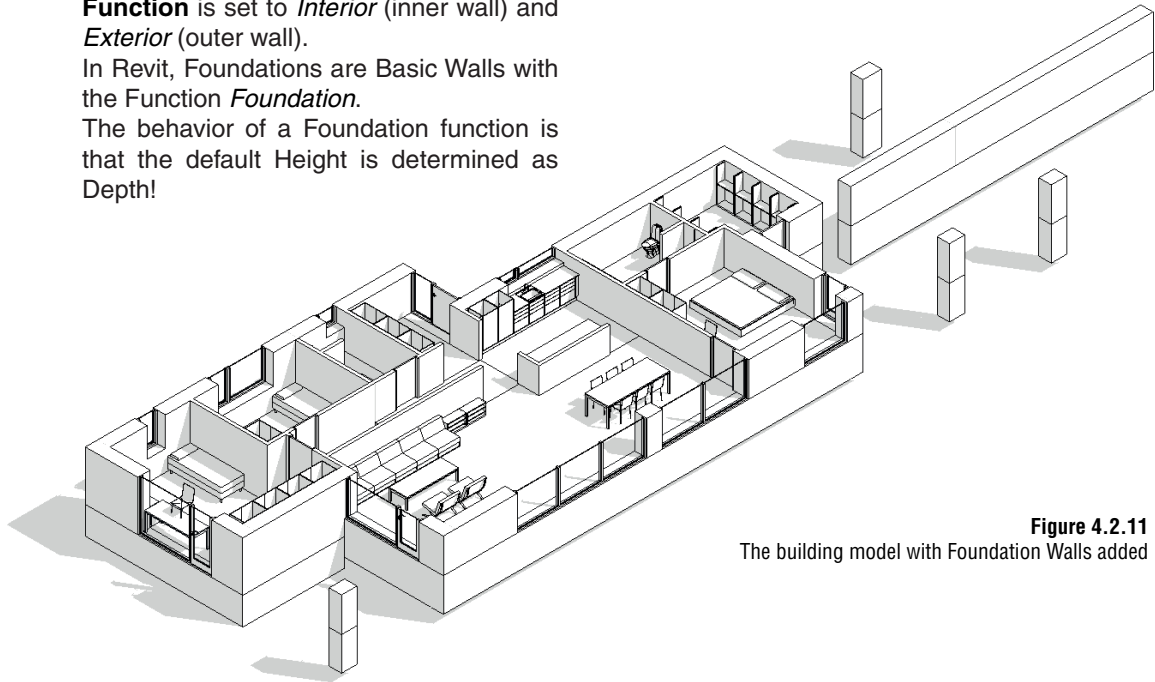
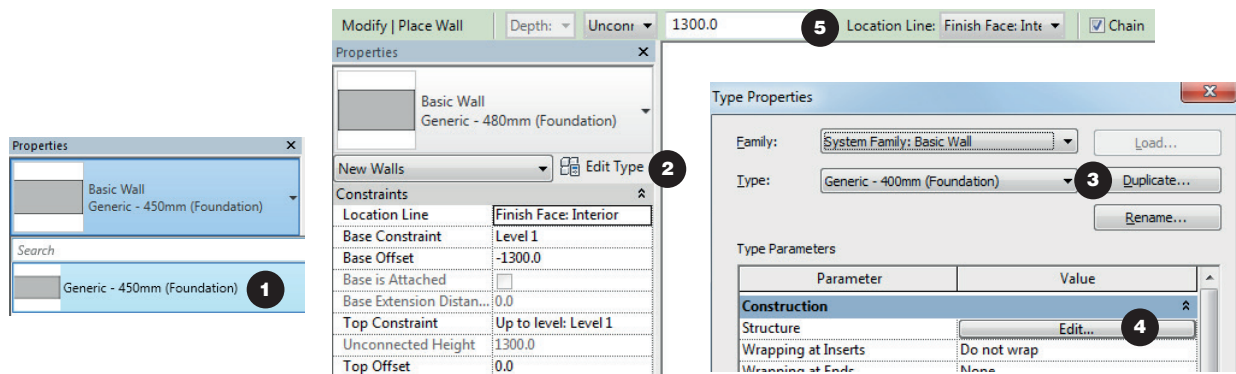


Figure 4.2.11
The building model with Foundation Walls added



PROCEDURE/ Creating Foundation Walls

Wall (Foundation)

File: Revit Case Study 4.2 p24

Create new Wall Type

Go to Level 1.

1 Start the Wall command; **Architecture > Wall**.

Choose the Wall that matches your next move: *Generic - 450mm (Foundation)*.

2 Click **Edit Type**.

3 Click **Duplicate** and name the Type *Generic - 480 (Foundation)*.

4 Click **Edit** and set the Wall thickness to 480. Click **OK > OK** to finish.

5 In the **Options Bar**, note that Walls will be drawn as a depth. Set **Unconnected** height to 1300, **Location Line** to *Finish Face Interior* and enable **Chain** to draw multiple Walls in one routine.

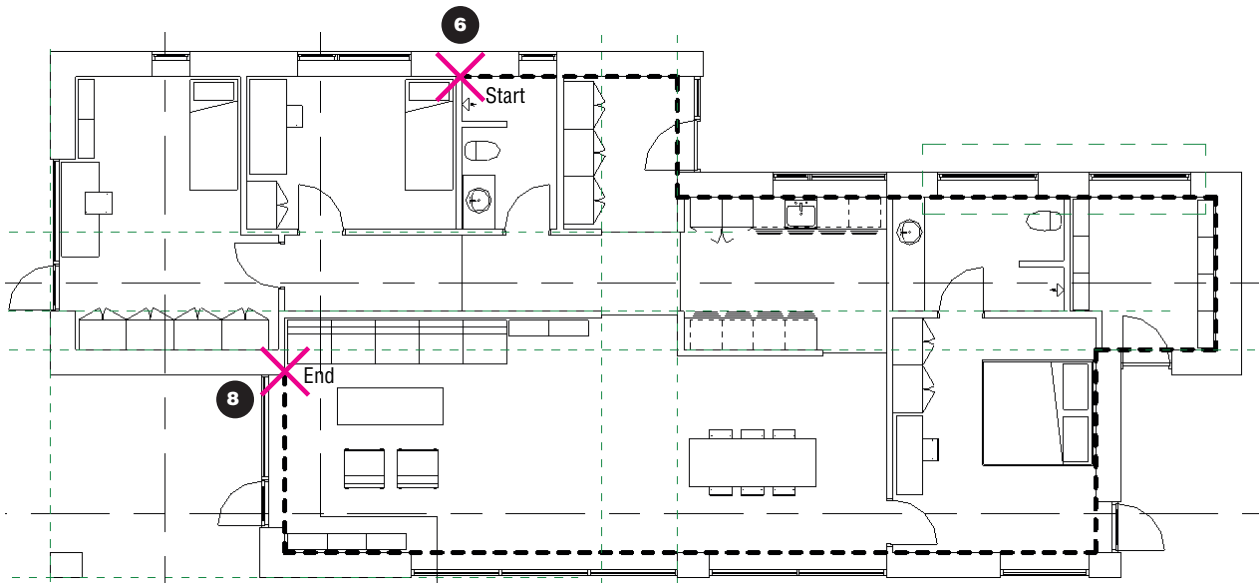


Figure 4.2.12
Adding foundations under Walls on *Level 1*

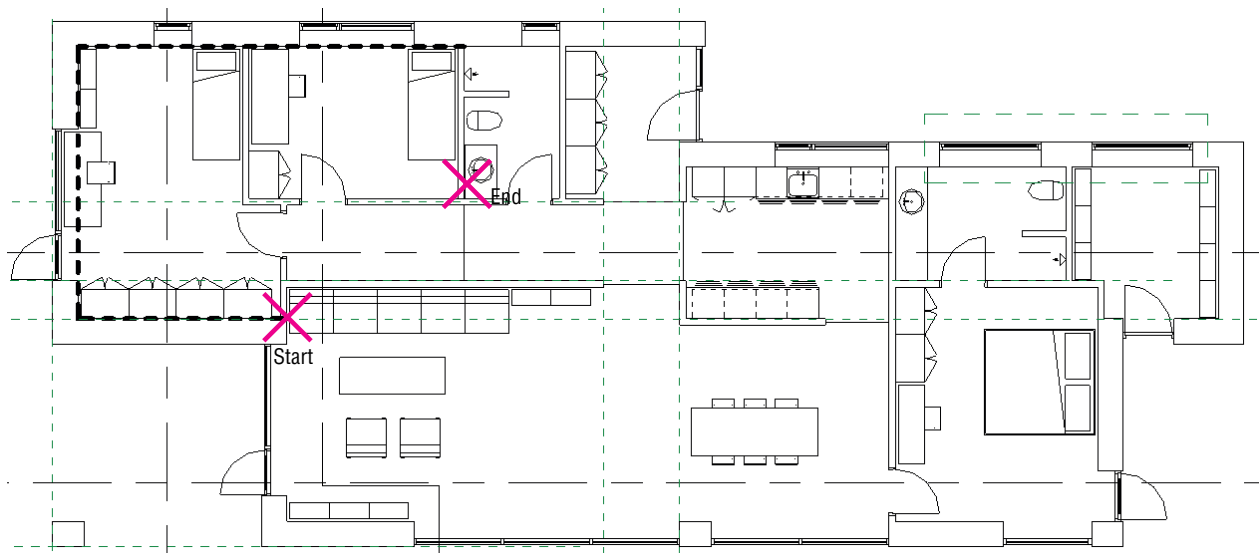
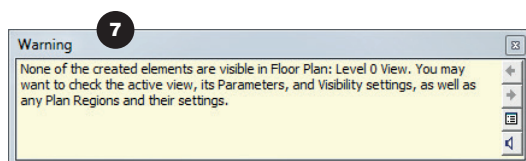


Figure 4.2.13
Adding foundations under Walls on *Level 0*



Create Foundation Walls I

6 Start drawing Walls from this point (interior side of Wall).

7 If you get a warning, read it and ignore it! This notifies that none of the created elements are visible in the floor plan.

8 End the chain of Walls here.

Go to *Level 0* and follow the same procedure to create the three remaining Foundation Walls (see *Figure 4.2.13*).

Review model

Activate the *3D View* to review the foundation Walls. For a better view, Select the Topography and press **VH** to **Hide** it in this View.

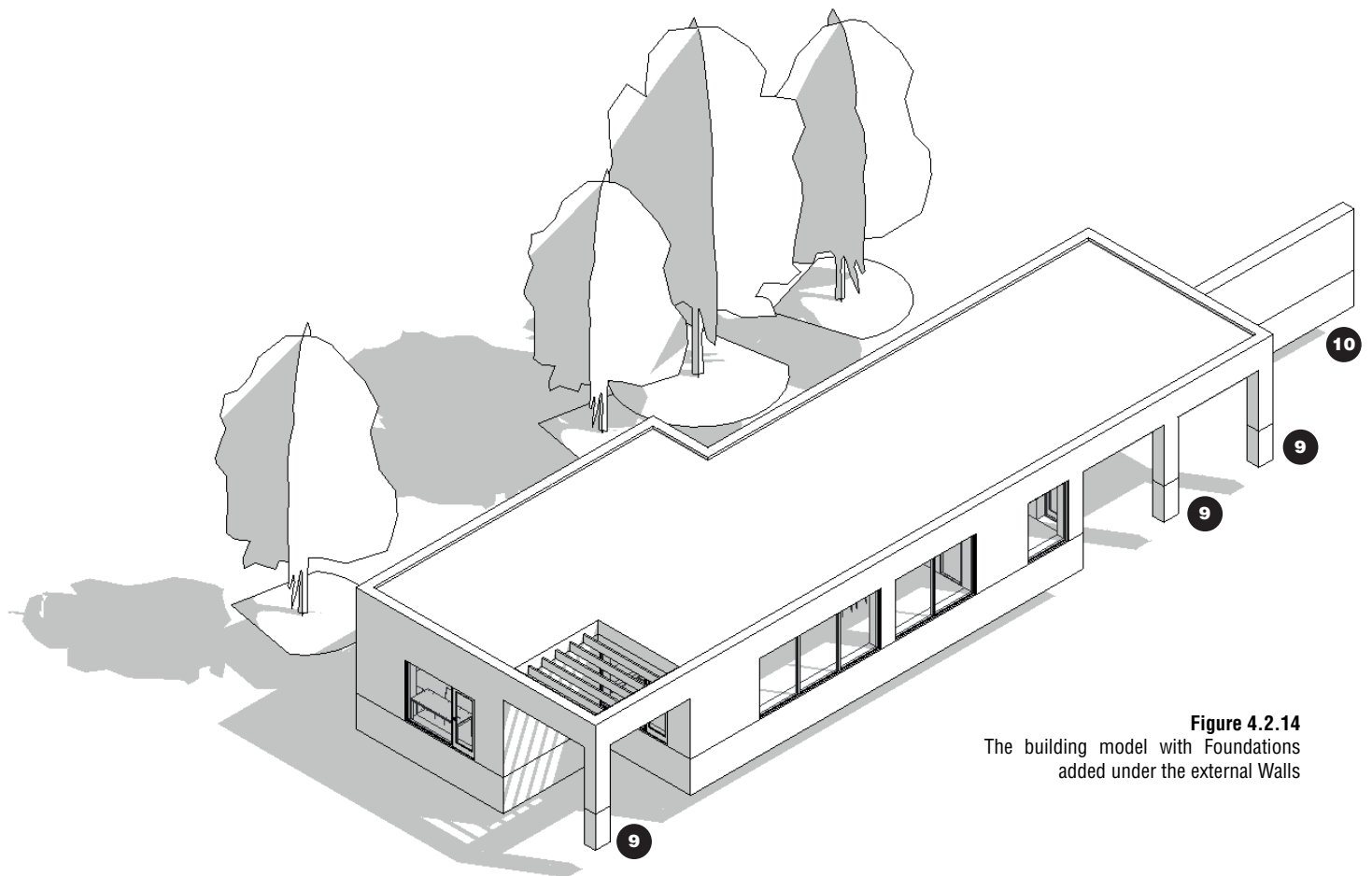
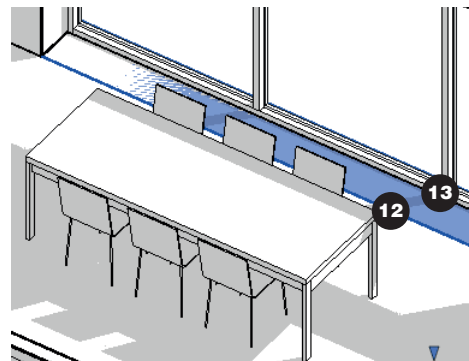
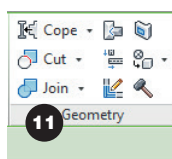


Figure 4.2.14
The building model with Foundations added under the external Walls



Join Geometry

Create Foundation Walls II

9 On *Level 1*, apply a foundation underneath each of the Wall pillars.

10 Create foundation underneath the garden Wall.

Cleaning up geometry

Since we made the Floor to go to the backside of the Windows and doors, we now have double geometry.

Go to *3D Section*.

11 Start the **Join** command.

12 Select the Foundation.

13 Click on the edge of the Floor to Join the two. If you find it difficult to select the Floor, hold

the cursor still over the Floor edge and press TAB again and again until the Floor is highlighted.

Without moving the cursor, click to Join the two.

Complete the rest of the building where the foundation is visible. You have to extend the 3D Section View to see all Foundations and Floors.

Terraces

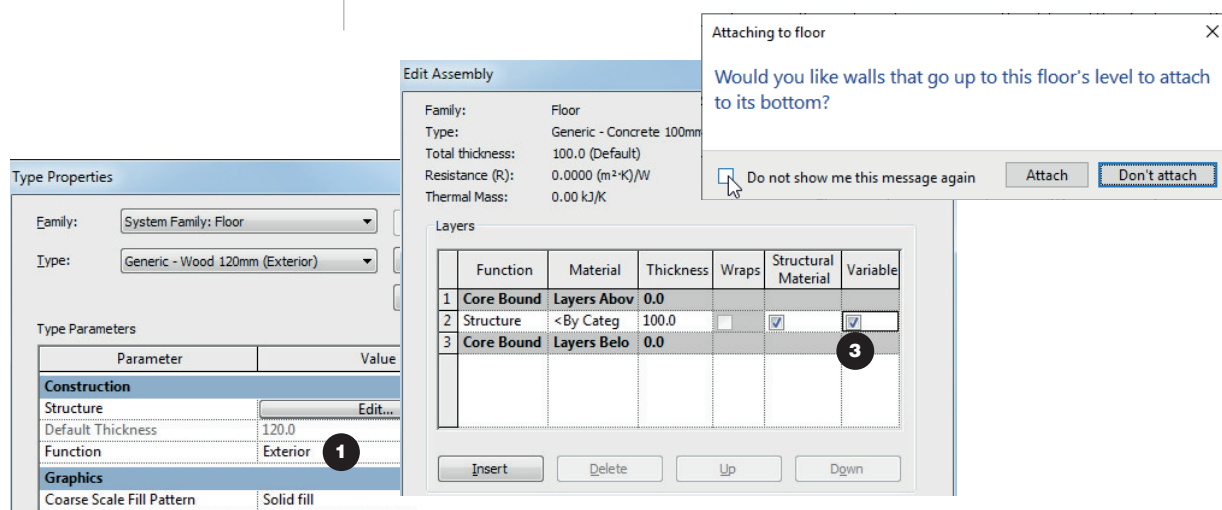
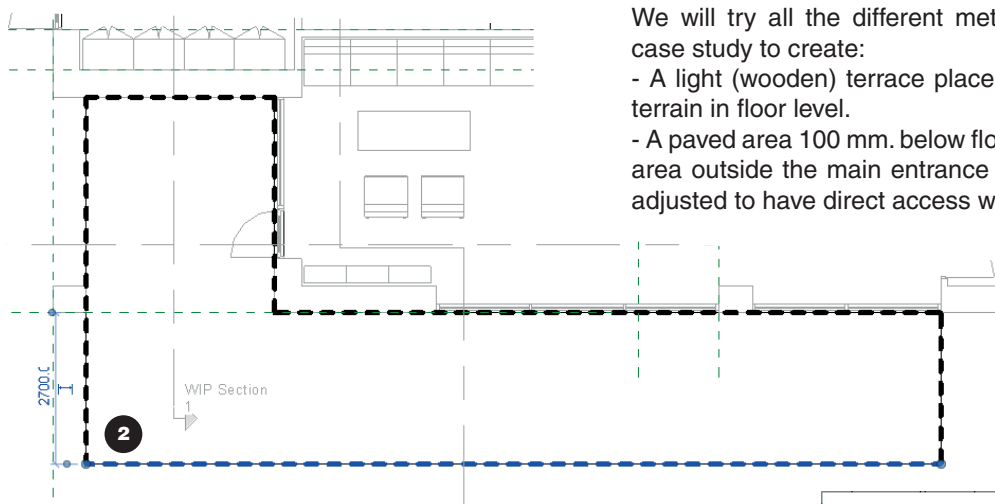
Revit does not have a terrace or a patio component.

Plan terraces can be made by creating **Floors** with their **Function** set to *Exterior*.

Sloped paved areas can be created in the same way and have its slope adjusted using the **Modify Sub Elements** tool, but if in a hurry, a visual indication of areas in the terrain having a different surface can be achieved by specifying separate regions in a Toposurface, using the tool **Subregion** introduced further in this section.

We will try all the different methods in the case study to create:

- A light (wooden) terrace placed above the terrain in floor level.
- A paved area 100 mm. below floor level. The area outside the main entrance door will be adjusted to have direct access without steps.



PROCEDURE/ Creating terraces

File: Revit Case Study 4.2 p27

Elevated terrace

Go to *Level 1* and start the **Floor** command.

1 Create a new Floor Type by duplicating *Generic - 100mm (Ground)*. Name it *Generic - Wood 120mm (Exterior)*. Set the **Function** to *Exterior* and the **Thickness** to 120.

2 Draw the boundary lines according to the sketch above. **Finish** the Floor command. In the pop-up box, tick the box *Do not show this message again* and click on *Don't attach* (we don't want the adjoining foundation Walls to be attached to the underside of the Floor, neither now or when editing Floors in the future).

Hard landscaping

3 Go to *Level 0* and start the Floor Command and create a new Floor Type: *Generic - Concrete 100mm (Exterior)*. To be able to adjust floor level in specific areas, set the floor to be **Variable**.

Terrace, patio

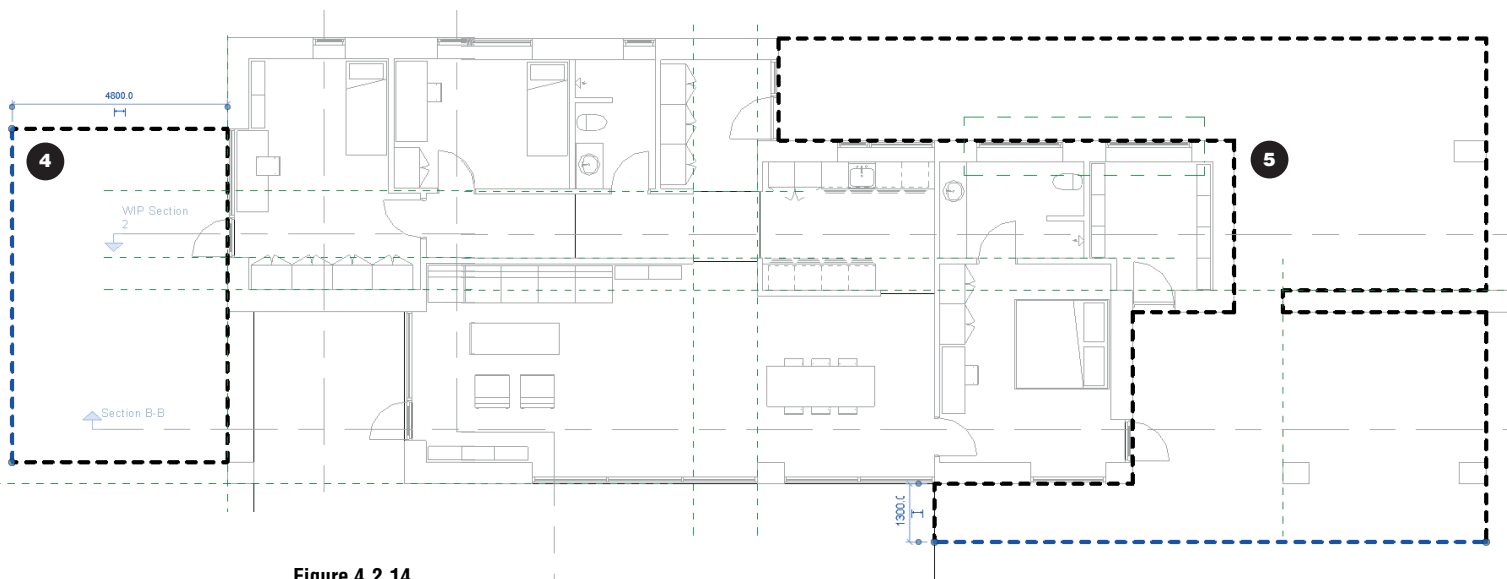
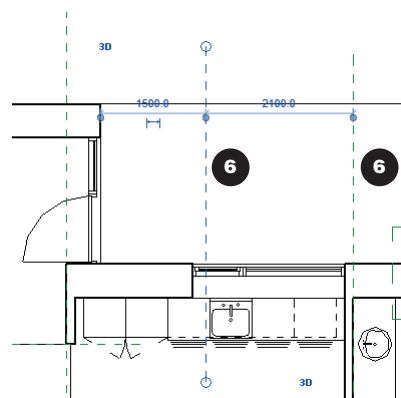
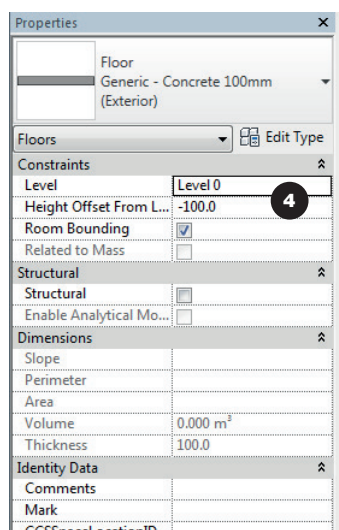


Figure 4.2.14
Floor boundary - west terrace and carport



4 Create a concrete terrace towards west. Draw boundary lines according to the sketch and set the **Height Offset From Level** to **-100**. **Finish Floor**.

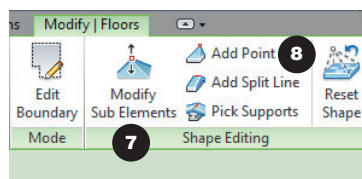
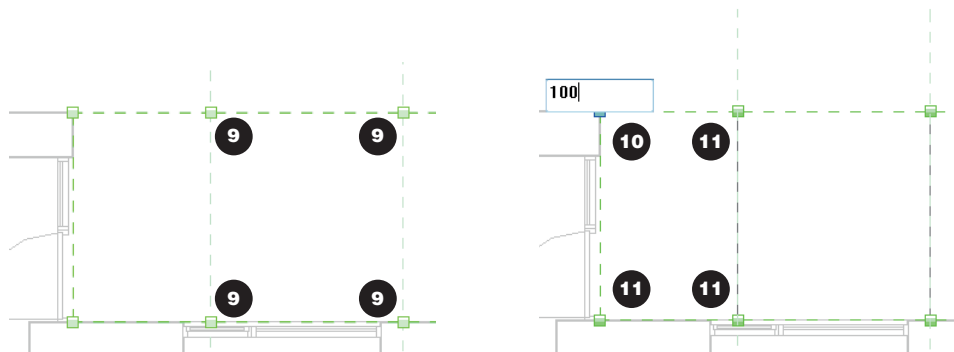
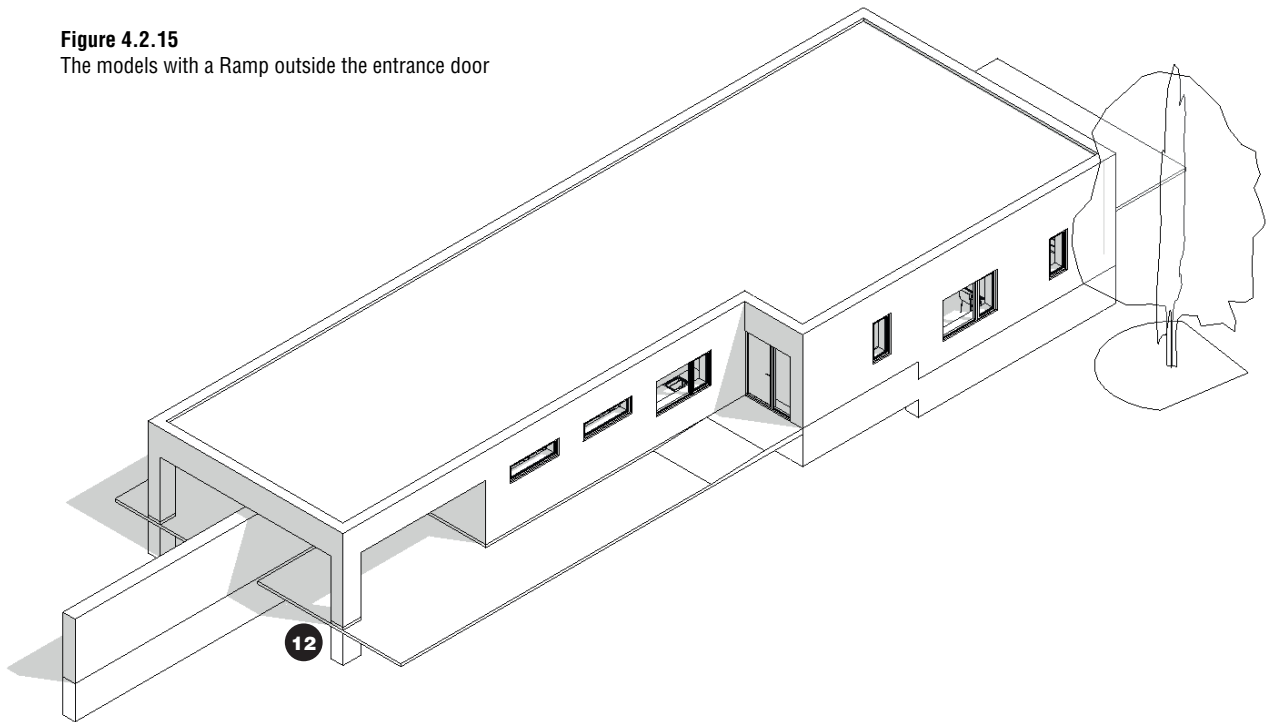
5 Go to **Level 1** and create a new terrace & carport floor. Draw boundary lines according to **Figure 4.2.14**. Again, set the floor height to **-100** and **Finish Floor**.

Set up Reference Planes

6 Create two new **Reference Planes** outside the Main Entrance: One **1500 mm** from the Wall at the entrance, and one further **2100 mm** away.

Figure 4.2.15

The models with a Ramp outside the entrance door



Making a Ramp

7 Select the Floor and click **Modify Sub Elements**.

8 Click **Add Point**.

9 Add four point where the Reference Plane intersect with the Floor.

10 Click on a point to change

the height. Click on *0* (zero) and set the height to *100*.

11 Select the three other points and do the same. Press ESC twice to finish modifying the height.

Model review

This will make a plateau in front of the main entrance door.

Go to the *3D* View to check out the models progression. Note that the underside of the Floor is even because we set the thickness to **Variable**. See *Figure 4.2.15*.

12 We have double Geometry where Foundation and Floor meet. Use **Join** to repair it.

Modify Sub Elements

Ramp

4.3/ ADJUSTING SITE TO BUILDING

Having allowed the building to respond to the terrain by introducing split levels, we will now make changes to the existing topography. Hence, the main topic of this chapter is the creation and modification of the terrain based on the existing.

A concept introduced in this connection is **Phasing**. All elements have a phase of creation and a phase of demolishing. By default, new elements created in the model have **Phase Created** set to *New Construction* and **Phase Demolished** to *None*.

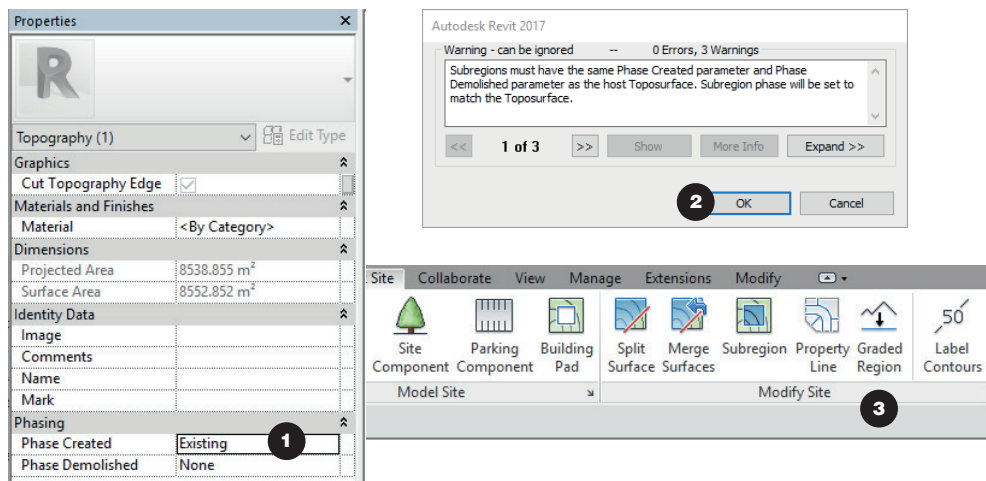
The existing terrain should have its **Phase Created** set to *Existing* and **Phase Demolished** to *New Construction*, while the new modified terrain should have its Phasing Parameters set like the elements of the rest of the proposed building.

Among many other uses, Phasing of terrain can be used to immediately extract exact information about earth work from the BIM model - of high relevance at the stage of concept design.

OVERVIEW/

Adjusting topography to Building

- Appoint Phase to existing Toposurface
- Create new Toposurface, set **Phase created to New**
- Adjust new toposurface to correspond to building



PROCEDURE/ Grading the terrain

Phasing

File: Revit Case Study 4.3 p30

Preparations

Go to the View *3D*.
If the terrain is not visible in the View, **Unhide** it.

Phasing

1 Select the Toposurface in the 3D View. Set **Phase Created** to *Existing*.

2 Read the Warning. Click **OK** to accept that Subregions must have the same Phase.

Create new Toposurface

Go to the *Site* View.

3 In the Tab **Massing & Site**, start the **Graded Region** command.

Grade the terrain

In projects on sloped sites, grading the terrain - moving, adding and deleting points in the toposurface - is a process that requires frequent reviewing in different Views: 3D,

Sections and elevations. Also in the process, the elevation of the building may need to be reconsidered.

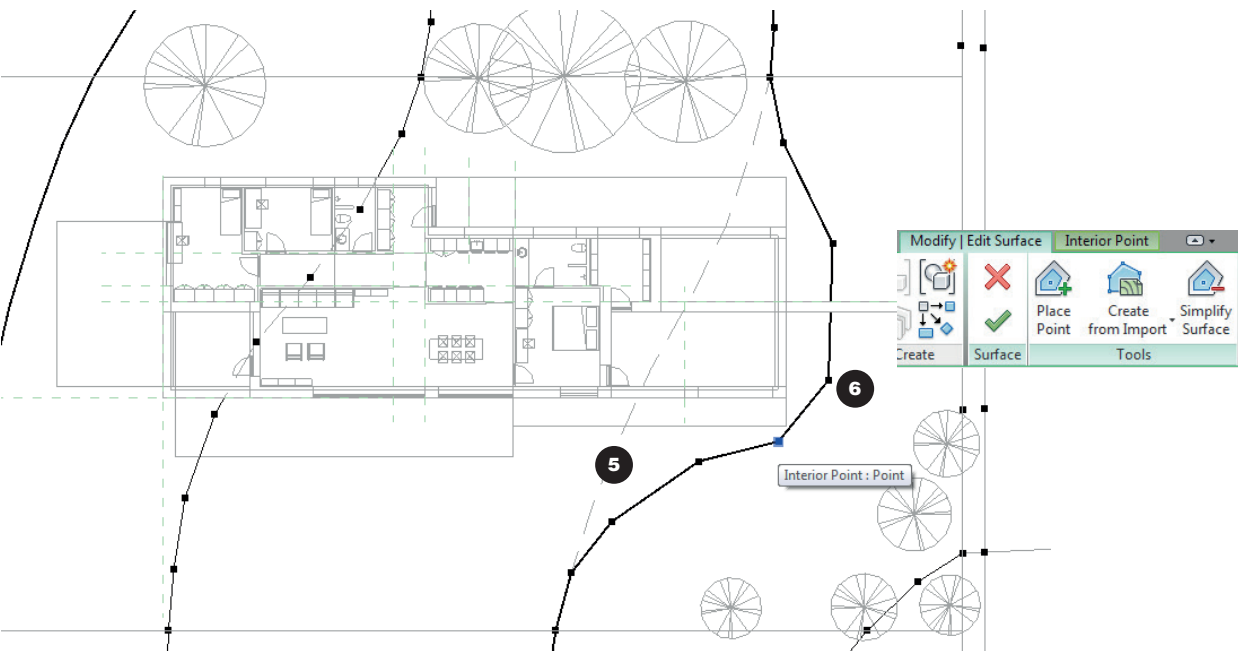
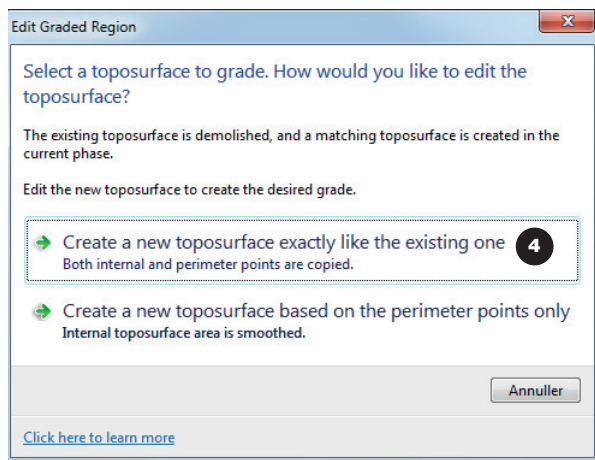


Figure 4.3.1
Creating a new terrain



Phasing	
Phase Created	New Construction
Phase Demolished	None
Other	
Net cut/fill	-37.005 m³
Fill	0.226 m³
Cut	37.231 m³

4 Select **Create a new toposurface exactly like the existing one**.

5 Click on a contour line.
A new Toposurface have been created in exactly the same position as the existing and its **Phase** is automatically set to **New**.

The new Toposurface will now be available for editing.

Grade terrain

6 Move the Interior Points one by one to a position outside the terrace east of the building.
Go back to **Modify / Edit Surface** Tab Click **Finish Surface**.

7 Select the New Toposurface and check the **Net cut/fill** value in **Properties**. You can see that a minor amount of the soil has been moved.
Press **ESC** to deselect the Toposurface.

Graded Region

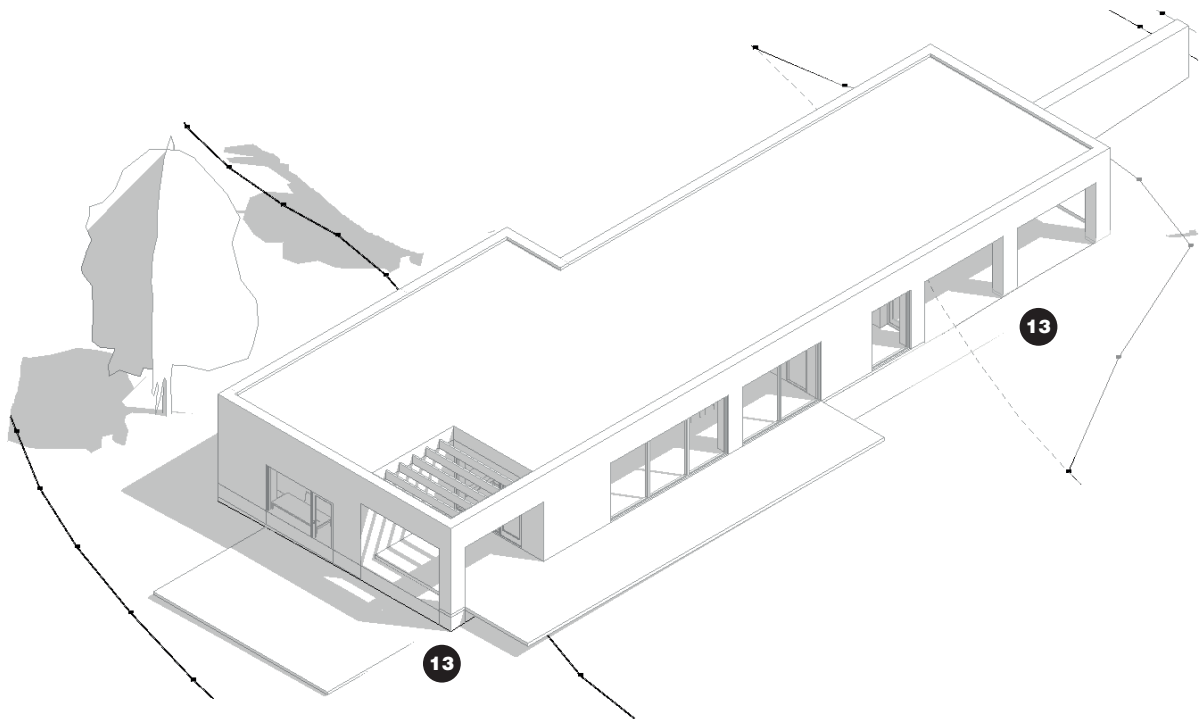
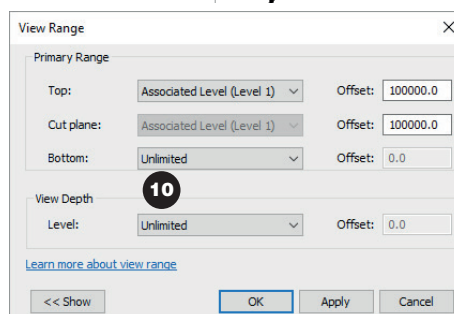
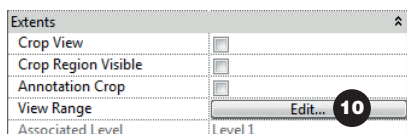
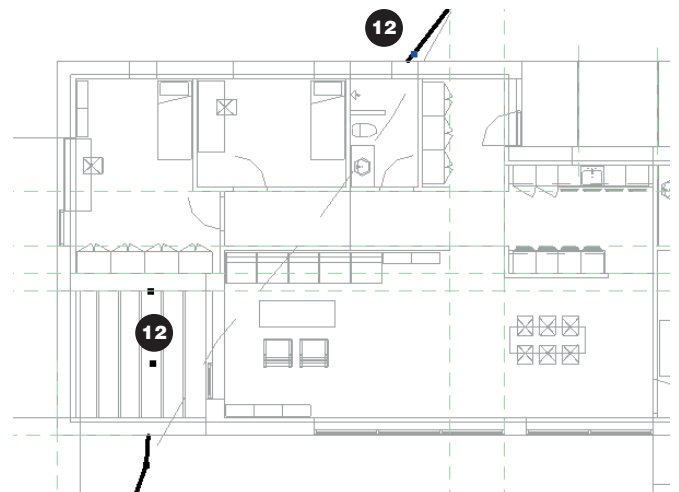


Figure 4.3.2
3D View of the site before final adjustment



10 To make all Points on Contour Lines visible, change the View Range of the view. In **Properties**, click **Edit View Range**. Set both **Bottom Primary Range** and **View Depth Level** to *Unlimited*.

11 Select the **New Toposurface** again and click **Edit Surface**.

12 Move the three Interior Points from inside the building according to the sketch.

Review Model

13 Do not finish Edit Mode. Check the 3D View. You will see that a detailed correction is necessary (the floor disappears under the terrain). Rotate the 3D View to get a good view of the East side.

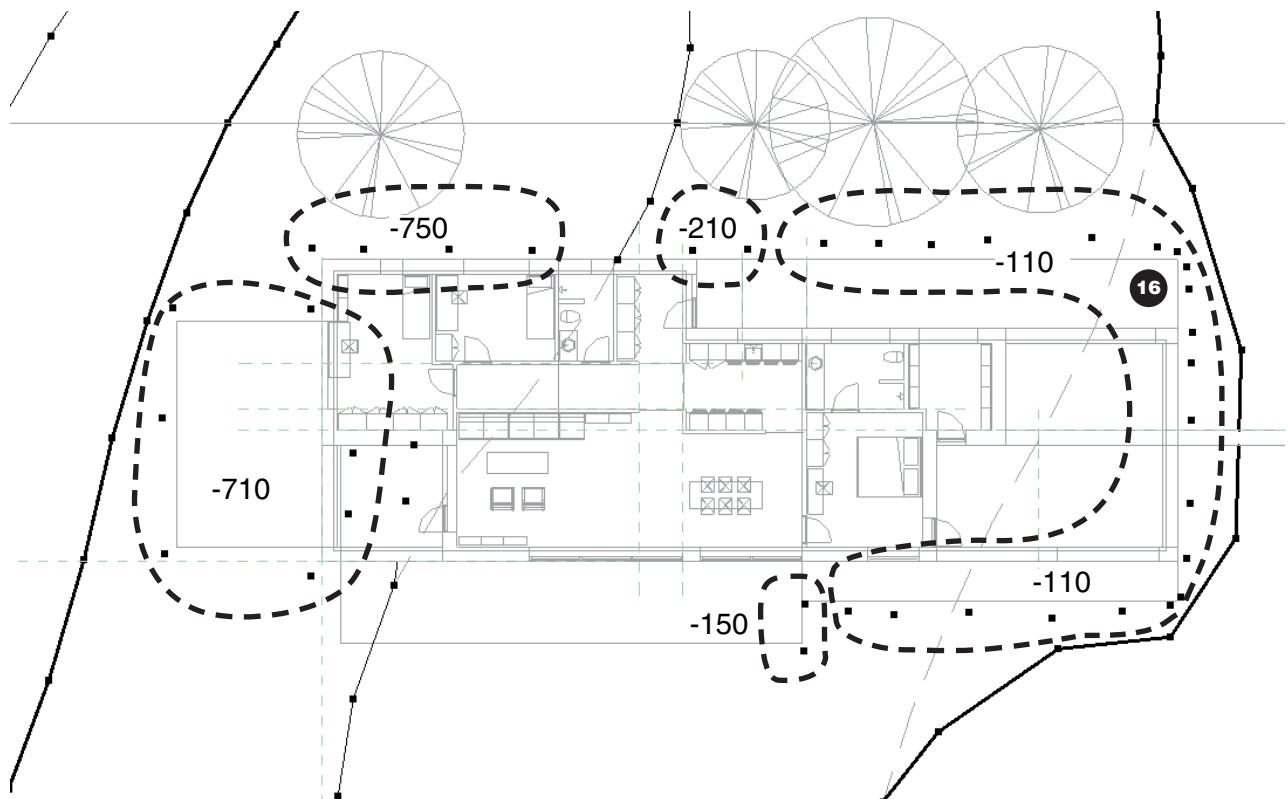


Figure 4.3.3
Project Elevation of Points by zones surrounding the building

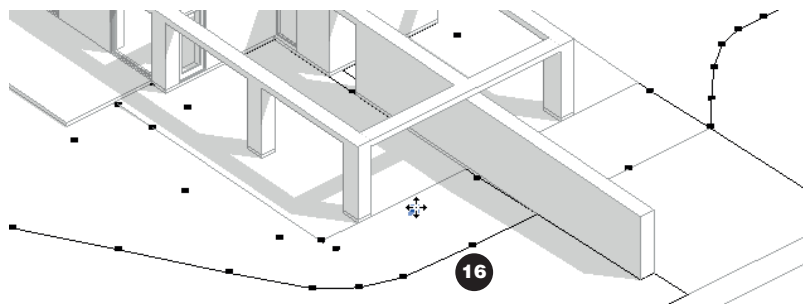
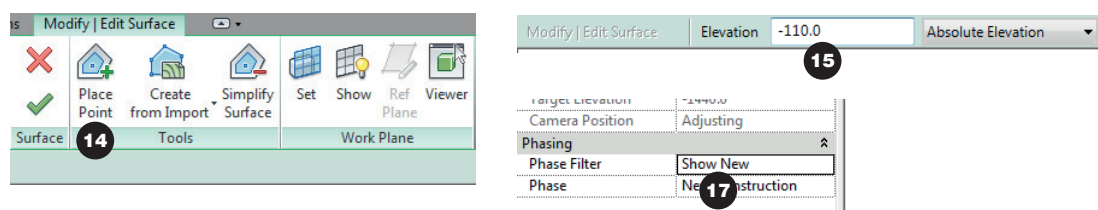


Figure 4.3.4
Adjust Toposurface in 3D View



Place more points

14 Start the **Place Point** command.

15 Set the Elevation to -110.

16 Place new Points along the outside of the Terrace Floor and in front of the main entrance. See Figure 4.3.3. and 4.3.4.

Adjust surface

Now fine-tune the rest of the elevations according to Figure 4.3.3. Switch to *Site* view if it makes a better view.

Click the green tick to Finish Surface.

Hide existing topography

Go to *Site*.

17 To hide the existing Toposurface, select **Show New** in **Phase Filter**. Only the new elements (Toposurface) will be visible in this view. This can be done in any Views.

Place Point

Phase Filter

Additional sitework

Apart from the terrain being graded, also the buildings footprint on the terrain must be adjusted after splitting the levels. We will adjust the Building Pad previously created and place another under the lowered part of the building.

Also, the tool Subregion is introduced as a means of subdividing the surface of the terrain.

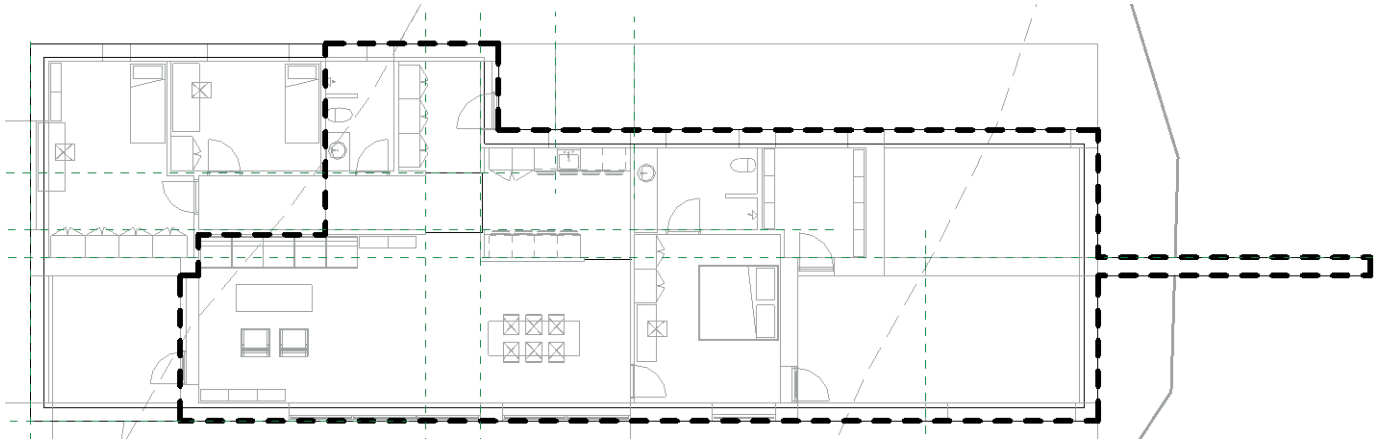
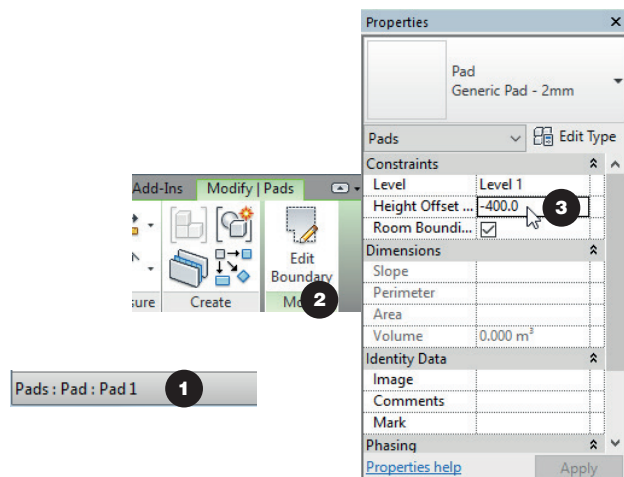


Figure 4.3.5
Building Pad under Level 1



PROCEDURE/ **Additional sitework**

Building Pad I: Modify

Go to *Site*. Hold the cursor over the exterior side of the External Wall. In this location the existing Building Pad is created.

1 Press TAB until you see the Pad in the Status Bar (lower left corner on your screen). Click to select the Building Pad.

2 Click **Edit Boundary**.

Adjust the Building Pad to the outside wall face and Floor boundary on Level 1. See *Figure 4.3.5*.

3 Set **Height Offset From Level** to **-400**.

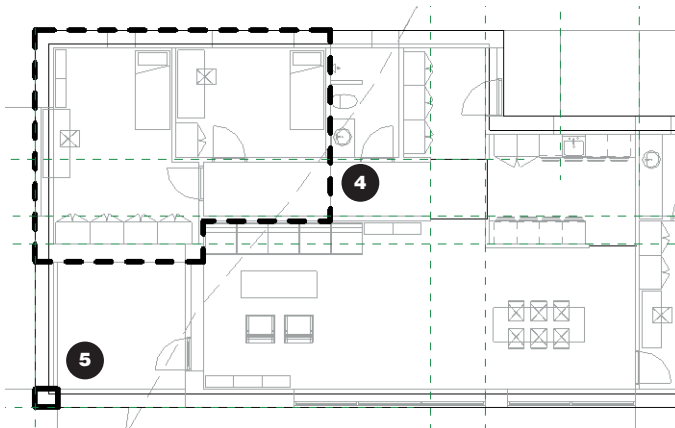


Figure 4.3.6
Building Pads under Level 0

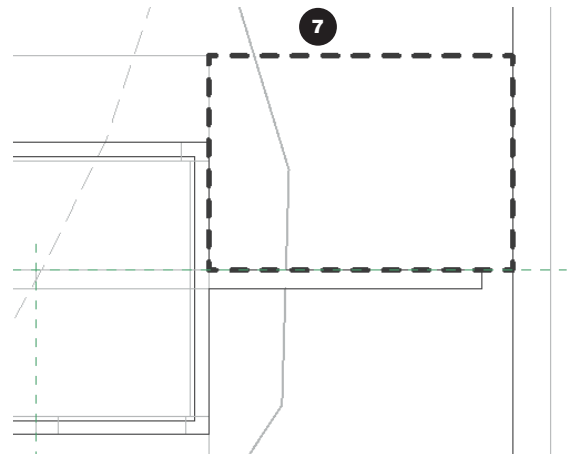
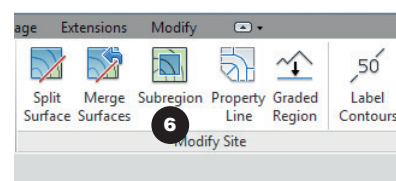


Figure 4.3.7
Driveway created with Subregion



Building Pad II: Create

4 Create a new Building Pad on *Level 0* (**Massing & Site > Building Pad**) following wall faces and floor boundaries exactly as shown in *Figure 4.3.6*.

Set **Height Offset From Level** to **-400**. Click **Finish Edit Mode**.

5 Create the third Building Pad around the pillar on the south-west corner using same procedure as before.

Create driveway

Subregion

6 Create a driveway from the road to the house: **Massing and Site > Subregion**.

7 Draw a boundary as shown in *Figure 4.3.7* and **Finish Edit Mode**.
Save the model.

4.4/ **ADJUSTING BUILDING TO SITE II**

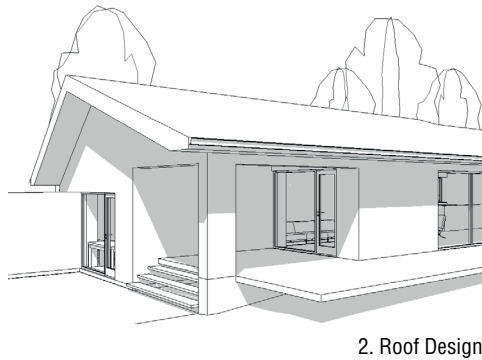
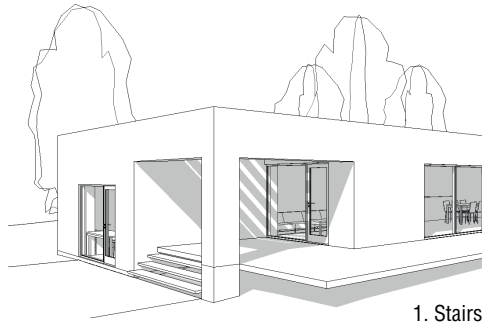


Figure 4.4.1
Progression in Chapter 4.4

In the beginning of this chapter, we changed the design of the building to follow the terrain by introducing one more floor level.

Then, we needed to adjust the natural terrain to follow the levels of the building more closely.

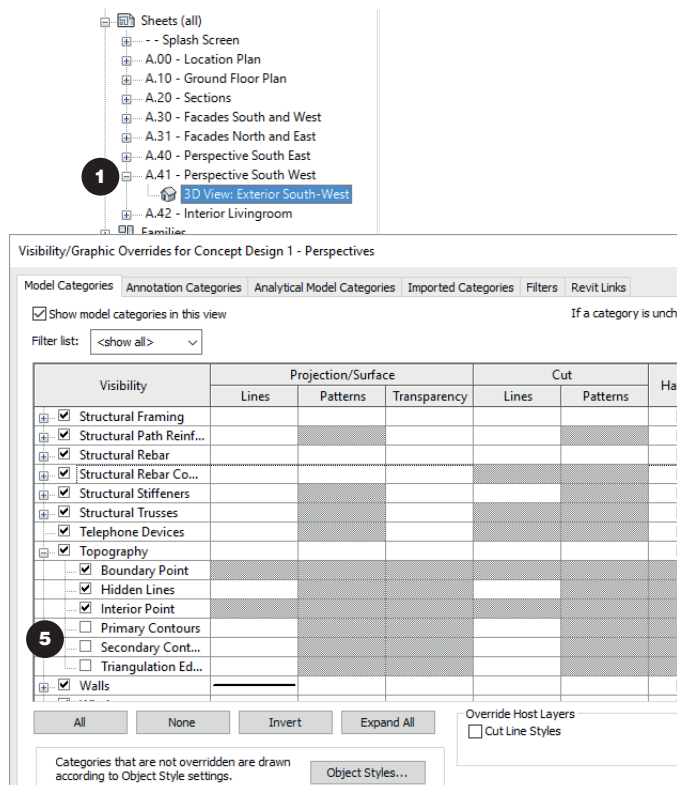
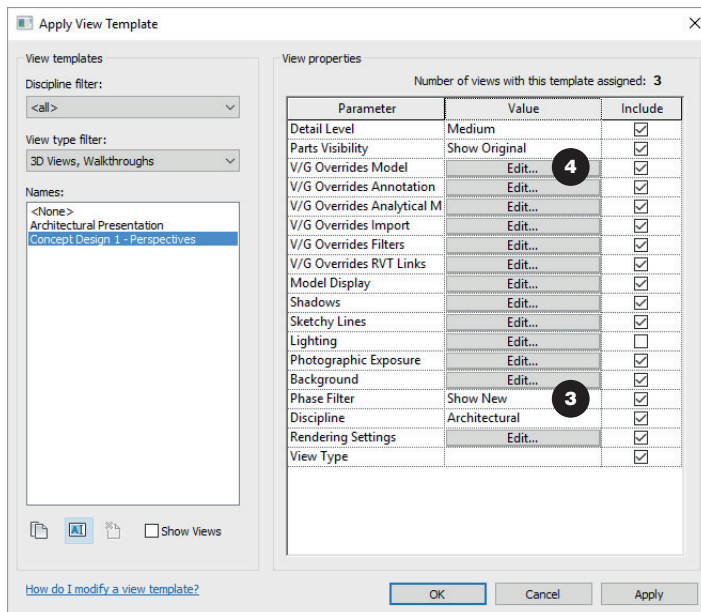
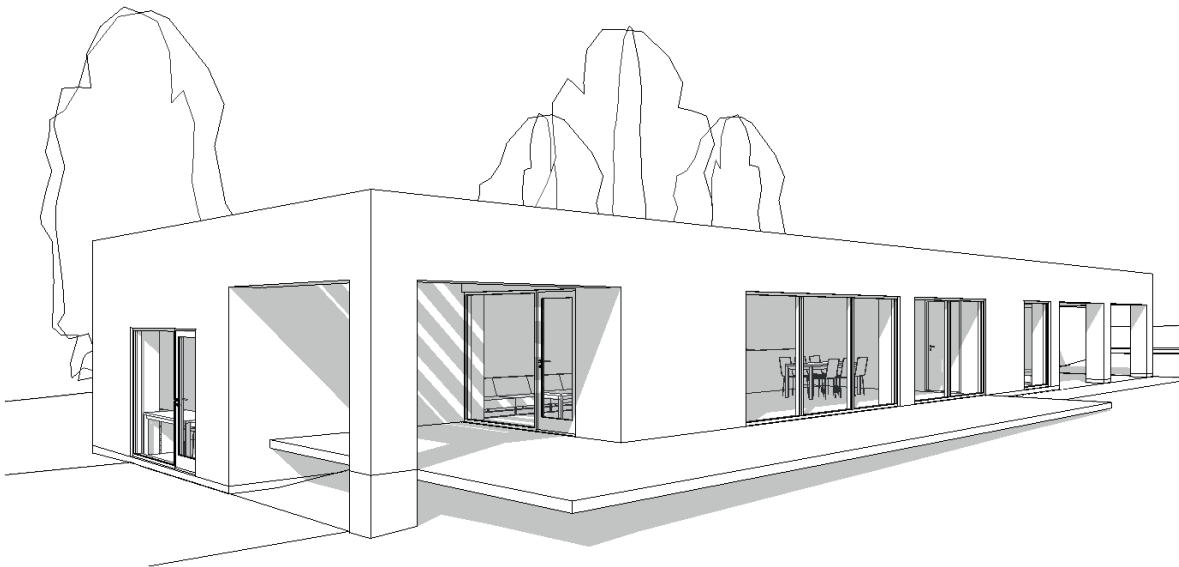
Now we are ready to make the final fine-tuning by connecting all levels inside and outside with **Stairs**.

Having a variation in floor levels, it is also worth to look for a roof design to help generate a variation in ceiling heights.

OVERVIEW/

Adjusting Building to Site II

- Adjust View Templates
- Add Stairs
- Trying different Roof designs



PROCEDURE/ Organizing Views

File: Revit Case Study 4.4 p37

Review model

1 In the Project Browser, click the + (plus) to expand the Sheet A1.41 - Perspective South - West. Double-Click to open the 3D View Exterior South - West to see the changes you made to the terrain.

Notice that the existing terrain is visible. In most Views, we want only the new terrain to be visible.

Edit View Templates

2 Edit View Template *Concept Design 1 - Perspectives*.

3 Set the **Phase Filter** to *Show New*.

4 Click **Edit** to Override Model.

5 Uncheck **Primary** and **Secondary Contours** under **Topography** to hide Contour Lines in view. Click **OK** twice to finish and to apply changes to not only this view, but all views with this View Template assigned.

View Template

Stairs

Stairs in Revit consist of the Components **Runs**, **Landings** and **Supports**. One Stair can have any number of each of these Components.

Three **Families** of Stairs are available:

- Assembled Stairs
- Cast-In-Place Stairs
- Precast Stairs

Cast-In-Place Stairs and Precast Stairs are characterized by being manufactured in one piece (monolithic) in a factory or on site. The material is normally concrete.

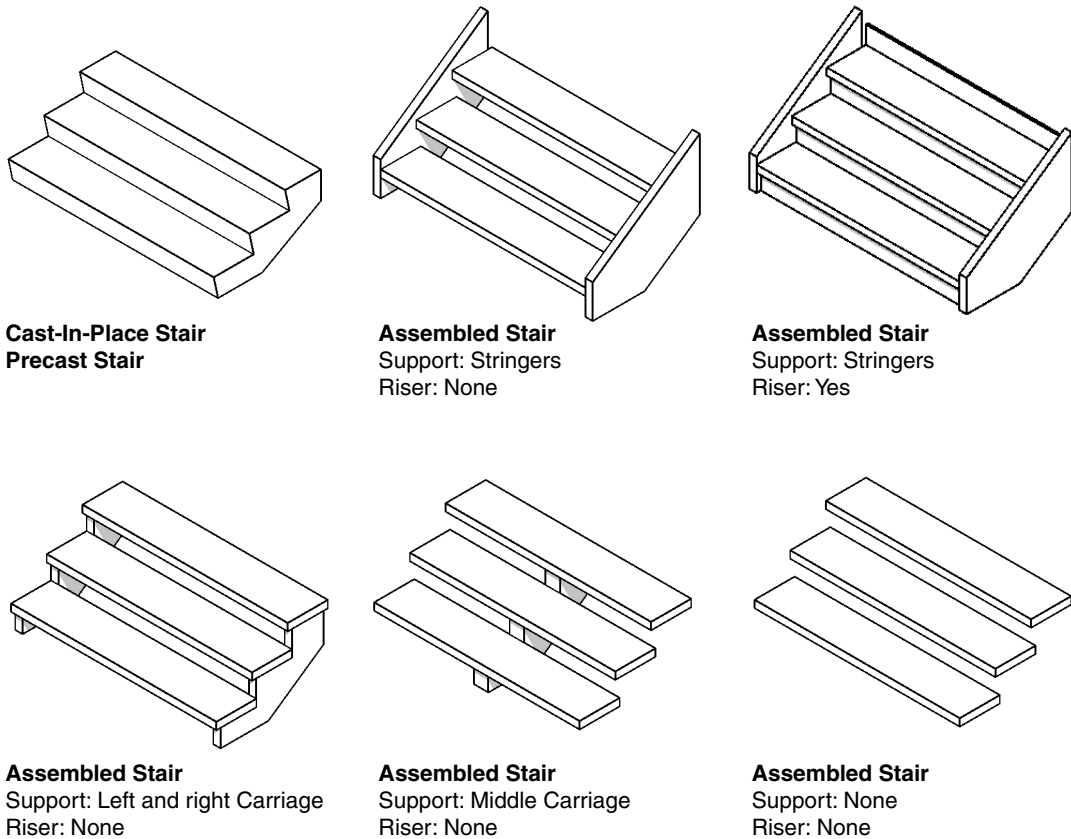
Assembled Stairs are composed of several individual components. The material is primarily wood or steel.

Stairs can be created using two different tools: **By Component** or **By Sketch**.

Creating simple stairs is easiest done **By Component**, which is a highly automated tool, whereas **Stair By Sketch** provides for more freedom of design to create Stairs of many different shapes; Straight, L-shape, U-shape, spiral, and highly customized stairs.

When the **Stair** command is activated, it is assumed that you want to create a stair between two **Levels**. The number of **Treads** for a Stair **Run** is generated automatically based on the distance between Levels and the **Maximum Riser Height** defined in the Stair **Type**.

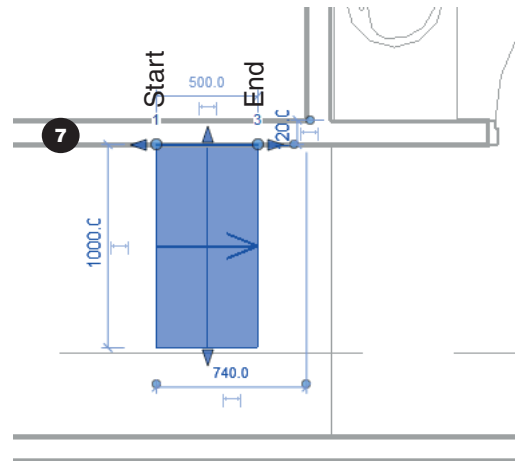
Figure 4.4.2
Stair Families and sub Components



Stairs can *host Railings*. Railings are generated automatically when Stairs are created - if not needed, these can be deleted. New **Railings** can be placed on Stairs at any time.

In this case study, we will use the method **Stair By Component** to create a Cast-In-Place Stair and an Assembled Stair.

In Chapter 5.4 you can find more information on Railings, Landings etc.



PROCEDURE/ **Creating Stairs**

Stairs I: Set up Type

1 Go to *Level 0* and start Stair command; **Architecture** > **Stair**. Select **Cast-In-Place Stair Monolithic 280 mm going - 175 mm riser**.

2 Click **Edit Type**. **Duplicate** and **Name** the new Stair Type; **Monolithic 250 mm going - 200 mm riser**.

3 Set **Maximum Riser Height** to **200** and **Minimum Tread Depth** to **250**. Click **OK**.

4 Set the **Desired Number of Risers** to **3**.

5 Select Run type **Straight**.

6 Select Location Line **Run Left**.

Stairs I: Create

7 Draw the stair from left to right, snapping at an approximate position on the inner wall.

Stair

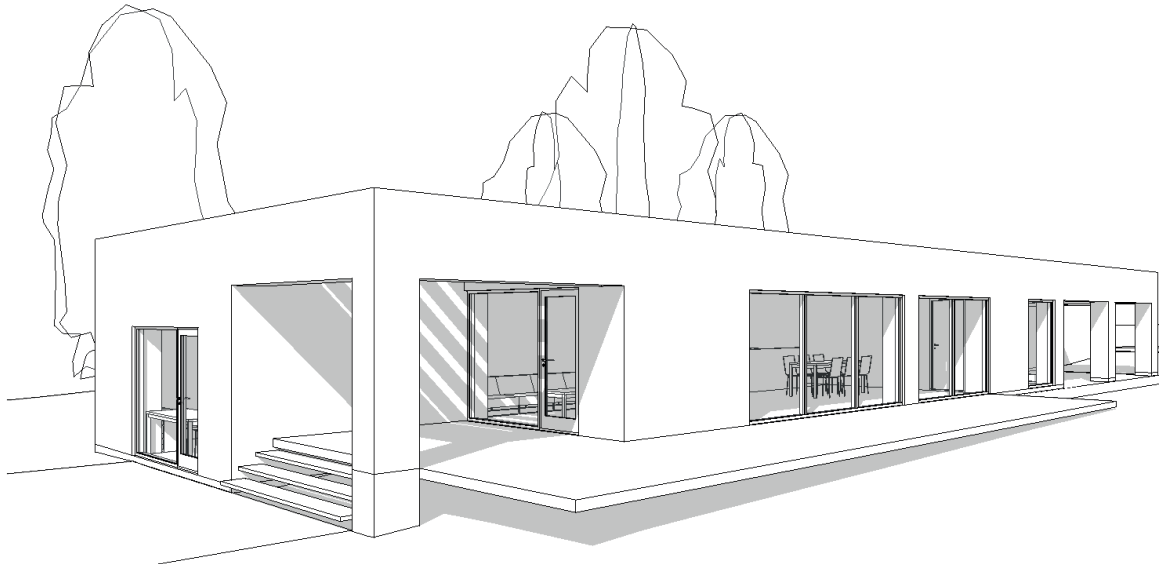
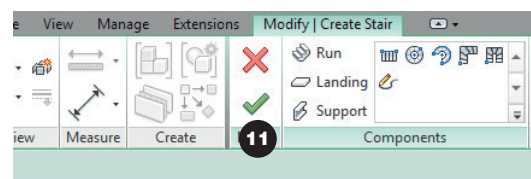
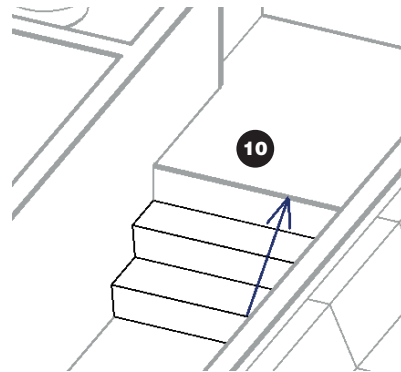
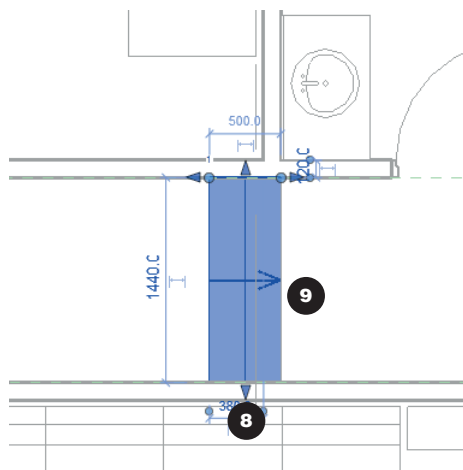


Figure 4.4.2
Exterior stairs between terraces



Stairs I: Relocate

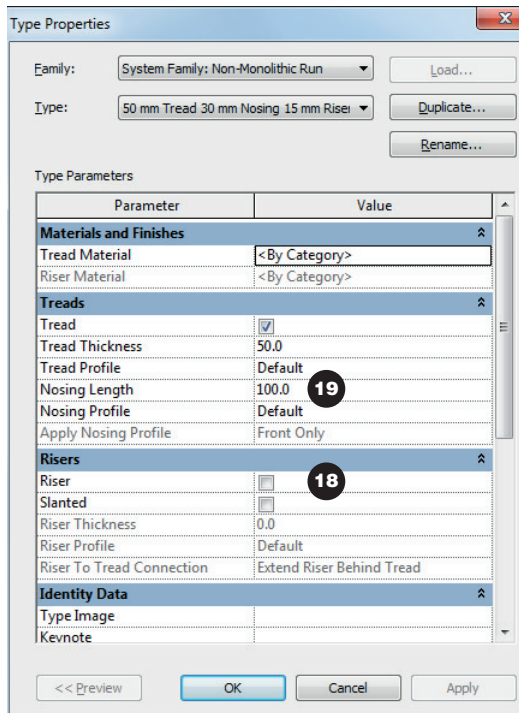
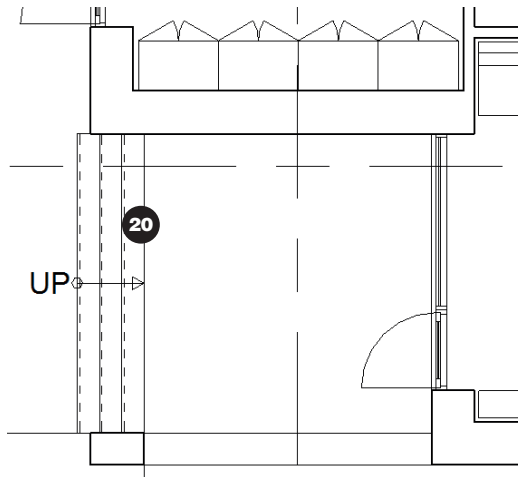
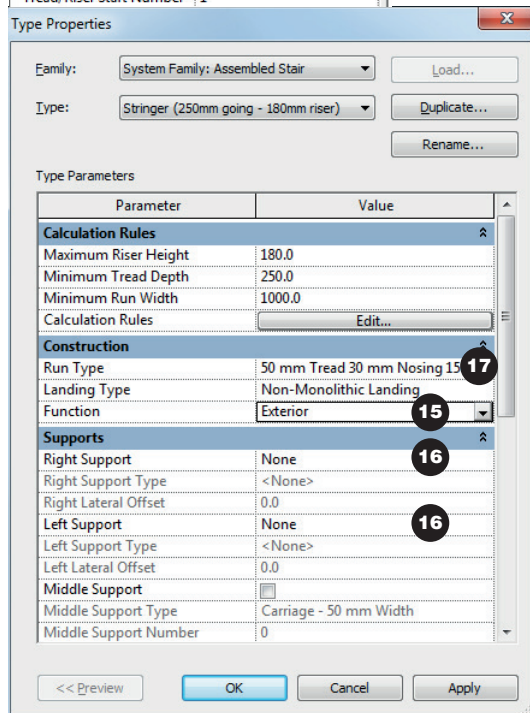
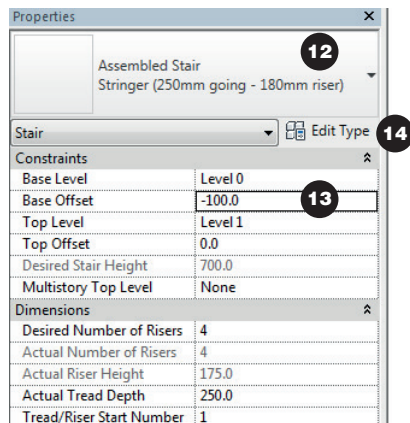
8 Click to select the Stair. Drag the Stair's **Controls** to adjust width to the opposite wall face.

9 Move the stair to the edge of the floor on Level 1 using **Align** or **Move**.

Stairs I: Review model

10 Go to *3D Section West End*. Here, you'll have a better view to the Stair.

11 Click **Finish Edit Mode**. Delete the two **Railings**, we don't need them now.



Stairs II: Set up Type

12 Go to *Level 0* and zoom in to the south-west corner and start **Stair** command. Select *Assembled Stair Stringer (250 mm. going - 180 mm riser)*.

13 Set **Base Offset** to *-100* because the stair must start at the top of the terrace.

14 Click **Edit Type**.

15 Set **Function** to **Exterior**.

16 Set **Right & Left Support** to **None**.

17 Click to edit **Run Type**.

18 The stair must be without risers. Uncheck **Riser**.

19 Set the **Nosing Length** to *100*. Click **OK** + **OK**.

Stairs II: Create and relocate

20 Draw the stair from the wall face. Extend the Stair to the pillar. **Move** or **Align** the Stair to the floor edge. Delete the Railings. **Finish Edit Mode**.

Roof III: Pitched with eaves, custom profile

A consequence of introducing split levels in the building is the rooms having different heights. This could have an impact on the architecture of the house in different ways. Trying to further integrate the slope of the terrain into the architecture of the building, we will now create a Roof by specifying a Profile rather than previously its Footprint, introducing **Roof by Extrusion**.

Creating a Roof by Extrusion is done by sketching the Profile in a vertical plane, and then extruding the profile by specifying the ends of the Roof.

To shield the terrace established and to integrate it spatially with the interior of the building, a garden Wall is introduced.

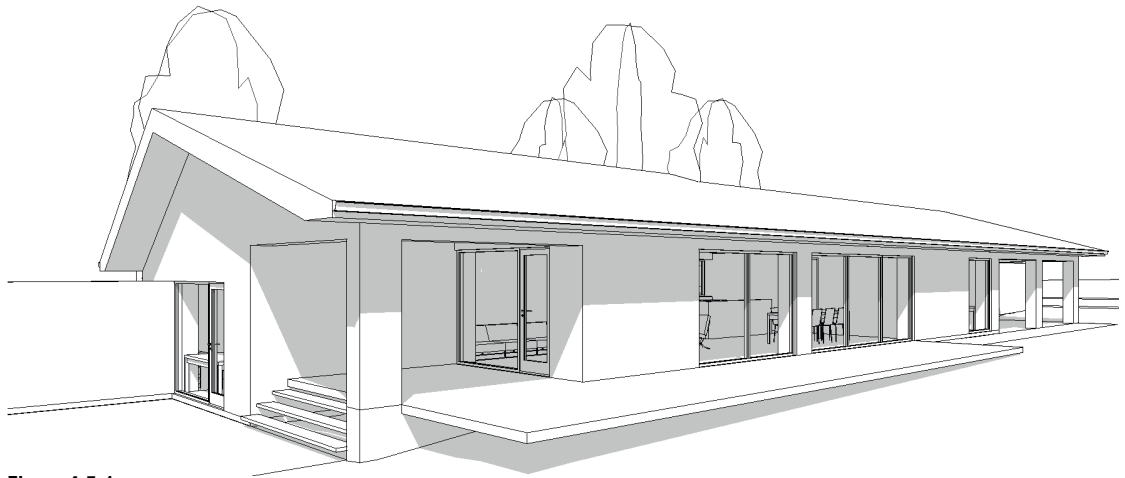
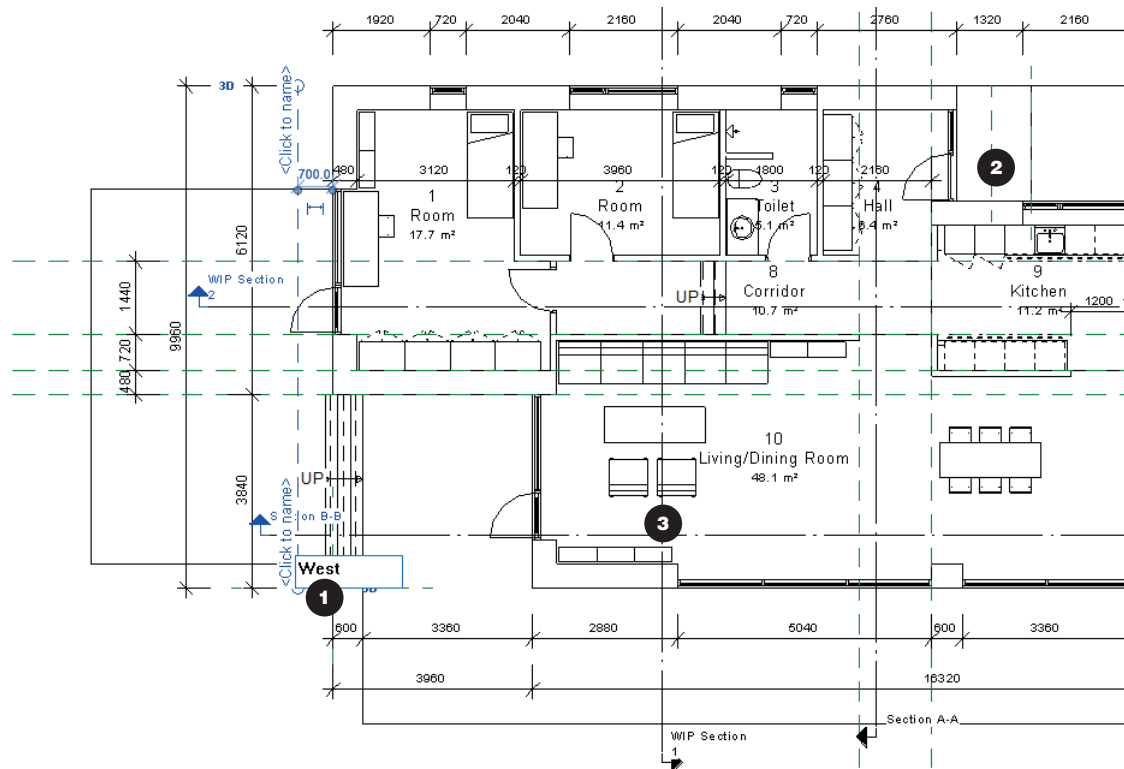


Figure 4.5.1
Pitched roof with gable end and eaves and a garden wall on the west facade



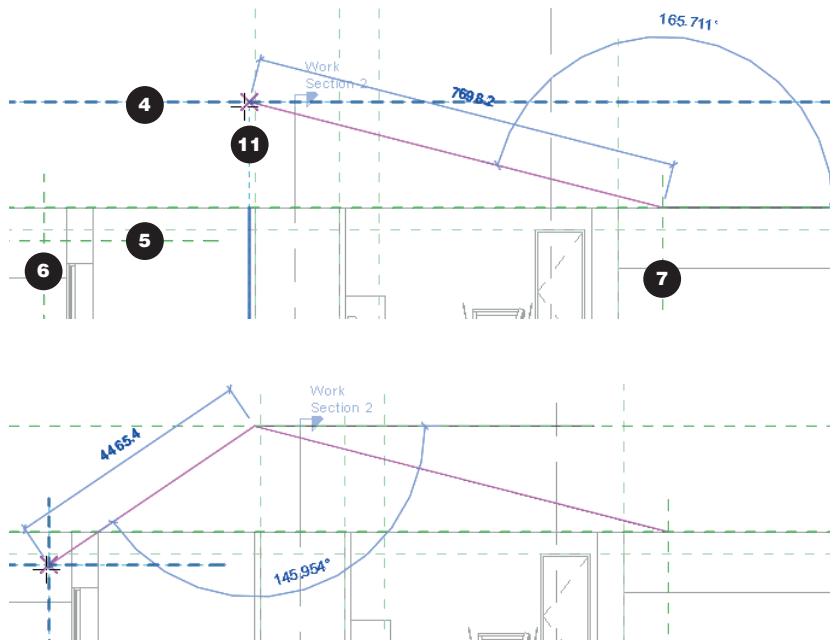
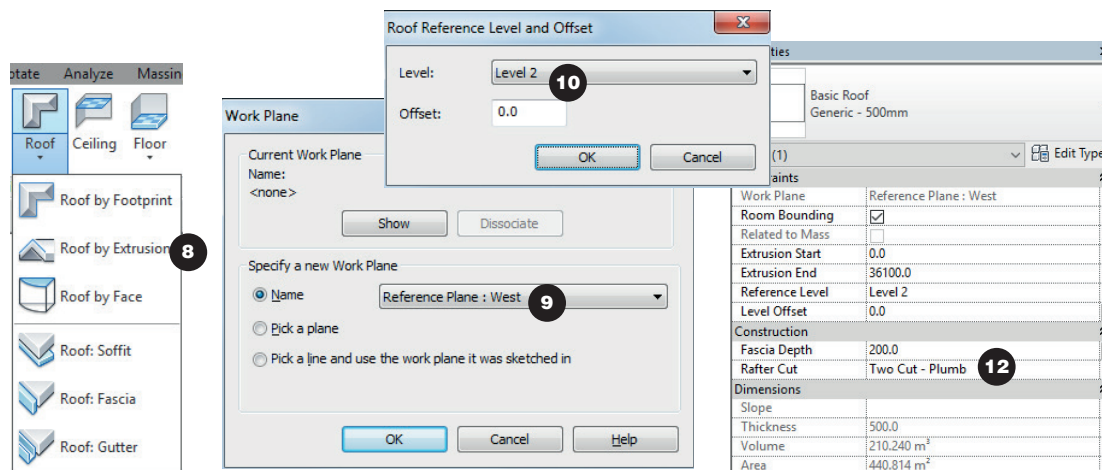


Figure 4.5.2
Roof Profile



PROCEDURE/ **Creating custom profile Roofs**

File: Revit Case Study 4.4 p43

Preparations

Go to *WIP Section 1* and Delete the existing Roof and the Sunshaders.
Go to *Level 1*.

1 Create a **Ref Plane** 700 outside the western external Wall. Select it and name it **West. Pin**.

2 Create another **Ref Plane** 700 outside the entrance facade (naming not important). **Pin**.

3 Move *WIP Section 1* to the Living Room (view direction east).
Go to *WIP Section 1* and extend the Crop Region.
Change the elevation of *Level 2* to 2600.

4 Create a horizontal **Ref Plane** 1900 mm above *Level 2*.

5 Create a horizontal **Ref Plane** 600 mm below *Level 2*.

6 Create a vertical **Ref Plane** 400 mm outside the northern external Wall face.

7 Create a vertical **Ref Plane** 800 mm outside the southern external Wall Face.

Create Roof

8 Go to Tab **Architecture** > **Roof** > **Roof by Extrusion**.

9 Specify *Reference Plane: West* as the **Work Plane**. Click **OK**.

10 Specify *Level 2* as the Roofs **Reference Level** and click **OK**.

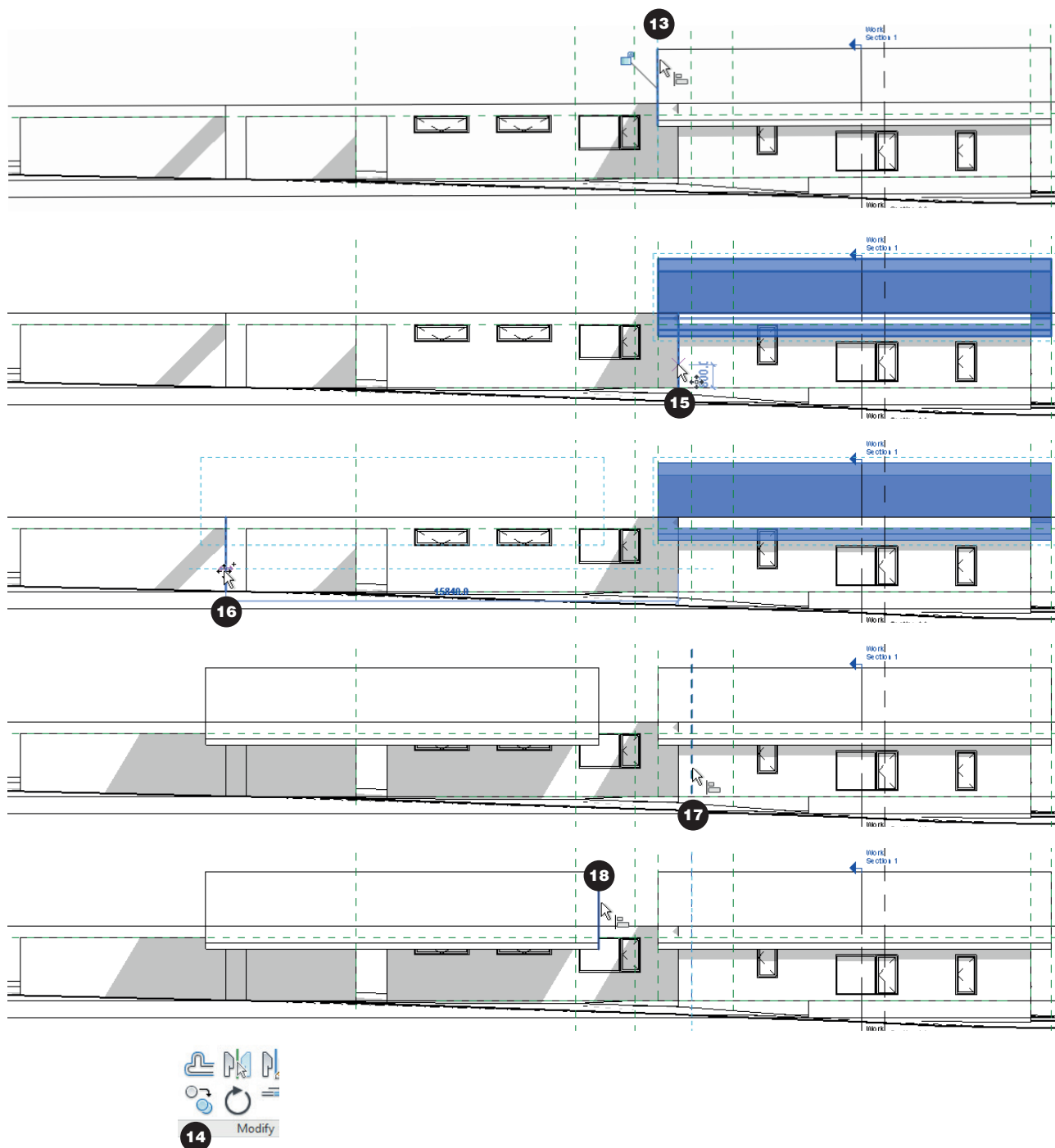
In the Type Selector, select *Basic Roof Generic 500mm*. Draw the lines snapping to intersections - the lines indicate the upper side of the Roof. See *Figure 4.5.2*.

11 At the ridge, snap to the intersection between the top Ref Plane and the extension of the left Wall face. Click **Finish Edit Mode**.

12 In Properties, set **Rafter Cut** to *Two Cut - Plumb* and **Fascia Depth** to 200.

Reference Plane - named

Roof By Extrusion



Copy

Copy Roof

Go to Elevation North.

13 **Align** and **Constrain** the left end of the Roof to the Ref Plane outside the entrance.

14 Select the Roof and start the **Copy** command.

15 Copy from the Wall edge...

16 ... to Wall edge.

Now the Eastern edge of the Roof is in place.

To adjust the Roofs Western edge, start the **Align and Constrain** command

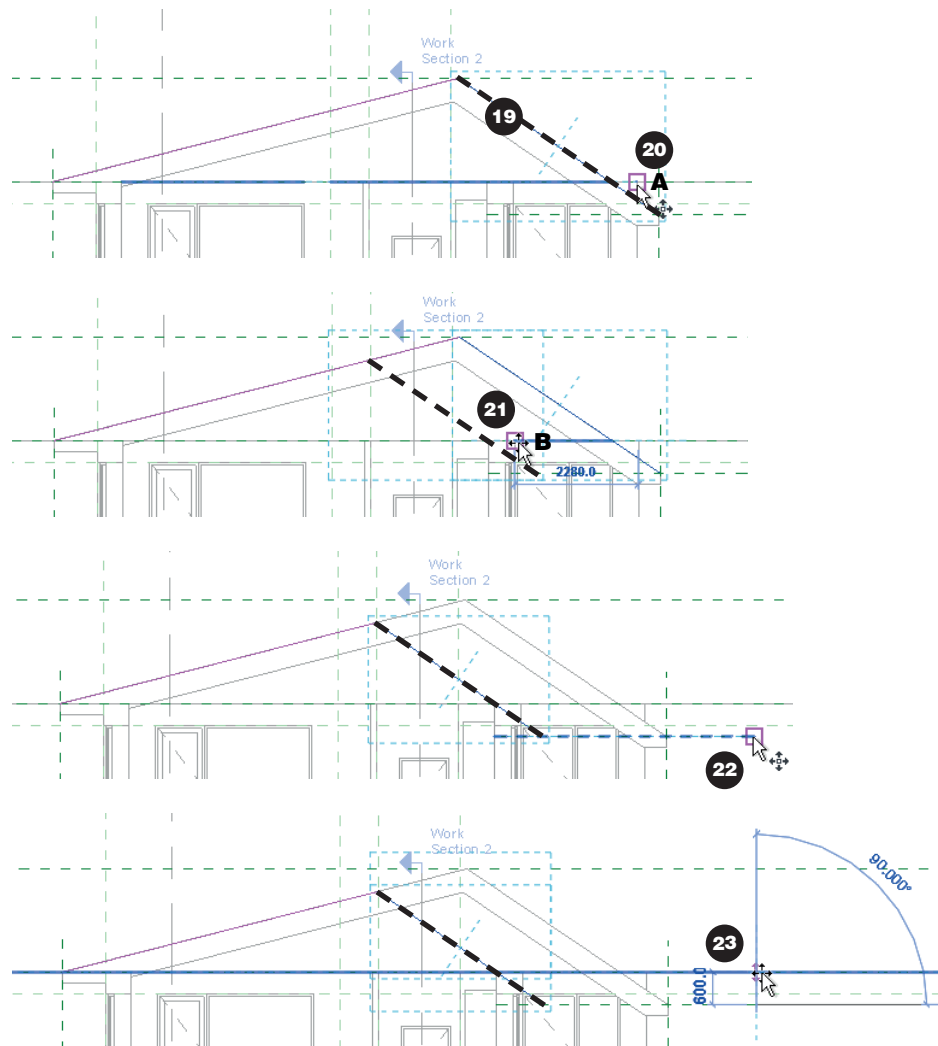
17 ...and click first on the Ref Plane on the inside of the entrance Wall,

18 ...then on the Roof edge to extend it to the Ref Plane.

Adjust Roof profile

Move *WIP Section 1* to cut through the kitchen Window. Flip it to view towards west. Activate it.

Double-click on the Roof to Edit its Profile.



19 Select the right sketch line and start the **Move** command. Now click twice to Move the sketch line from A to B:

20 ...from the top outer edge of this external Wall (A)...

21 ...to the top outer edge of this external Wall (B). Start the **Move** command again...

22 ...and move from Ref Plane...

23 ...600 mm vertically up to Level 2.

Finish Edit Mode to save the changes made to the Roof.

Edit Profile

Move



Select all Instances

Review model

Go to View {3D} to check the Roof from all sides.

24 The two Roofs overlap.

25 The Walls do not reach the Roofs or is above the roof.

26 Start the **Join** command and Join the two Roofs.

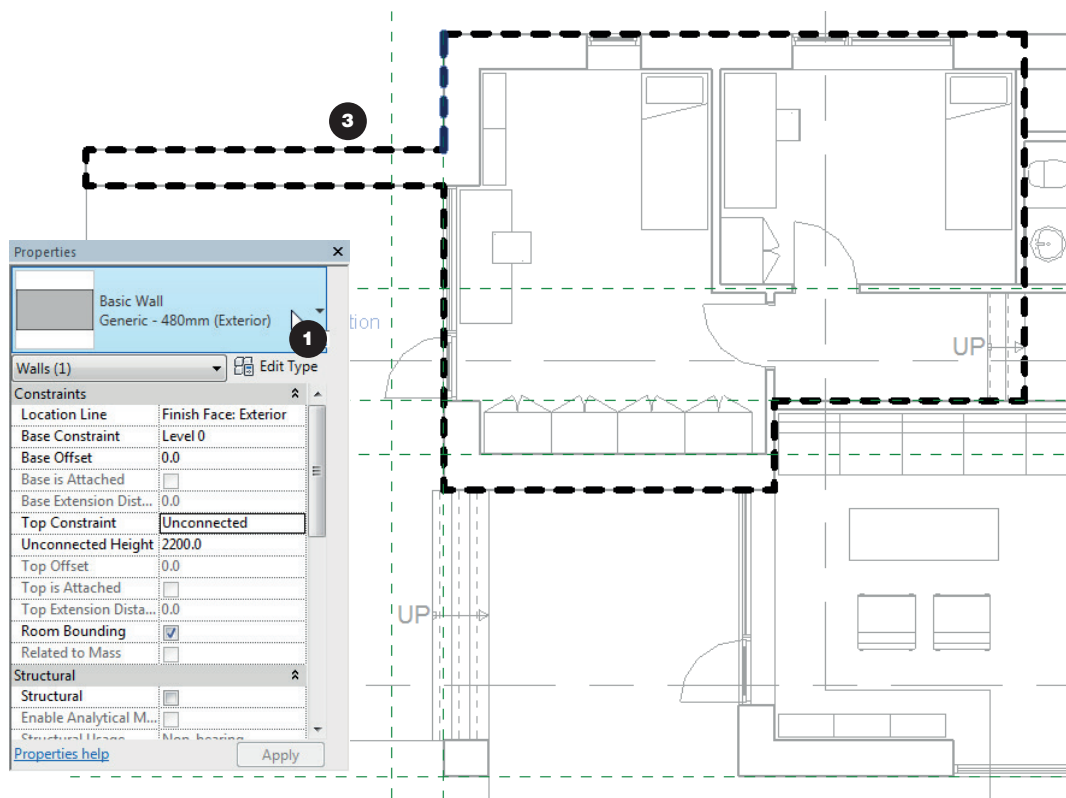
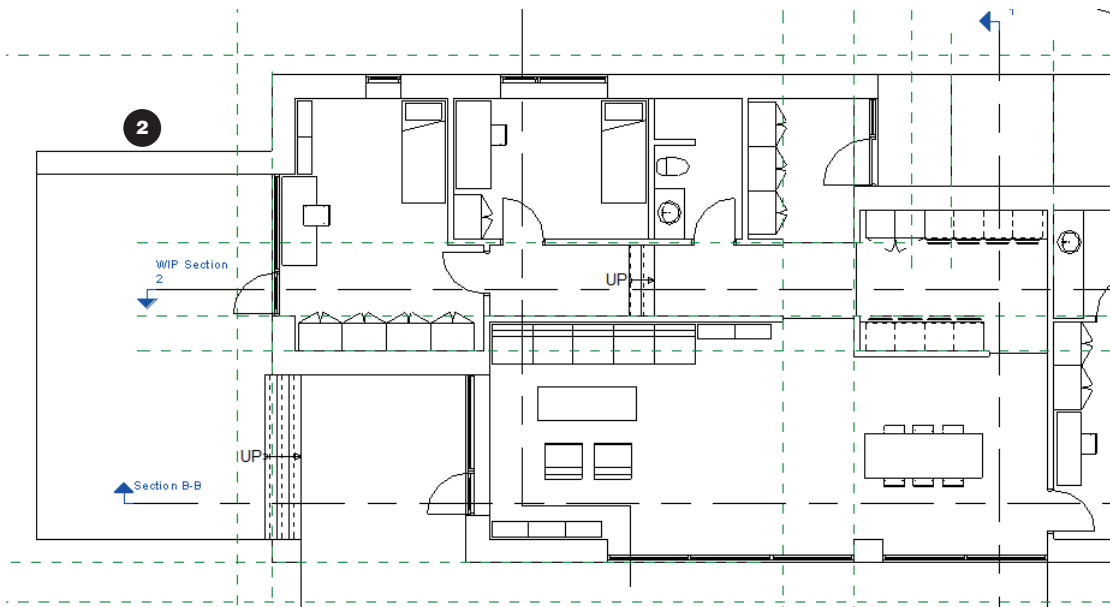
Attach all Walls - except **Curtain Walls** - to the two **Roofs**. An easy way is:

27 Right-click on a Wall and pick **Select all Instances > In entire Project**. Click **Attach Top/Base** and click on one of the Roofs.

28 This Warning may appear - click **Detach Targets** to avoid Attaching objects that are not touching each other. Click **Attach Top/Base** again, and click on the other Roof.

Repeat, until all Walls - exterior and interior - are attached to the Roof above them.

29 This Window needs resizing. Select it, **Edit Type > Duplicate >** set up new Type. Set **Rough Height** of the new Type to **800** and rename accordingly.



PROCEDURE/ **Creating a garden Wall**

Create garden Wall

Go to *Level 0*.
Start the **Wall** command.

1 In the **Type Selector**, pick Type **Generic - 480 (Exterior)** from the Family Basic Wall. Set **Height** to *Unconnected* and **Unconnected Height** to 2200.

2 Create a Wall in the location shown.

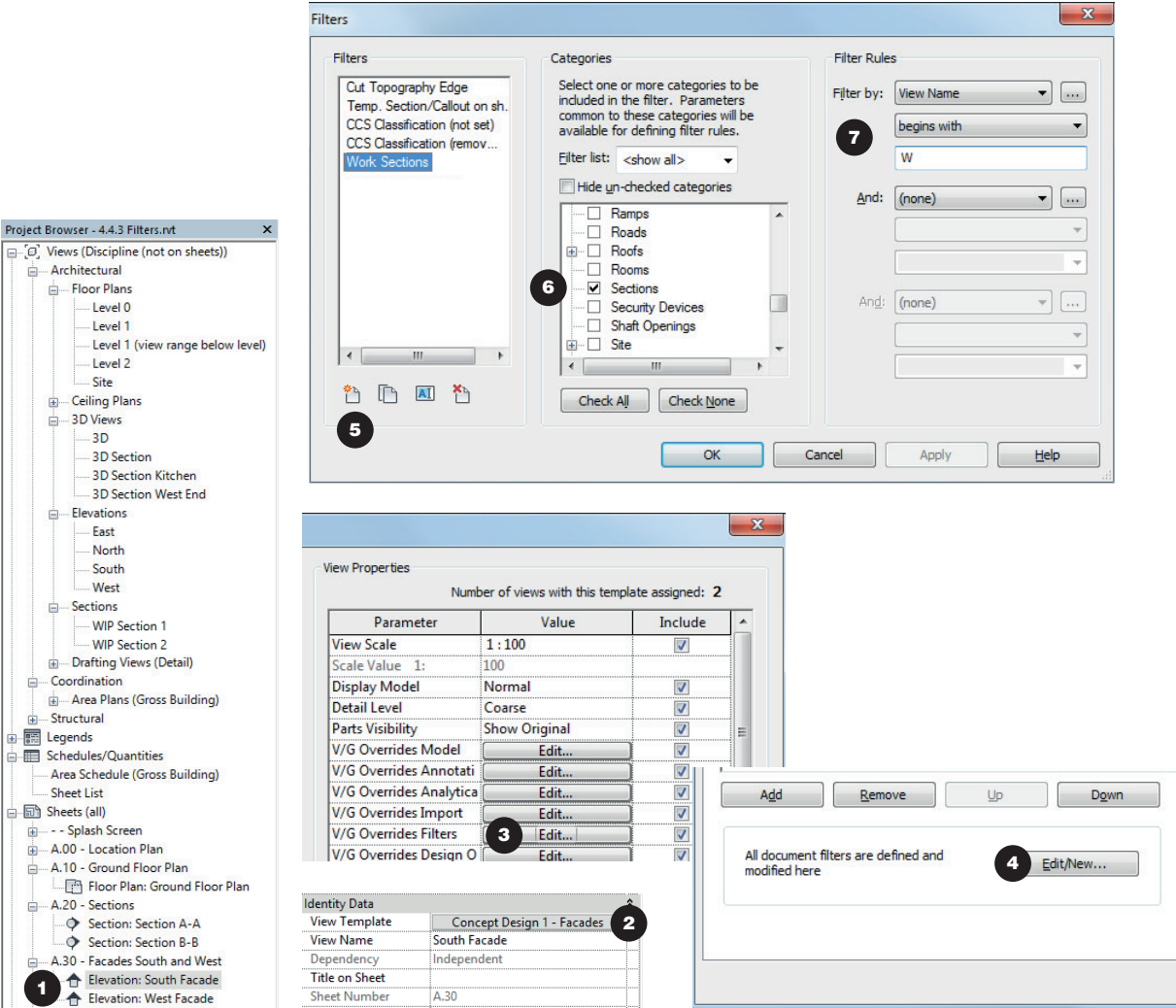
Create a **Foundation Wall** under the Wall like previously described.

3 If the Building Pad is hidden, **Unhide** it. Edit its Boundary to align with the new Garden Wall by changing the Western boundary and adding some lines. Finish and review the model in *3D View*.

Hide View references by automation

As a project becomes increasingly complex, many Views are needed in the project to be able to inspect all corners of the model properly.
As Views are added, the Views tend to become cluttered with references to other Views.

To tidy up a bit, we will now hide certain View references in certain Views. To automate the process and to make the visibility of View references behave according to our needs also in the future, we will do this using **Filters**.



PROCEDURE/ Hiding WIP Sections by View name

Filters

Edit View Template

- 1 Open one of the Elevations placed on a Sheet, e.g. *South Facade*.
- 2 In Properties, click to edit the assigned View Template.
- 3 Edit **V/G Overrides Filters**.

Create new Filter

- 4 Click **Edit/New** to create a new Filter.
- 5 Create a new Filter and name it *WIP Sections*.
- 6 Check **Section** Category.

- 7 Set the Filter Rules to Filter By: **View Name - Begins With - W**. Click **OK** to go back to previous window.

Filtering for process automation

All Revit objects belong to a **Category** of multiple Families.

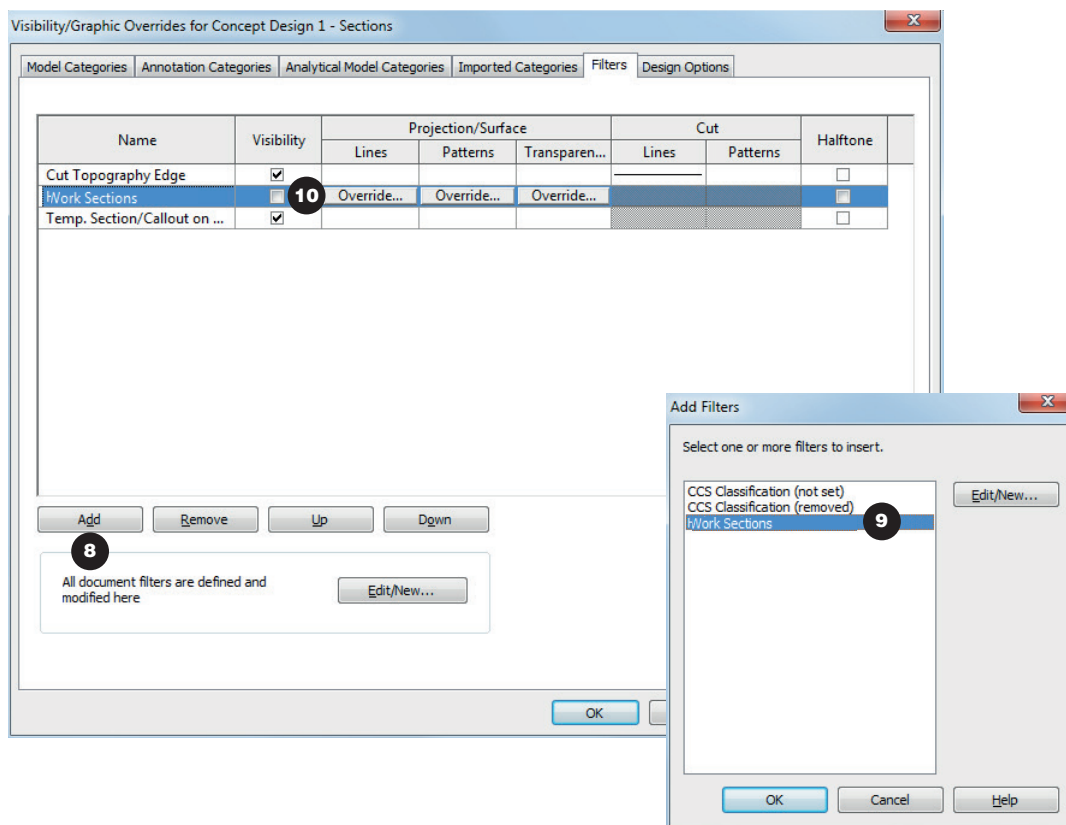
Each Category has a standard appearance setting that is applied to all objects in a category. Appearance settings control visual object characteristics like Line Color, Line Weight, and Line Pattern. These settings can apply to an entire project or to individual Views.

We have tried to change these settings previously in the book.

Sometimes it is useful to **Hide** objects with certain traits within a Category, but to keep other objects of the same Category visible. In the Visibility/Graphics Overrides menu, this can be controlled by using **Filters**, setting up **Filter Rules**.

To **Filter** an object is to point it out for further processing. A Filter Rule defines by which attributes in the objects **Parameters** it is appointed.

In this case, objects are Filtered to **Hide** them, but filtering can be used to point out objects to be processed in other ways also.



Add Filter

8 Click **Add** to find the Filter you created before.

9 Select the Filter and click **OK**.

10 Uncheck **Visibility**. All Sections where **W** is the first letter, will now be invisible in this View.

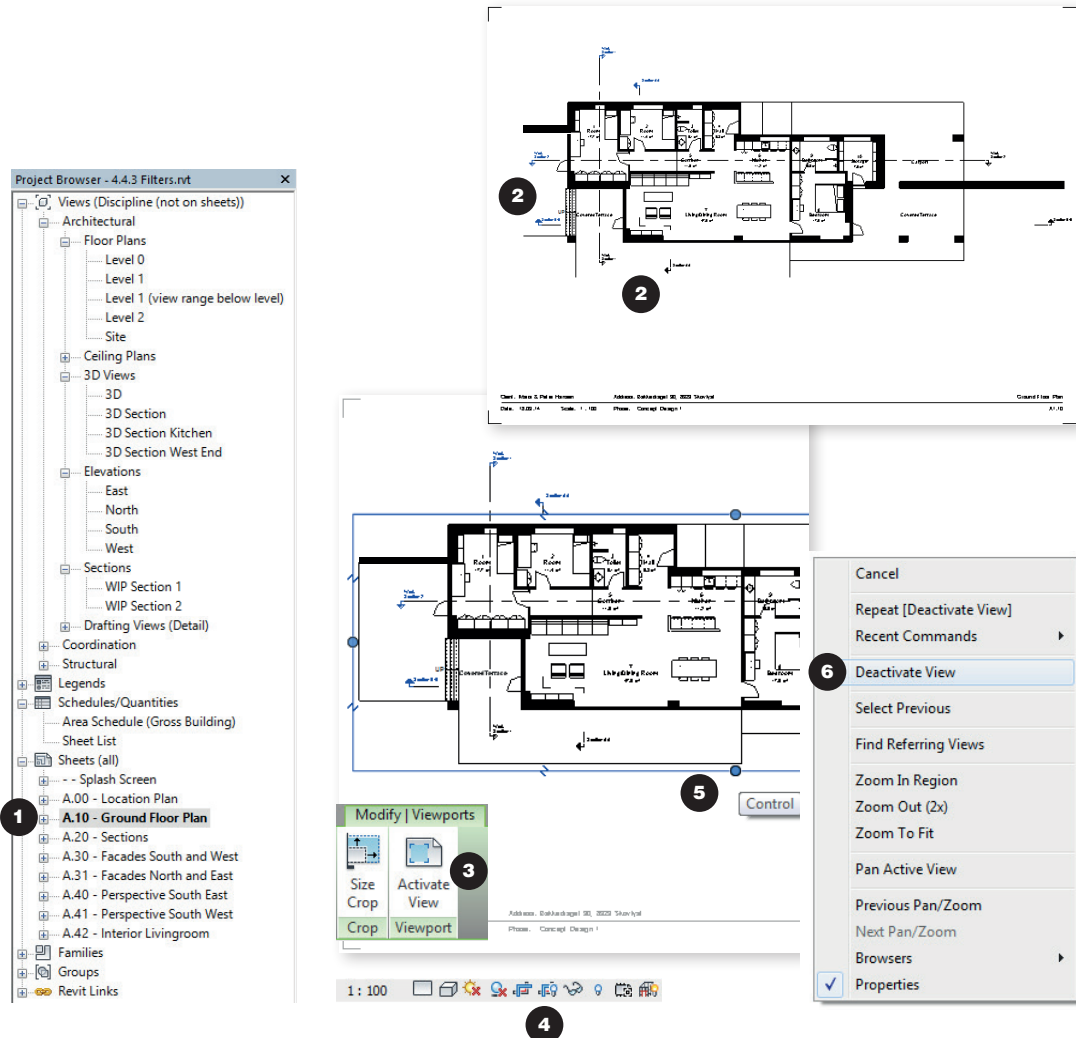
Add Filter to other Views

This Filter can be applied to all other Views where you don't want to see the WIP Sections.

Adjust Sheets and Output Views (optional)

Presenting the changes made to the client would be a natural next step.

Because of the changes to the building, an adjustment of the Sheets and of the output Views is needed.



PROCEDURE/ Adjusting Sheets and output Views

Plan View

1 Go to the Sheet A.10 - Ground Floor Plan. Expand the list of Views on this Sheet by clicking on the +. Remember that Level 1 and Ground Floor Plan are two different Views. Do **not** double click the View.

2 Note that the terraces are not completely visible.

3 Select the Viewport (the building on the Sheet), *right-click* and **Activate View** (or double click) to make it editable. The View Ground Floor Plan is now ready for adjustment.

4 Click **Show Crop Region**.

5 Drag the Controls to adjust crop. Click **Hide Crop Region**

(same button as Show Crop Region).

6 Right-click and click **Deactivate View** (or double click outside frame) to exit edit mode.

Review the Sheet with the Location Plan. Consider the cropping in the same way and correct if necessary.

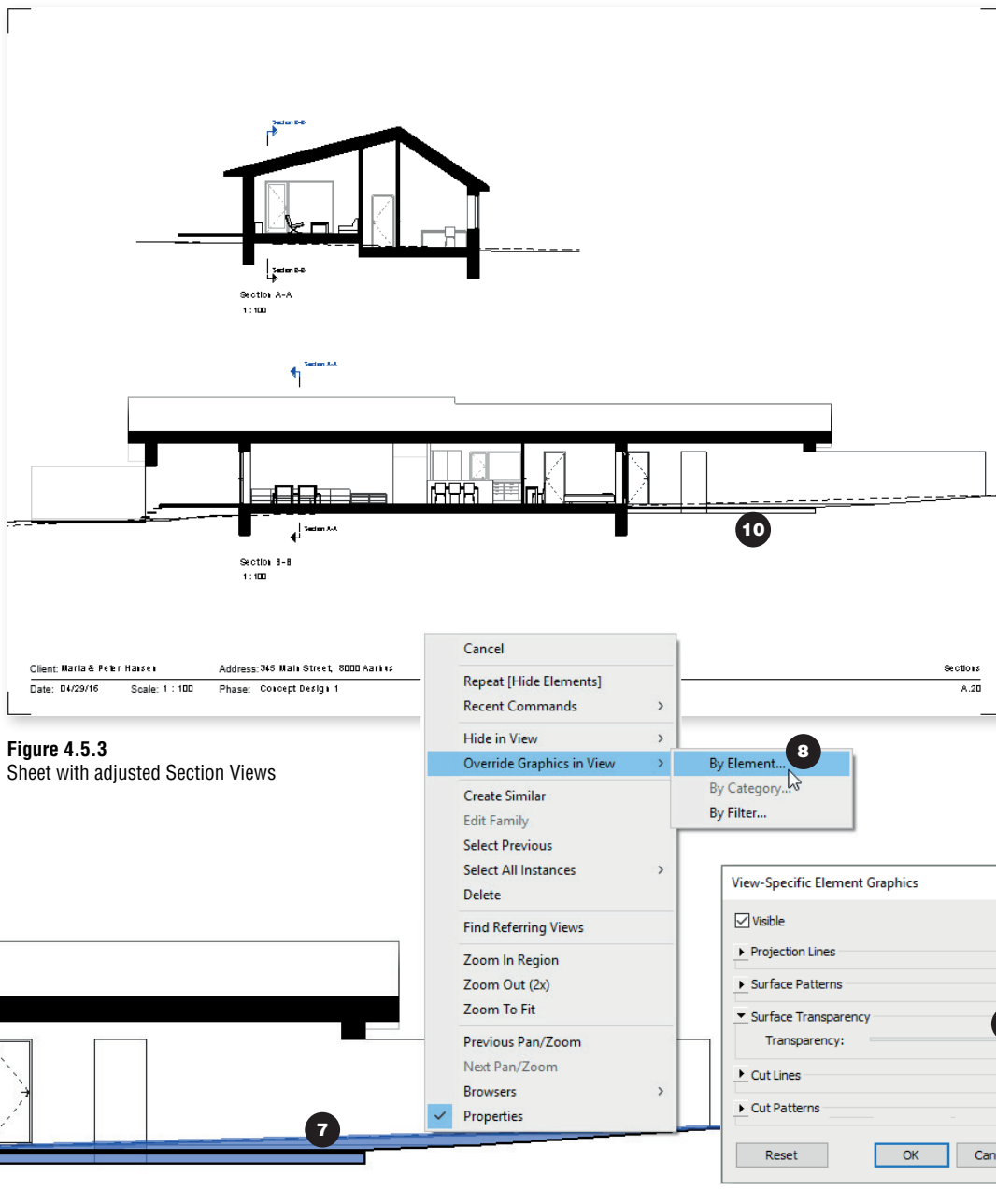


Figure 4.5.3
Sheet with adjusted Section Views

Section and Elevation Views

Go to the Sheet with the output Section Views.

To show the recently added and modified elements (Roof, terrain and foundation Walls) optimally, adjust the cropping and the position of the Views on the Sheet as shown in *Figure 4.5.3*.

Go into each Section View, one by one, and make the following corrections.
Some Walls may need to be Attached to the Roof.

To show the difference between existing and new topography, we will not hide the existing terrain (shown dashed). However, we want to make it transparent, so it does not hide the bottom of the outside opening.

7 Select the existing terrain.

8 Right-click and go to **Override Graphics in View > By Element**.

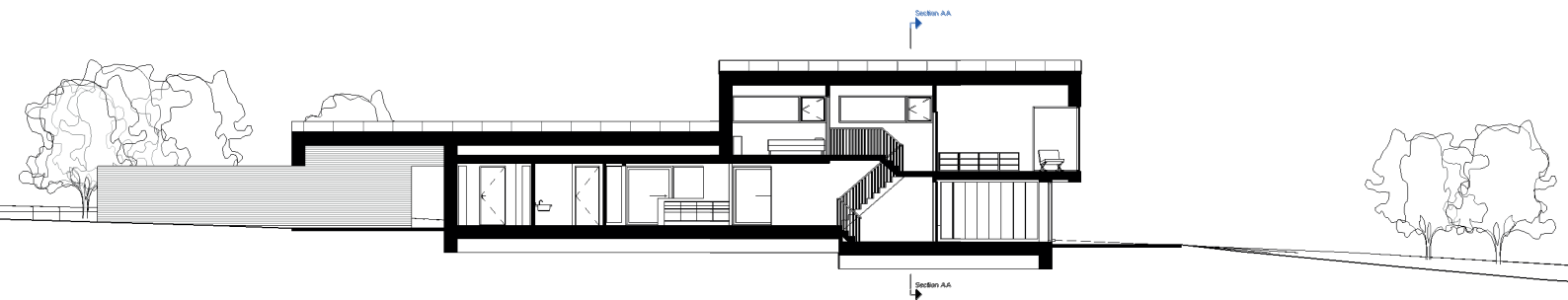
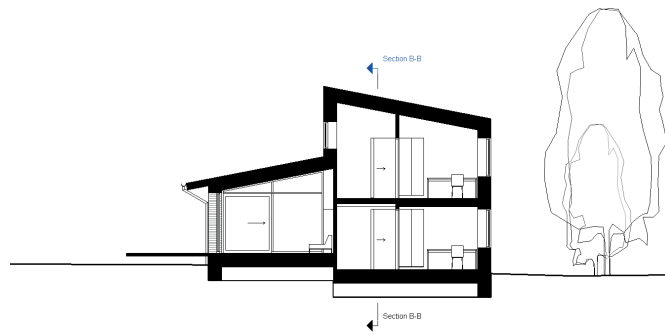
9 Expand the group **Surface Transparency** and set **Transparency** to 100.

10 A cavity is now visible between the underside of the terrace Floor and the Building Pad.

This can be corrected by adjusting the Building Pad to not include the terrace, and then create a separate Pad under the terrace (optional).

Review the Sheets with Elevation Views to make similar corrections.

Overwrite Graphics in View by Element



5 *building II*

PROJECT CHANGES

Like real-life projects, changes occur frequently along the course for many reasons at any stage in the project - which is why a process that balances detail and effort is encouraged in this case study: A modest level of detail, generic Element Types and Constraints (used with consideration together with Reference Planes) are means to keep this balance.

While waiting for the clients to respond to our preliminary proposal, we have been occupied with feeding the project with information concerning the physical surroundings, causing us to propose some changes to the project.

Now the clients reply with radical changes to the brief, forcing us to reconsider the project thoroughly.

This chapter will to a large degree be an exercise in using Modify tools and a repetition of modeling tools already learned.

A few new tools and concepts will be introduced, and the Stairs tools will be examined more closely.



5.1/ CHANGES TO BRIEF

Due to changes in family and work relations, the clients need more space than implied in the original brief. This and other changes to the brief is demanded:

- One extra room which can function as a home office and also occasional meetings with a client
- One more adult occupant in the house
- One room to let if possible
- Higher levels in the house to benefit from the view to the landscape
- More storage in the kitchen
- Brick as exterior wall material

The revision of the Revit project will be based on a revised sketch proposal shown on the *Reference Sheet* available for download and print on the website; keep this at hand for reference while making the changes and additions to the project.

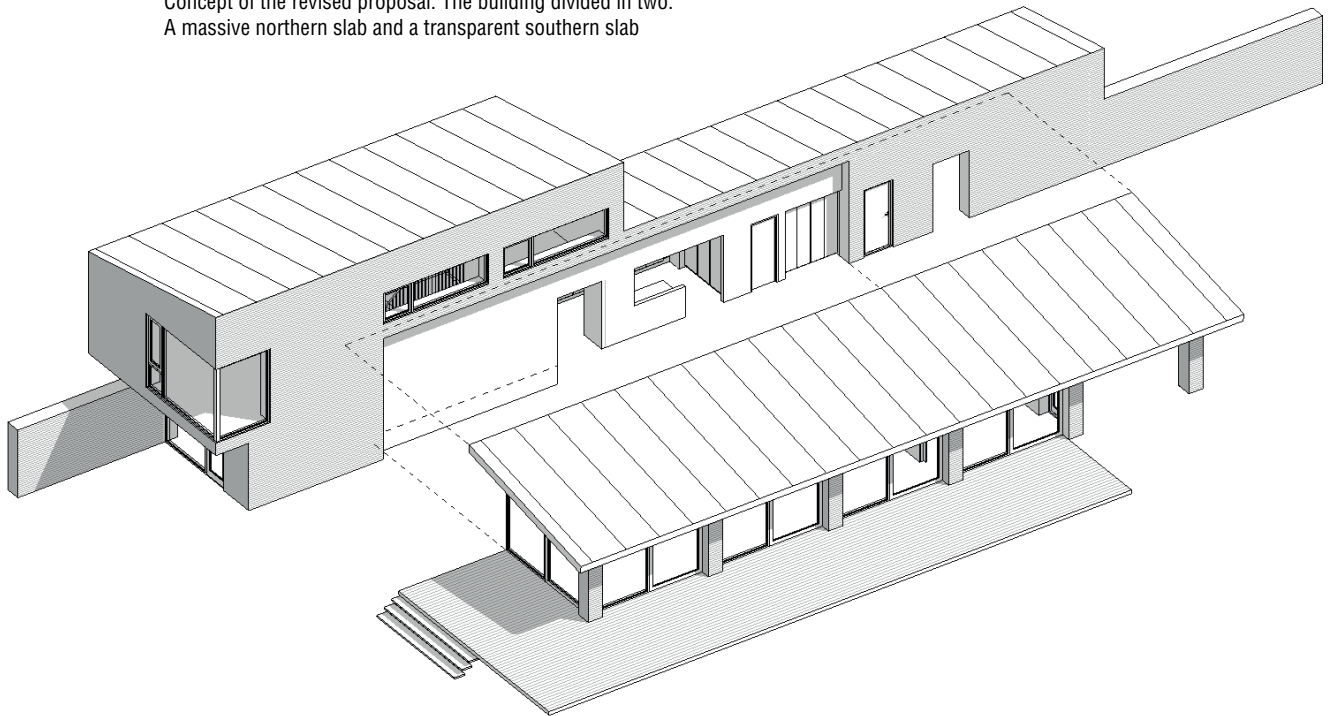
Also, this page and the previous pages supply an overview of the revised proposal.

To modify elements that are already created is a core subject of the exercises in the chapter - so is repetition of Revit tools already learned.

The revised sketch proposal: Concept

Figure 5.1.1

Concept of the revised proposal. The building divided in two: A massive northern slab and a transparent southern slab

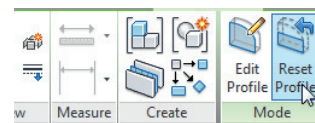
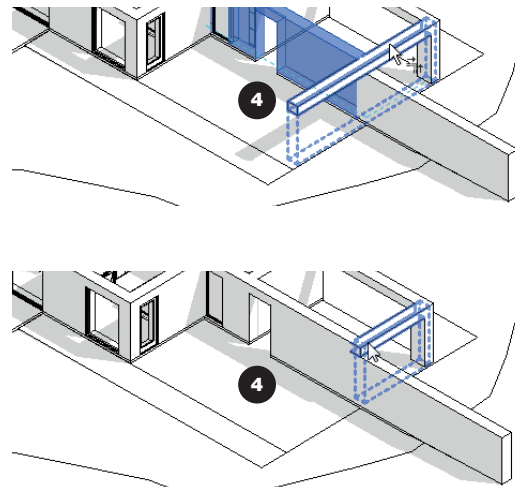
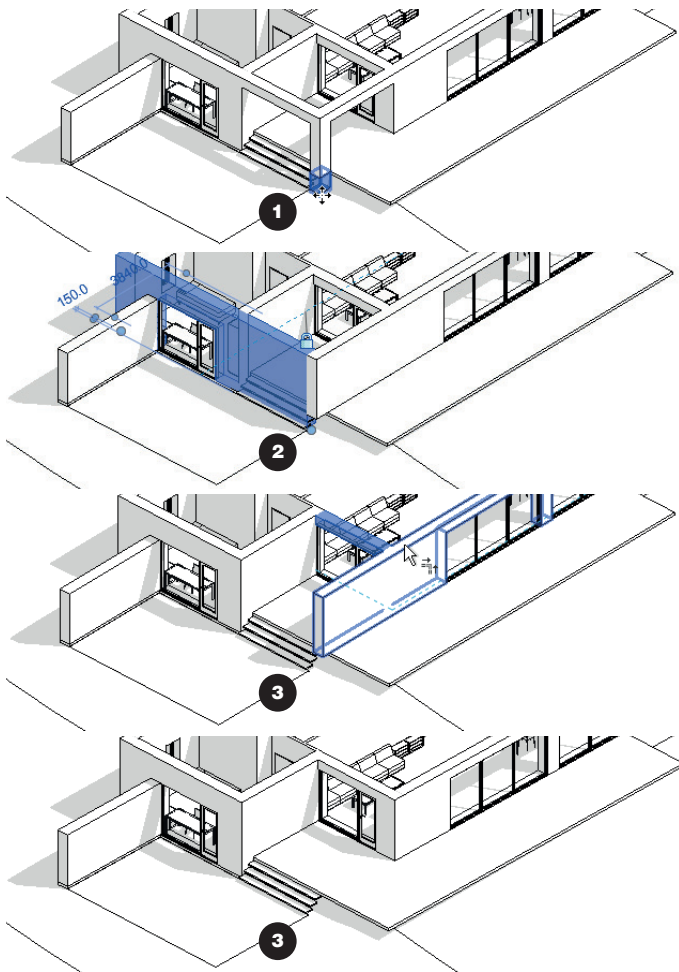


5.2/ PLAN ADJUSTMENTS

Preparations

Before setting out adding more space in the building to address the change of brief, there will be some revisions to do. Some of these support the change of

spatial concept - dividing the building in a northern and a southern slab - and some are minor changes of refinement, introducing some new Revit tools and methods.



PROCEDURE/ Preparations and miscellaneous revisions

File: Revit Case Study 5.0 p55

Purge obsolete elements

Go to (3D). Delete all roofs. Go to *Level 1* and Delete Ref Planes used for creating the Roofs.

Adjust building perimeter

Go to (3D), navigate to see the south-western corner of the building.

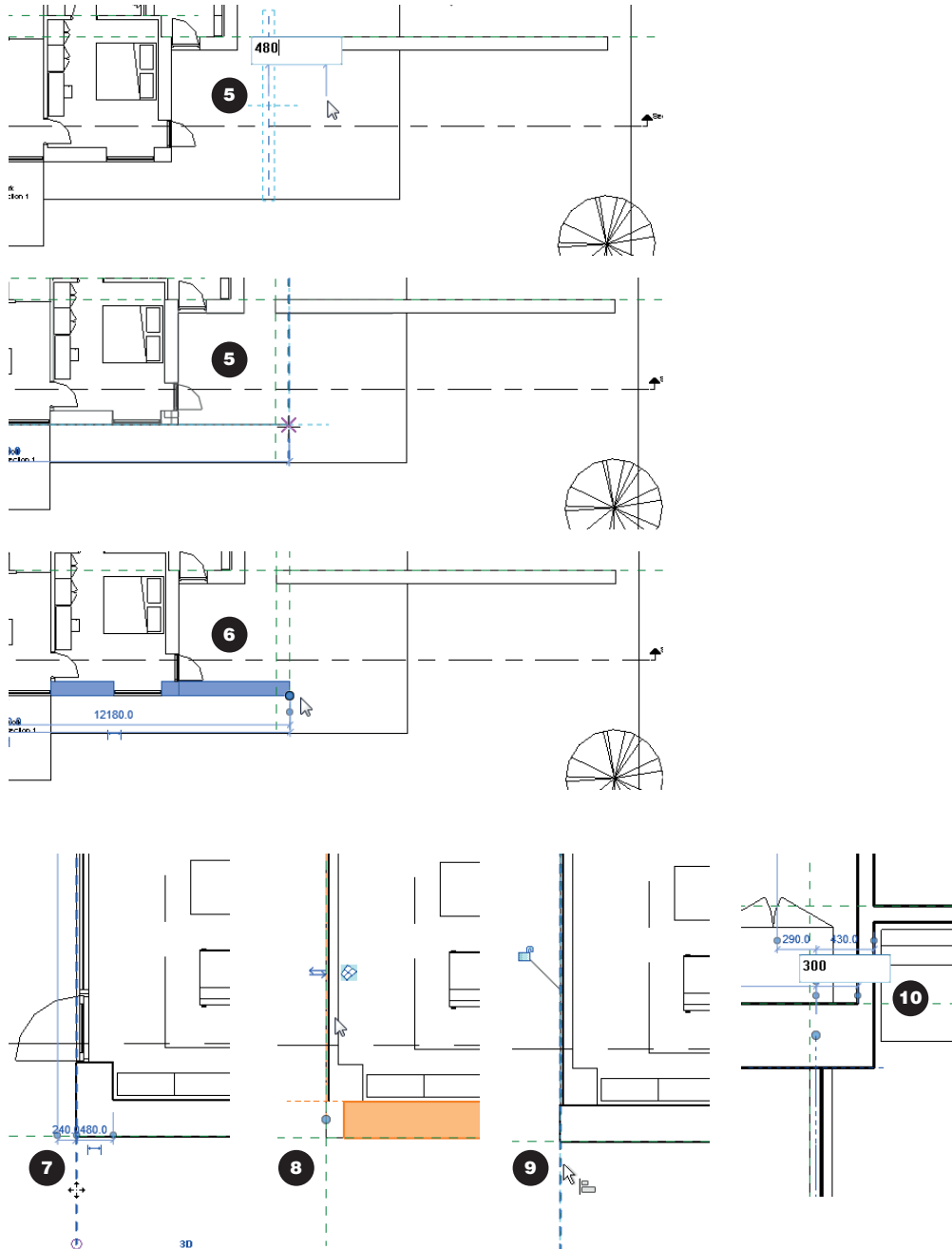
1 Delete Pad and Foundation Wall under the corner Wall pillar.

2 Select south- and west-facing external Walls and **Reset Profile** of both.

3 Trim the Wall ends back to the adjoining external Walls as shown, using **Trim/Extend to Corner**.

4 Navigate to see the south-eastern corner of the house and do the same to the east-facing Wall.

Reset Profile



Go to *Level 1*.

5 Copy Ref Plane 480mm to the right. Pin.

6 Select the southern external Wall and Drag its eastern end to the new Ref Plane, using the **Drag Control**.

West-facing glass facade

7 Still in *Level 1*, create a Ref Plane *here* (aligned to the Wall face) and Pin.

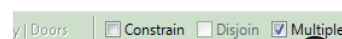
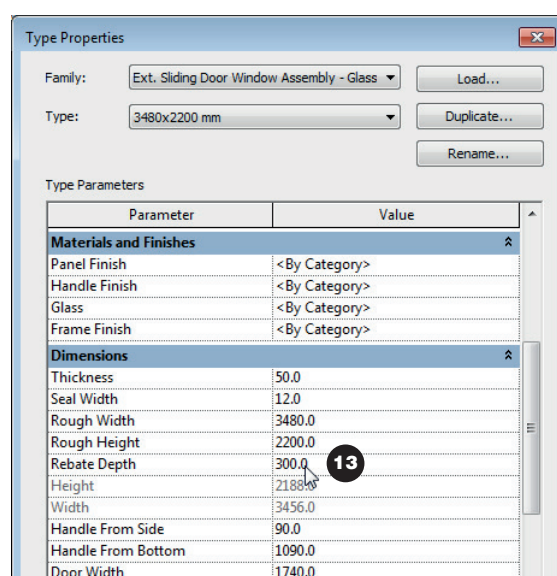
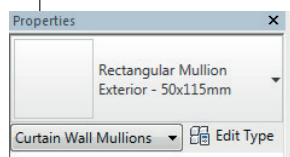
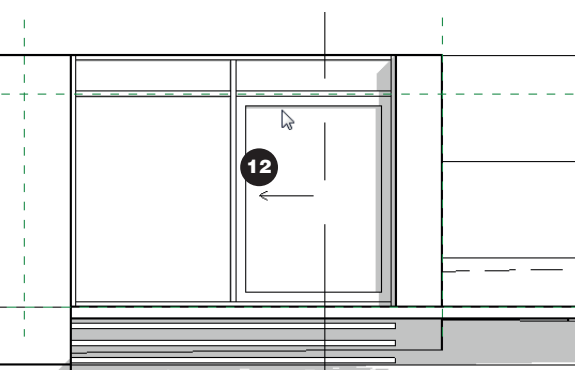
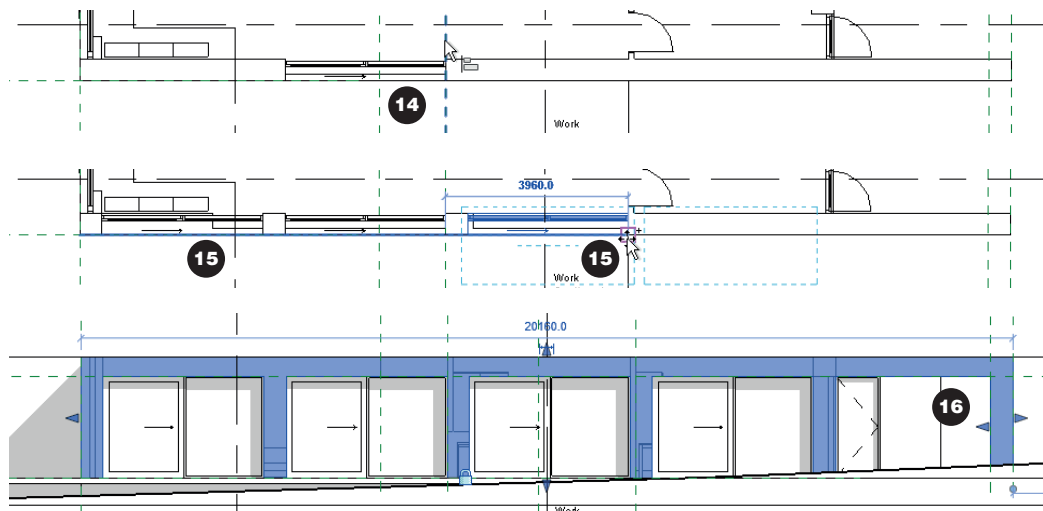
Select the west-facing external Wall at the living area.

8 In the **Type Selector**, set its **Type** to **Curtain Wall**. The inserted Door will be deleted in the process.

9 Select the south-facing external Wall and Align its end to the Ref Plane.

10 Select the Curtain Wall and position it 300 from the inner Wall face as shown, using Temporary Dimensions.

Go to Elevation *West*. Add **Curtain Grid** to Curtain Wall: one vertical in the middle and one horizontal at the Ref Plane 'Top apertures'.



11 Add **Mullions** to Curtain Walls: *Exterior - 50x115mm*. Add them to all **Grid Lines**.

12 Select the bottom right **Panel** of the Curtain Wall (press TAB multiple times to select). In **Type Selector**, set **Type** to *CW Ext. Sliding Door - Glass*.

Apertures in south facade
Go to **Level 1**.
Delete all Windows and Curtain Walls in the south-facing

external Wall.
Start the **Door** command, pick Type *Ext. Sliding Door Window Assembly - Glass*.

13 **Edit Type > Duplicate > 3480 x 2200mm**, set **Door Width** to 1740 and **Rebate Depth** to 300.

14 Place a Door in the south-facing external Wall and Align and Constrain the right edge to the Ref Plane as shown.

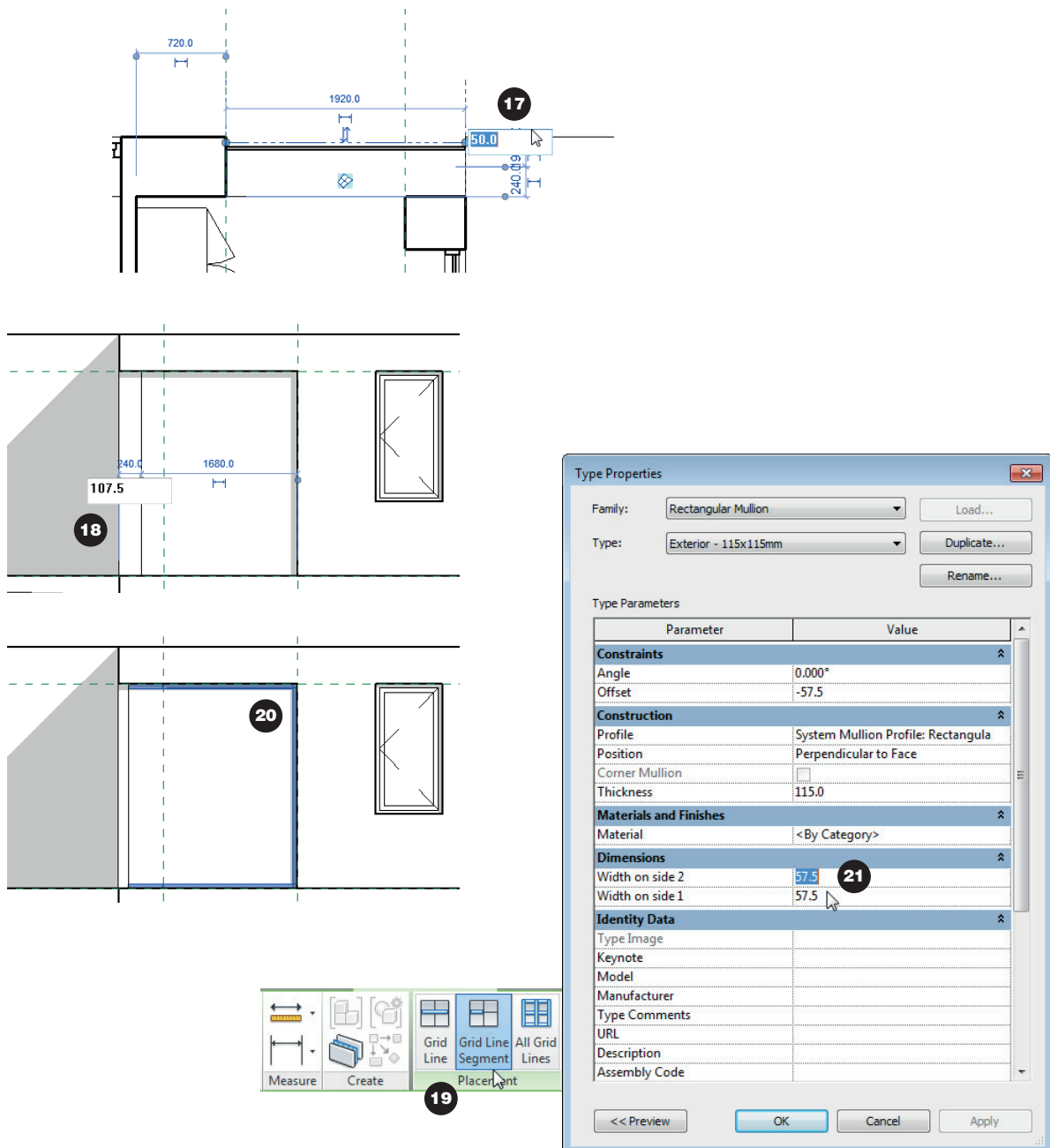
15 Select and **Copy** the Door 3960 to the left. Select the original Door again and start the **Copy** command. In **Options Bar**, tick **Multiple**. **Copy** from point to point as shown *twice*.

Go to **Elevation South**.
Select again the south-facing Wall. **Edit Profile**.

16 Draw an opening as shown. Remember to Constrain its edges to Ref Planes whenever possible.

Curtain Grid

Mullion



Internal Sliding Doors

Go to Level 1.

The Doors to rooms #1 and #8 need to be replaced with sliding Doors (see revised floor plan on page 1 of the *Reference Sheet*). Select the Doors and exchange their Type to M9 x 22 of the Family *Int. Sliding Door on Wall*.

Align and **Constrain** the edges of the Doors' openings to the adjacent Wall faces.

Glazing at entrance

17 Create an embedded **Curtain Wall** in the north facade at the entrance according to the revised plan on page 1 of the *Reference Sheet*. Set its rebate depth to 50 - but first, move the entrance Door away from the corner while setting up the Curtain Wall.

Go to Elevation North.

Align and Constrain the top of the Curtain Wall to the Ref Plane 'Top apertures'.

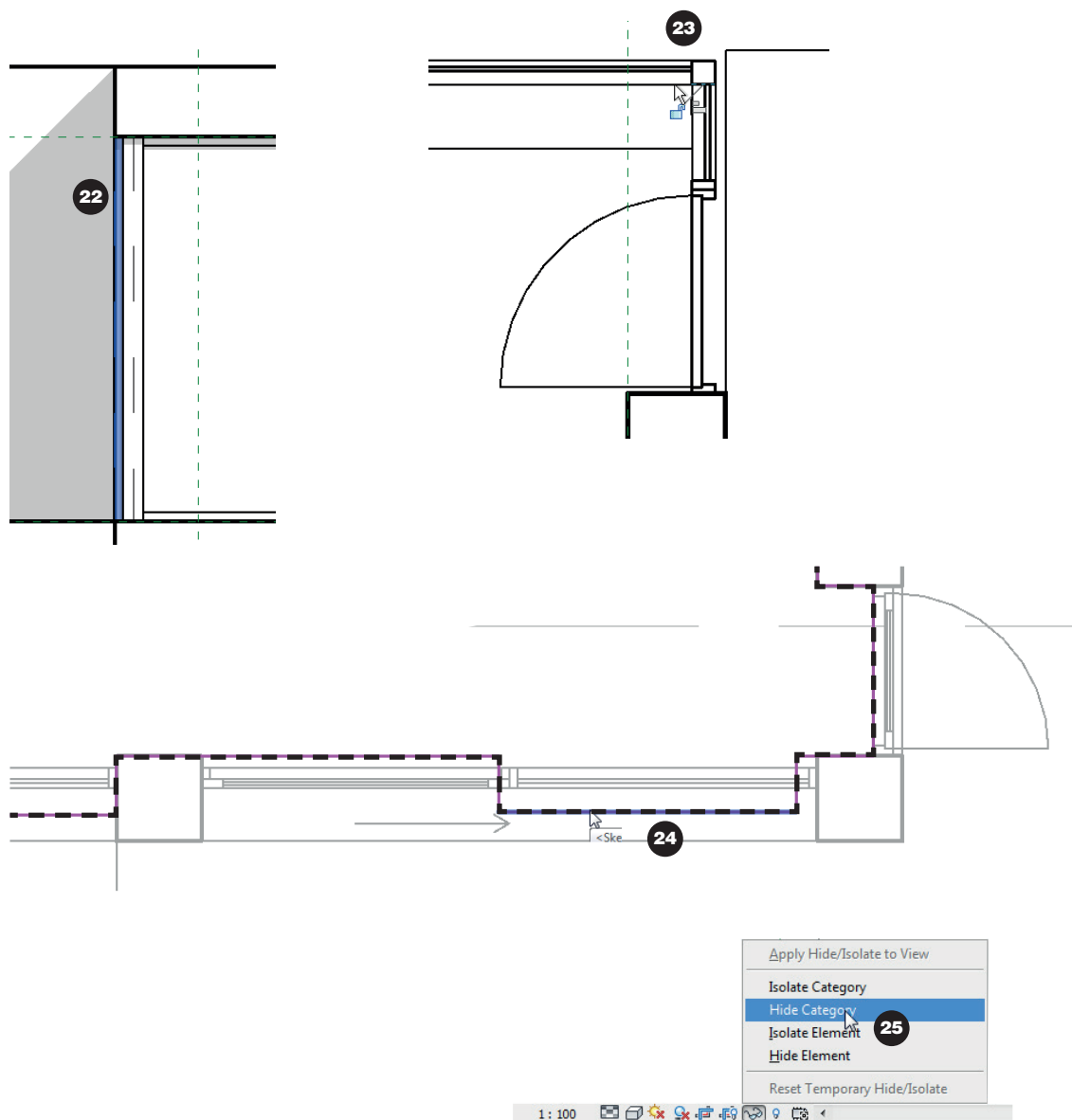
18 Create a vertical **Grid Line** in the Curtain Wall and locate it 107.5 from the Wall end.

Start the **Mullion** command and set Type to *Rectangular Mullion - Exterior 50x115mm*.

19 Set **Placement** to **Grid Line Segment**.

20 Click to place it in these three locations.

21 Set up another **Mullion** Type - *115 x 115mm* - and place it on the **Grid Line** you created before. Leave the remaining Grid Lines with no Mullions.



22 Select the narrow end **Pane** of the Curtain Wall (use the TAB key to pick it) and set its Type to *Empty*. Go to *Level 1*. Select the entrance Door and assign a new Type based on the current. Set the **Width** of the new Type to 1560.

23 **Align** and **Constrain** it to the Curtain Wall **Mullion** as shown.

Model review

Go to (3D) and check if all changes seem correct. In particular, check if Foundation

Walls and Building Pads need to be adjusted.

24 Also, check if Floor edges are in the right position. Adjust as necessary - use **Align** and **Constrain**.

Hide Furniture

Go to *Level 1*.

In the following sections, we will change partition Walls first and adjust fixtures and furniture afterwards. To get fixtures and furniture out of the way in *Level 1* while remodeling the partition Walls, we will **Hide** it.

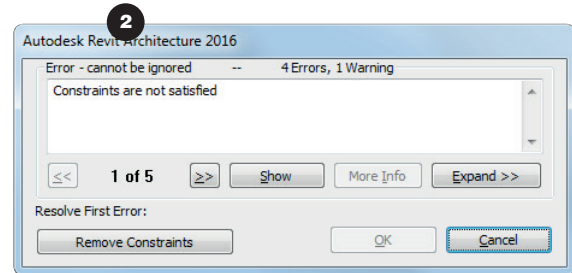
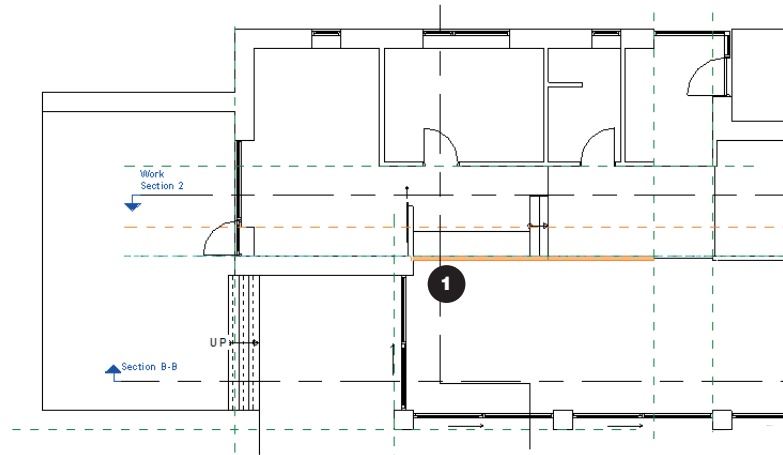
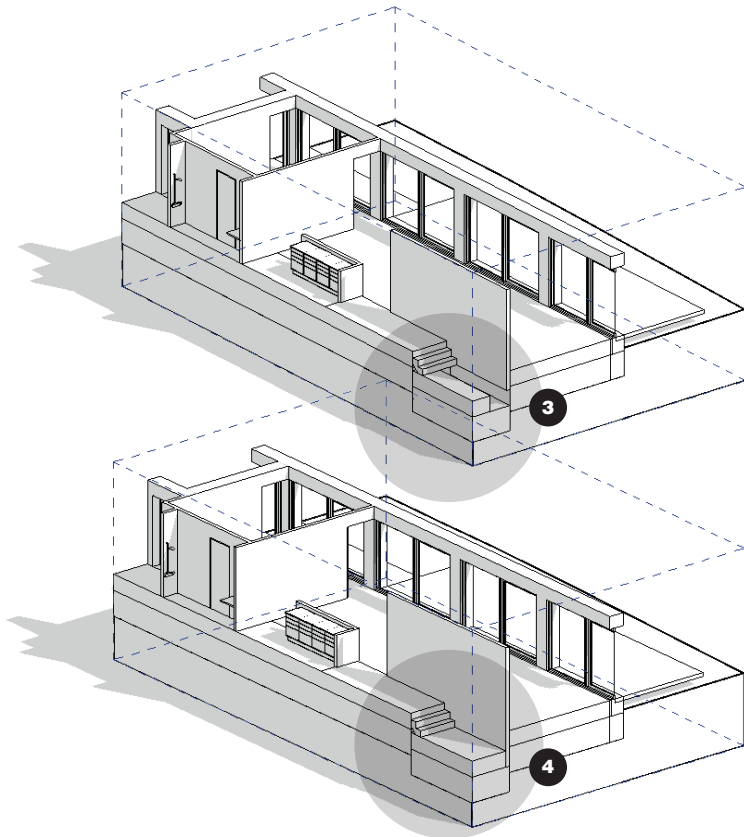
You can hide all fixtures and furniture in a View easily this way:

25 Select a piece of furniture. In the View Control Bar, click **Temporary Hide/Isolate > Hide Category**. Do the same for the Categories **Casework** and **Plumbing Fixtures**.

Temporary Hide

Make room for the stairs

To make room for the stairs to the upper storeys, a Wall need to be moved. This involves editing the step between Level 0 and 1.



PROCEDURE/ Making room for the stairs

Move Wall: Corridor

Go to *Level 1*.

1 Select the partition between the corridor and the living area. Align it to the Ref Plane.

2 You may get **Warnings** - read these. It is fine to **Unconstrain**. Some warnings may relate to the issues below (read further). See more about *Warnings* in chapter 1.

Review model

NB. Notice that we have moved the line where the levels in the house change. The edges of the Floors and the Building Pads below should move along

with the Wall - but they will do so **ONLY** if the edges were earlier Constrained to the Wall edge. If they have not moved, Move them manually now:

3 Go to *3D Section West End*, unhide the Section Box and adjust it to cut the model like shown. Hide fixtures and furniture temporarily if necessary. Check if the following have been moved along with the Wall:

- The Floor edge at Level 1.
- The Floor edge at Level 0.
- The Building Pad edges at both Levels.

If an edge has not moved,

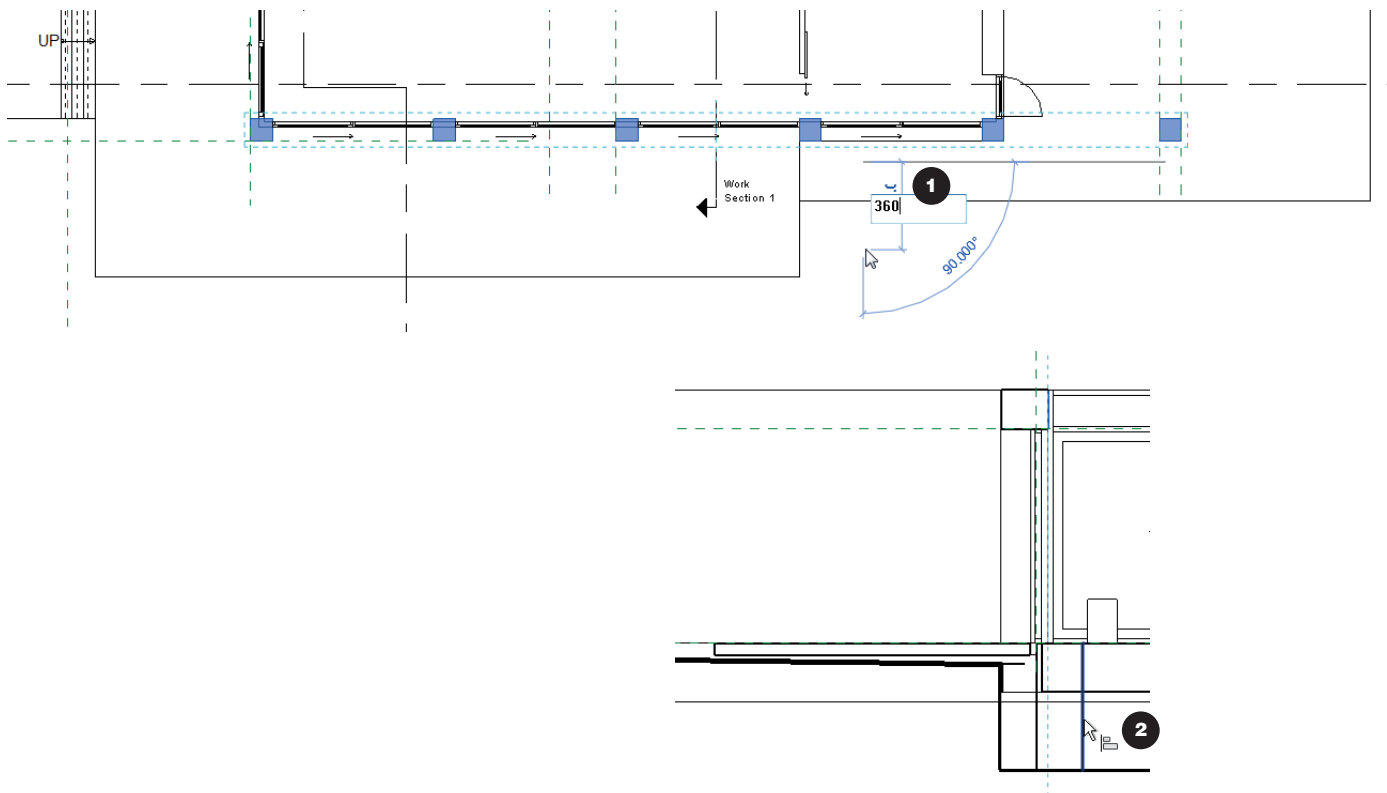
Select the element and **Edit Boundary**. While still in *3D Section View*, **Align** and **Constrain** the magenta edges to the proper Wall Face. **Finish Edit Mode**.

NB. Note that **Building Pads** are not allowed to overlap! So if edges of both Building Pads need to be moved, move first the edge of the upper Building Pad (below *Level 1*).

4 The Elements should intersect like this when adjusted correctly.

Resize the living/dining room

The living area was made smaller to give room for the stairs - now, to gain back some space for the living area, an external Wall is moved, changing the footprint of the building.



PROCEDURE/ Resizing the living/dining room

Move Wall: South Facade

Go to *Level 1*.

1 Select the external Wall and the adjacent Doors and **Move** them 360 mm vertically down.

Move also the outer edges of the terraces, so they are not narrower than before (ill.): Select the terrace > **Edit Boundary** > Select the edge and **Move**. **Finish Edit Mode**.

Review model

As before - and always - the model should be reviewed after changes: Have Floor edges, Building Pad edges, Foundation and Stairs edges moved along with the Wall? (ill.)

Like before:

Go to a *3D Section View* to check, correct if necessary, using **Align** and **Constrain**.

2 It is also a good idea to go to *WIP Section 1* to check if the Foundation has followed the Wall.

NB. Remember to **Edit Boundary** in order to move *only* the Floor Edges and *not* the whole Floor.

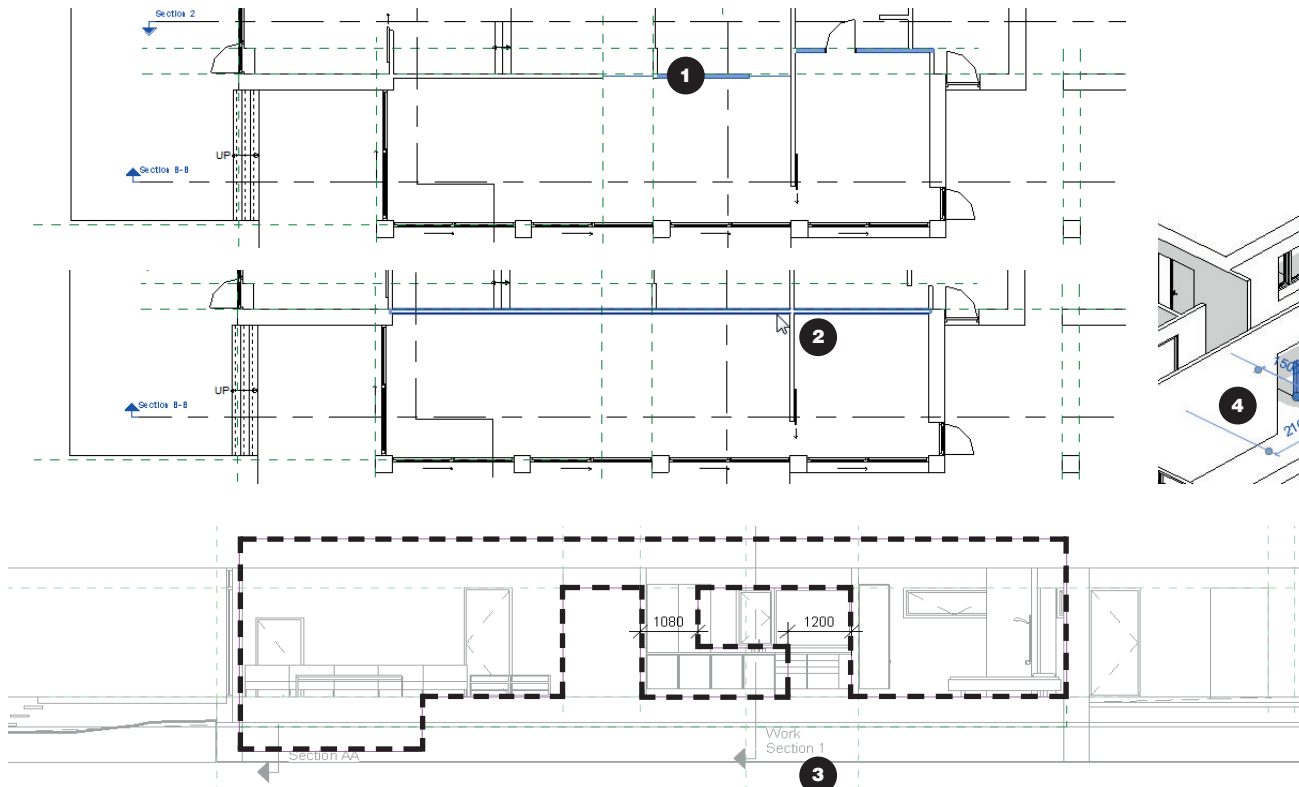
Divide the building

A core concept of the revised proposal is to divide the building in two slabs - one facing south and one facing north.

The division line is a wall in the middle, spanning the full length of the building. To achieve this, we will make the partition Wall between the stairs and the living area continuous through the whole interior of the house and pierce it to maintain connections

between the north and the south side of the house.

This and the following section is dealing with ways to control how to make Revit elements intersect in simple ways to avoid issues of over-constraining or element corruption, even in a layout of moderate three-dimensional complexity.



PROCEDURE/ Dividing the plan

Edit Wall Profile

1 First, Delete the two Walls and the two **Room Separation Lines** shown.

Ignore any Warnings about *multiple Rooms in the same enclosed area* and click **OK** - do not delete Rooms.

2 Next, *drag* the eastern end of the Wall to the end of the building.

Move and Flip *WIP Section 2* to face the Wall from the living/dining room. Go to *WIP Section 2*.

3 Select the Wall and **Edit Profile**. Now change the Wall Profile as shown.

Useful drawing tools are **Pick Lines**, **Line** (can be used with **Offset**), **Trim/Extend to Corner**, **Offset** or **Copy**, **Align** and **Constrain**. Wherever possible, remember to Constrain to Ref Planes rather than to other Walls.

Finish Edit Mode.

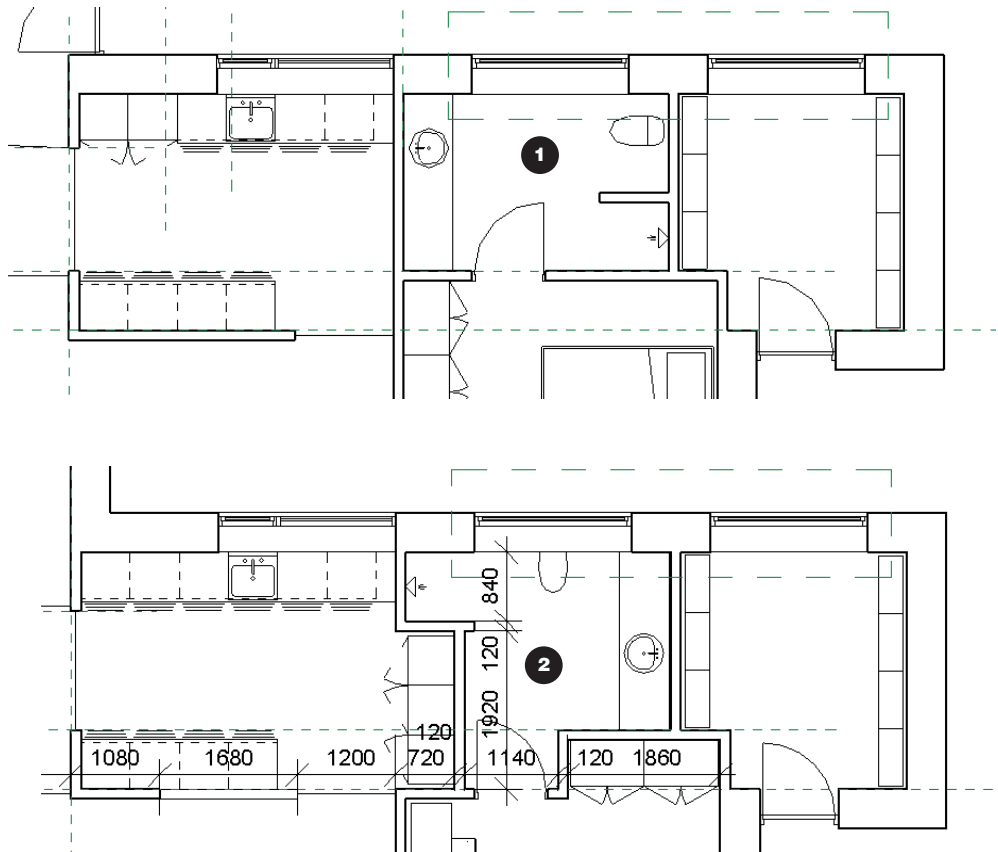
Review model

Go to *(3D)* to check the result. If Walls cross with no visible intersection lines, **Join** them.

4 Select the low Wall between the kitchen and the corridor. In Properties, change its **Top Constraint** to *Level 2*. If the Wall has disappeared, create a new.

Optimize the kitchen layout

To get more storage space in the kitchen, some Wall niches are introduced, and the bathroom rearranged.



PROCEDURE/ Optimizing the kitchen layout

Edit partitions

Go to *Level 1*.

1 Change from this...

2 ... to this (see also revised plans on page 1 of the *Reference Sheet*).

Use tools learned previously to **Delete**, **Split**, and **Move Walls**, and to create niches in the Walls for the tall cabinets.

Useful tools are: **Unconstrain**, **Extend/Trim to Corner**, **Delete**, **Align**, **Constrain**, **Wall Opening** or **Edit Profile**.

Review model

Go to (3D) to check the changes. If you have used **Wall Openings** to create niches for the tall cabinets, go to *WIP Section 2* to check the height of the

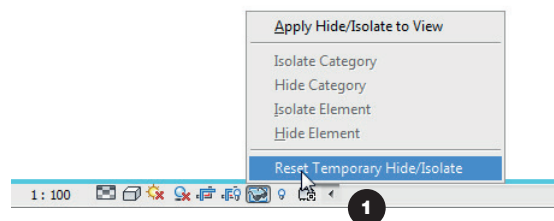
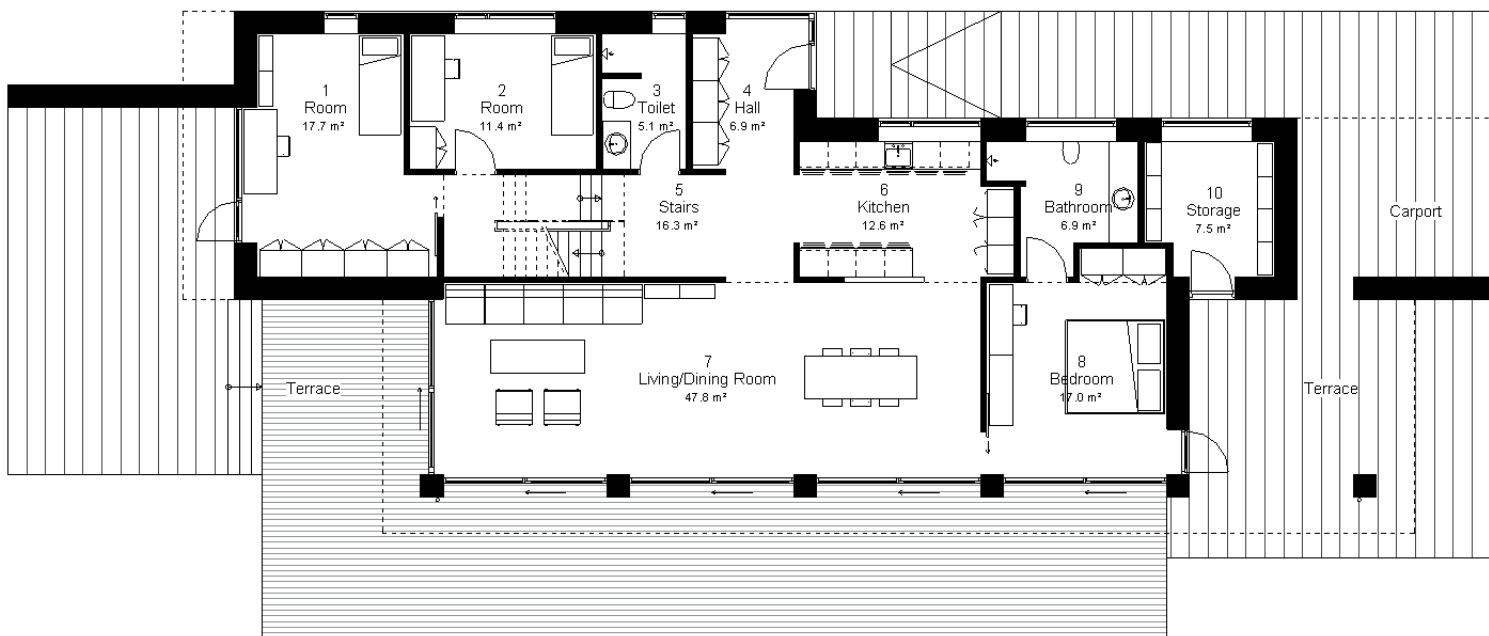
openings. Adjust the height of the Wall Openings according to the top of the cabinets.

Alternatively, you could **Align** and **Constrain** the top of the Openings to the Ref Plan 'Top apertures', and then Edit the Cabinet Type to fit the height of the Wall Opening.

Rearrange fixtures and furniture

To finalize the changes made so far, the furniture need to be rearranged to match the new layout.

Figure 5.2.1
Furnitures and Fixtures on Ground
Floor Plan of the revised proposal



PROCEDURE/ Rearranging fixtures and furniture

Rearrange

1 In View Level 1, **Reset Temporary Hide/Isolate** to view furniture and fixtures again. View fig. 5.2.1 for Components used and their approximate location. The wall-hung toilet can be loaded from the *DanEDU* folders. Distribute Components as shown.
Tools to use: **Move**, **Copy**,

Align, Mirror - Draw Axis, Load Family.

Notice that Components can be Flipped by selecting the Component and then press SPACEBAR.

When using the **Move** command, some Components can only be moved horizontally or vertically. To overrule this, press down SHIFT while Moving the Component.

Adjust heights

Remember to check in Section View if the top of the tall cabinets align with the top of the wall niches. If not, select a tall cabinet and Edit Type to change its height so it aligns to the top of the Wall Opening.

5.3/ ADDING UPPER STOREYS

At this stage, the upper storeys of the revised proposal are modeled. First, Levels are set up and Floors created, then Walls, Roofs, apertures, and Roofs.

By then, we will create the main stairs and have a closer look at Revit's Stair tools.

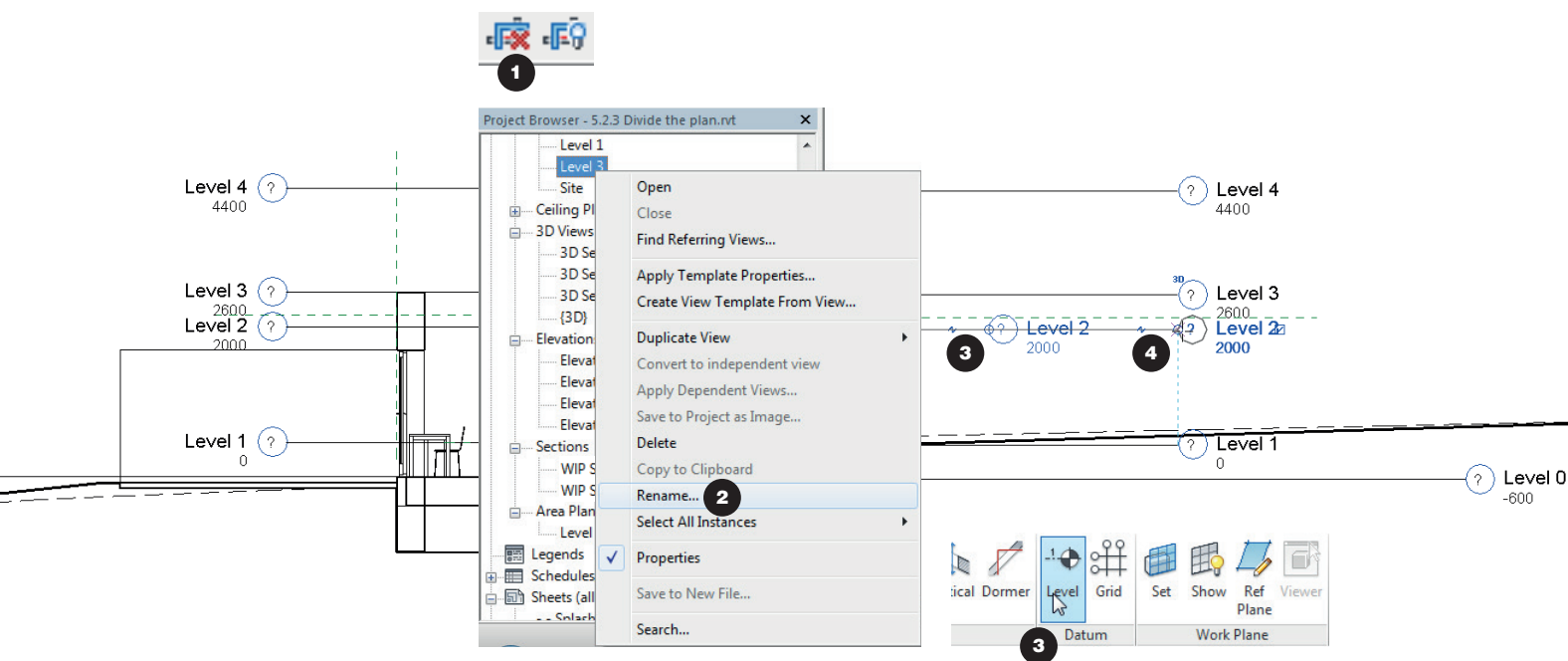
Floors

The first step towards adding the upper storeys is creating the **Floors**. To do this, we will first set up more **Levels** - one for each of the new Floor levels, and one for the upper Roof.

Each new level created will automatically generate an associated Plan View. To avoid getting the Project Browser cluttered

with Plan Views - and because in many projects, Levels is a main organising concept - it is good practice to create no more Revit **Levels** than one for each Floor level in the project.

Like on the ground floor level, we will locate the boundaries of the Floors aligned to the inner face of the external Walls.



PROCEDURE/ Creating Floors

Set up Levels

Go to *Level 1* and move *WIP Section 2* to cut through the internal Stair.
Go to *WIP Section 2*.

1 In the **View Control Bar**, adjust **Crop Settings** so the View is not cropped.
Select *Level 2* and set **Elevation** to *2600* if not already done.

2 In the Project Browser, Rename *Level 2* to *Level 3* by Right-clicking (rename corresponding views: **Yes**).

3 In the Tab **Architecture**, start the command **Level** and draw to create a new **Level** at its approximate elevation. Adjust elevation to *2000*. Name it *Level 2*.
Create *Level 4* at elevation *4400*.

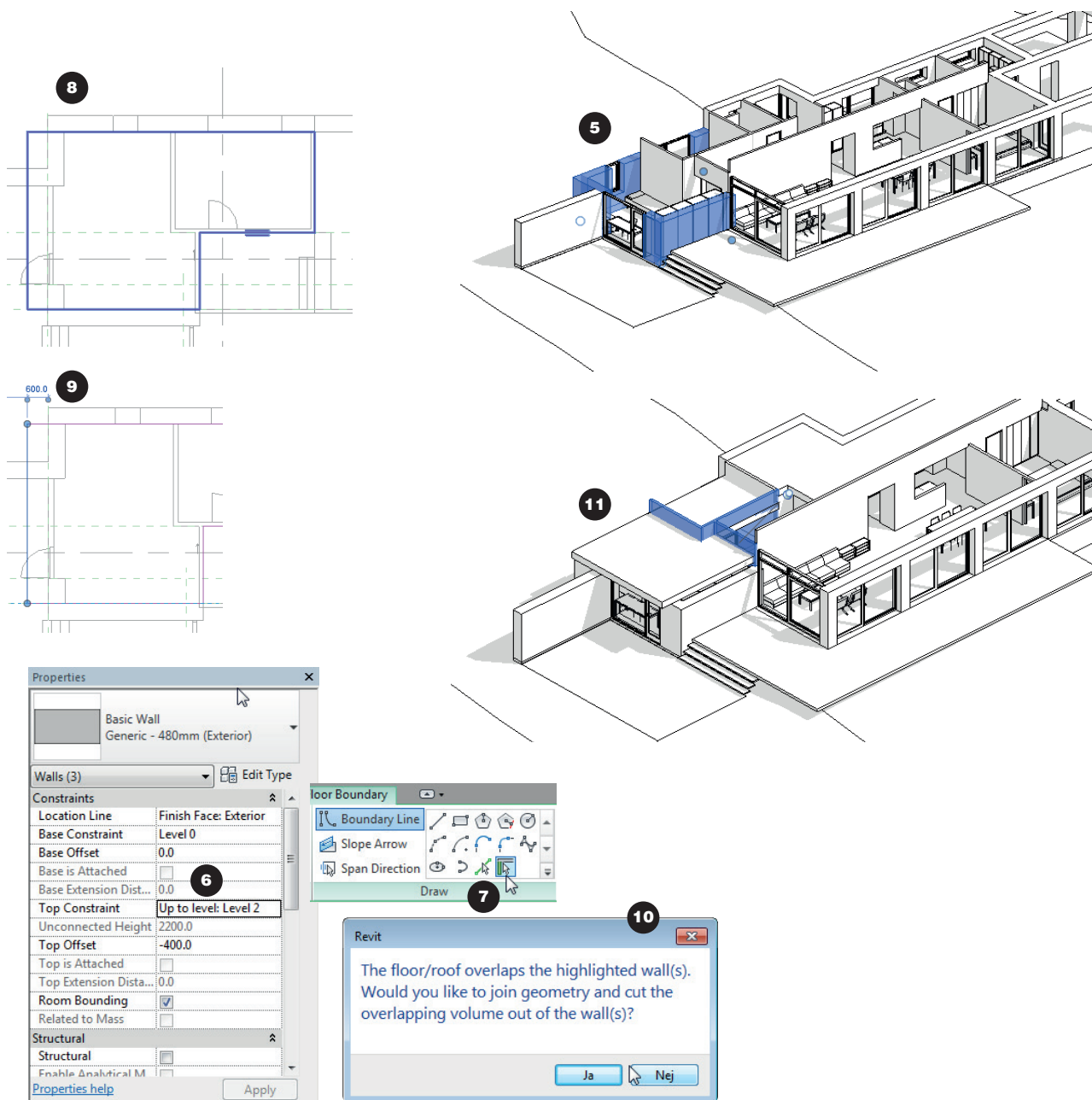
4 Tidy up the Level symbols in the Section View: Select a Level Tag (the large circle) and **Drag** it by the tiny circle to be aligned to one or other Level Tags.

Levels are 3D Model elements, and once Tags are aligned, they will line up in all parallel Views.

Go to *WIP Section 1* and do the same.

Pin all Levels!

Level



Pick Wall

Adjust external Walls

5 Go to (3D). Select the external Walls of *Level 0* (the parterre storey).

6 In Properties, set **Top Constraint** to *Level 2* and **Top Offset** to *-400*.

Adjust View Settings

Go to *Level 2*. In **Properties** set the **Underlay** to *Level 0*. Notice that all furniture at *Level 0* is gray. This indicates that it is only visible in this View, because it belongs to a Level used as **Underlay**. To avoid confusion, Temporary Hide fixtures and furniture as before.

Create mezzanine Floor

Start the command **Floors** and pick the Type *Generic - 300mm*. In Properties, set **Offset** to *0*.

7 Use the drawing tool **Pick Wall**. Use the **Flip Controls** (the blue double arrows) to control on which edge of the Wall to locate the Floor edge. When the **Pick Wall** tool is used, edges are constrained to the Wall even though no padlock symbols have been shown.

8 Draw as shown.

9 Adjust the position of the western edge of the Floor like this.

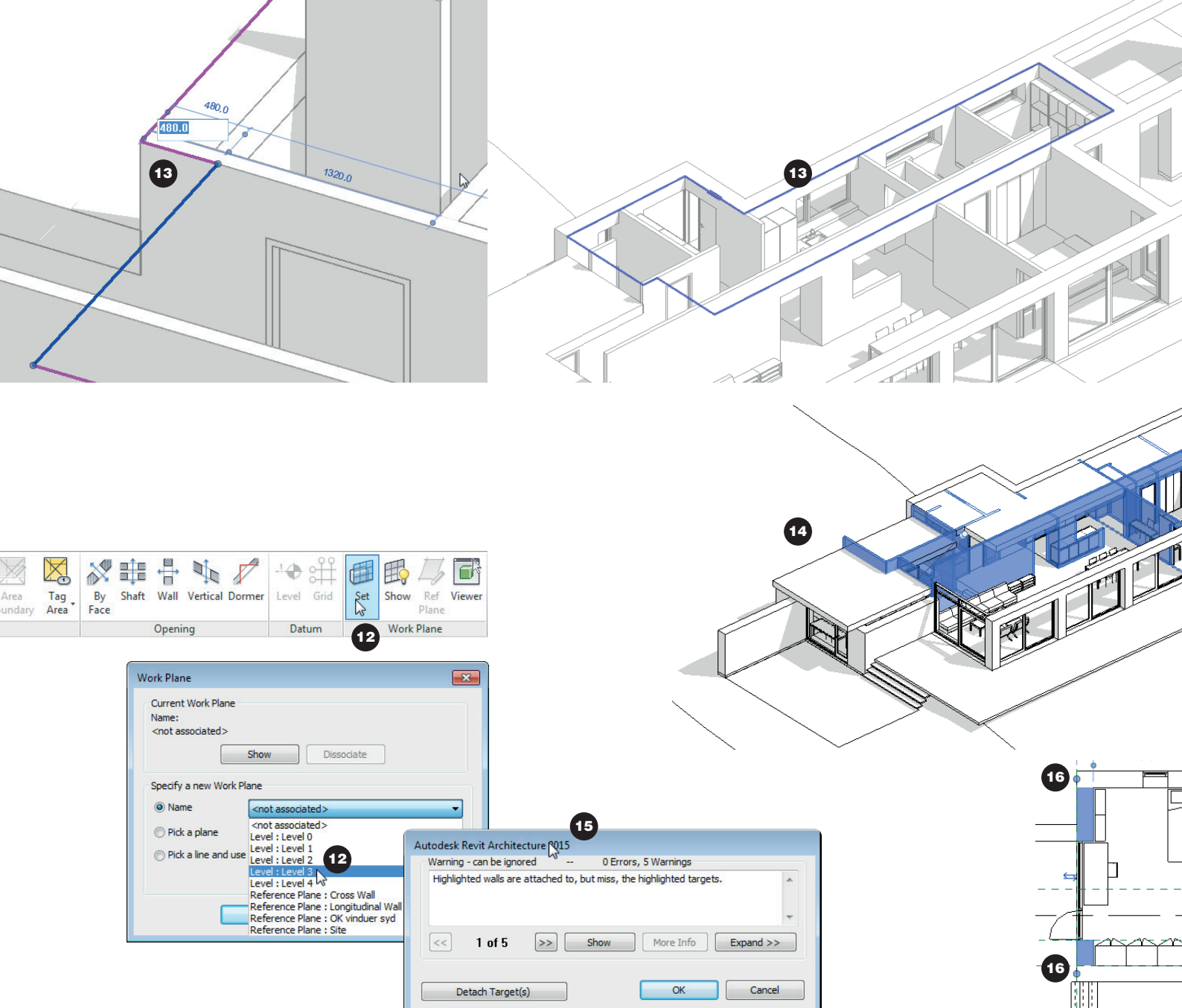
Trim/Extend to Corner to form a closed loop.

Finish Edit Mode.

10 Response **No** to any queries about Joining or Attaching Walls to the Floor - we will do this manually now to control of how Walls attach to the new Floor.

Review Model

11 Go to (3D) and navigate to see the intersection between Floor and Walls. Select the Walls shown and **Attach** to the new Floor.



Create upper Floor

The upper Floor slab will also serve as ceiling above the kitchen and the bathroom. Stay in (3D).

12 Set Work Plane to Level 3.

13 Create Floor (like before, now in (3D)).

Other Warnings may pop up. Leave Wall/Floor joining to do manually afterwards.

Review model

Still in (3D), select all the Walls coming up through the new Floor and Attach Top to Floor.

14 Tip: Right-click one Wall > Select all Instances of the Same Type > Attach all at once.

15 This Warning may appear. Pick Detach Target(s).

Go to Level 1.

Select the west-facing external Wall to control how the Wall joins the other external Walls at the corners.

16 We want it to join like this at the corners. If they do not, use the command Wall Joins to adjust as needed.

Go to (3D).

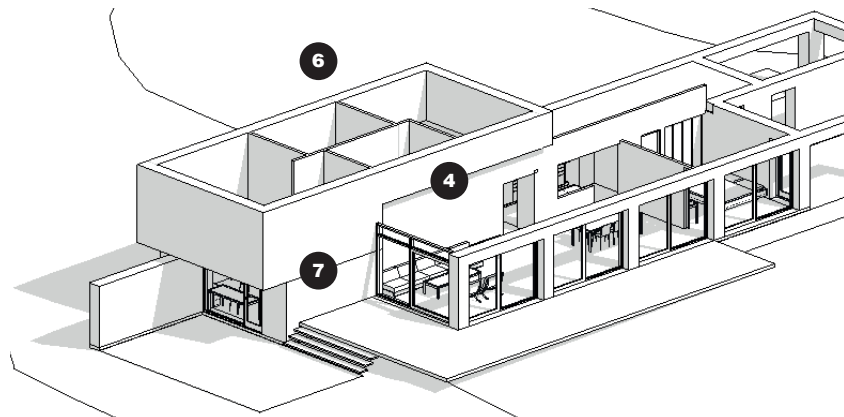
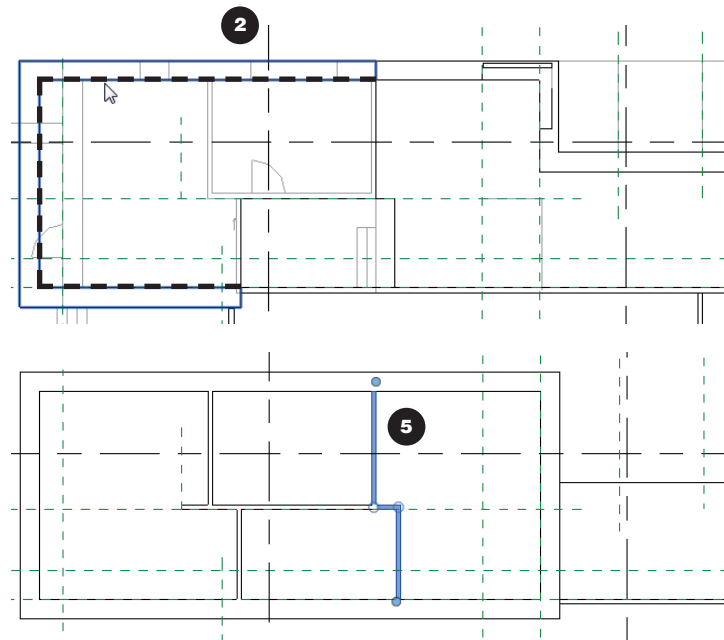
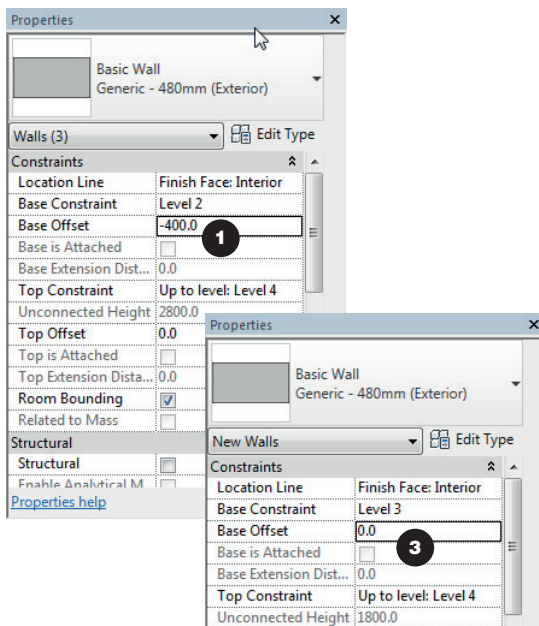
Select the west-facing Wall at Level 0 and Attach the Top/Base to the Floor above.

Set Work Plane

Wall Joins

Walls

Next step is creating the Walls - first the external, then the partitions.
The external Walls will be located to envelope the new Floors created, whereas the partitions will be positioned to rest upon the Floors.



PROCEDURE/ Creating Walls

Join

Create external Walls

Go to *Level 2*.
Start the Wall command.
Set Type to *Generic - 480 (Exterior)*.
In the **Options Bar**, set **Top Constraint** to *Level 4* and **Location Line** to *Finish Face Interior*.

1 In Properties, set **Base Offset** to *-400*.

2 Create Walls as shown - remember to draw clockwise.

Go to *Level 3*.
Set **Underlay** to *None* if convenient.
Start the Wall command.
Set Type to *Generic - 480 (Exterior)*.
In the **Options Bar**, set **Height** to *Level 4* and **Location Line** to *Finish Face Interior*.

3 In Properties, set **Base Offset** to *0*.

Create the remaining external Walls as shown.

4 Set the **Base Offset** of the south-facing external Wall to *600*, and add *600* to the height of the inner wall using **Edit Wall Profile**.

Create partitions

Go to *Level 2*.
Start Wall command, set Type to *Generic - 120mm (Interior)*.
In the **Options Bar**, set **Height** to *Level 4* and **Location Line** to *Finish Face Interior*.
Create Walls as shown on the revised plans on page 1 of the *Reference Sheet*. Some Walls can be drawn in the correct location immediately, some can better be drawn at an approximate location and moved in place afterwards, using **Temporary Dimensions**.

5 Select the three walls and set **Base Constraint** to *Level 3* and **Height** to *Level 4*

Model review

Go to (3D) and check the model.

6 The model should look like this, with no Walls overlapping and the Base of all partitions aligned to the surface of the Floor below it.

7 To remove any intersection lines between flush Wall faces, use the **Join** tool to Join Walls.

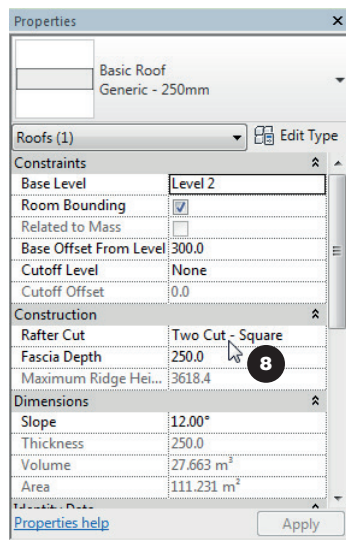
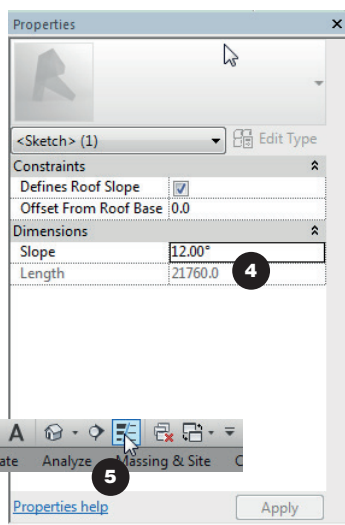
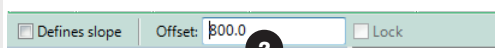
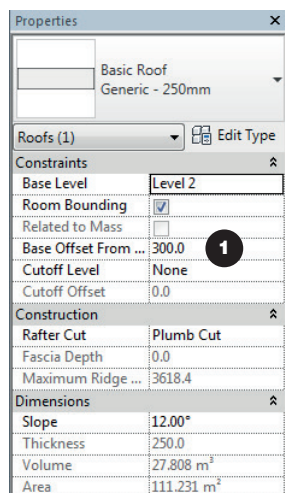
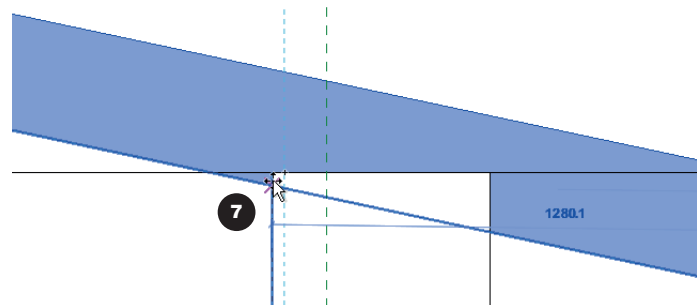
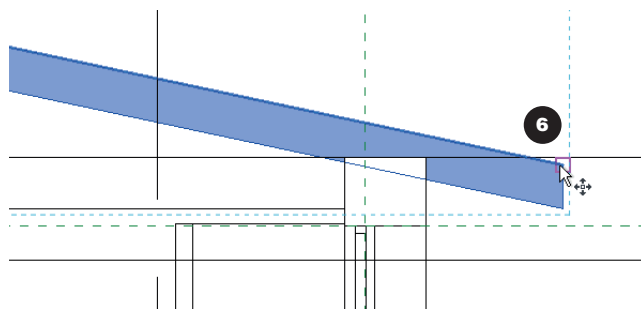
Rooms

Go to *Level 2* and create the **Rooms** located here. Do the same on *Level 3*.

Roofs

Finally, the Roofs are created to finish the primary elements of the building.

The southern roof need its full thickness only above the interior rooms (to allow for the thickness of the insulation), not in the overhang. To allow for alternating thicknesses, we create this roof as two stacked Roofs.



PROCEDURE/ Creating Roofs

Create Roof with eaves

Go to *Level 2*.

In the Tab **Architecture**, start the command **Roof by Footprint**.

Set up a new generic **Basic Roof** Type with Thickness **250**.

1 Set **Base Offset From Level** to **300**.

2 In the Options Bar, set **Offset** to **800** for eaves.

3 Draw as shown (no offset on north side).

4 To make the Roof mono-pitched, set only the southern edge to **Define Slope** and set **Slope** to **12.00°**.

Finish Edit Mode.

Go to *WIP Section 1*.

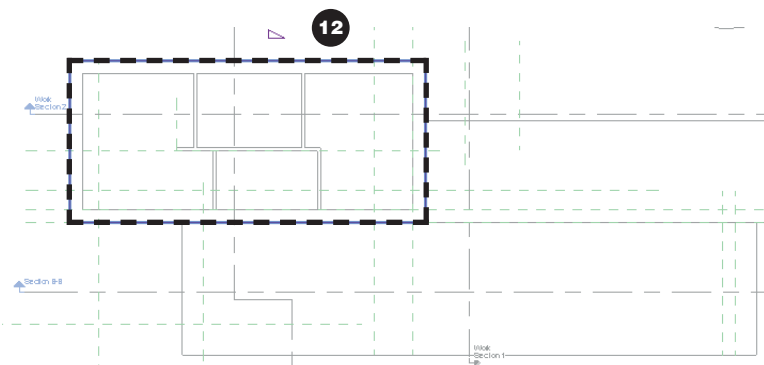
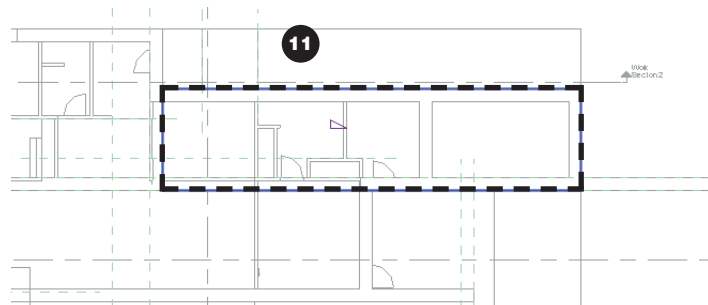
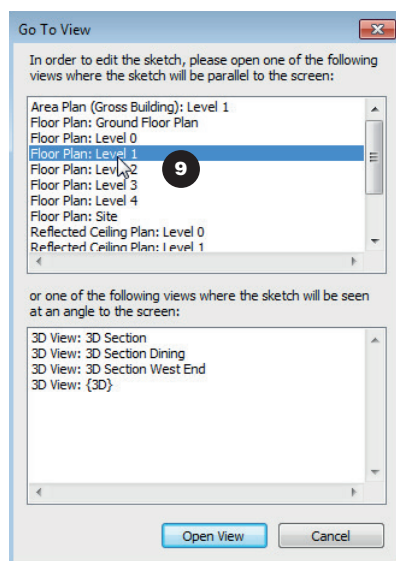
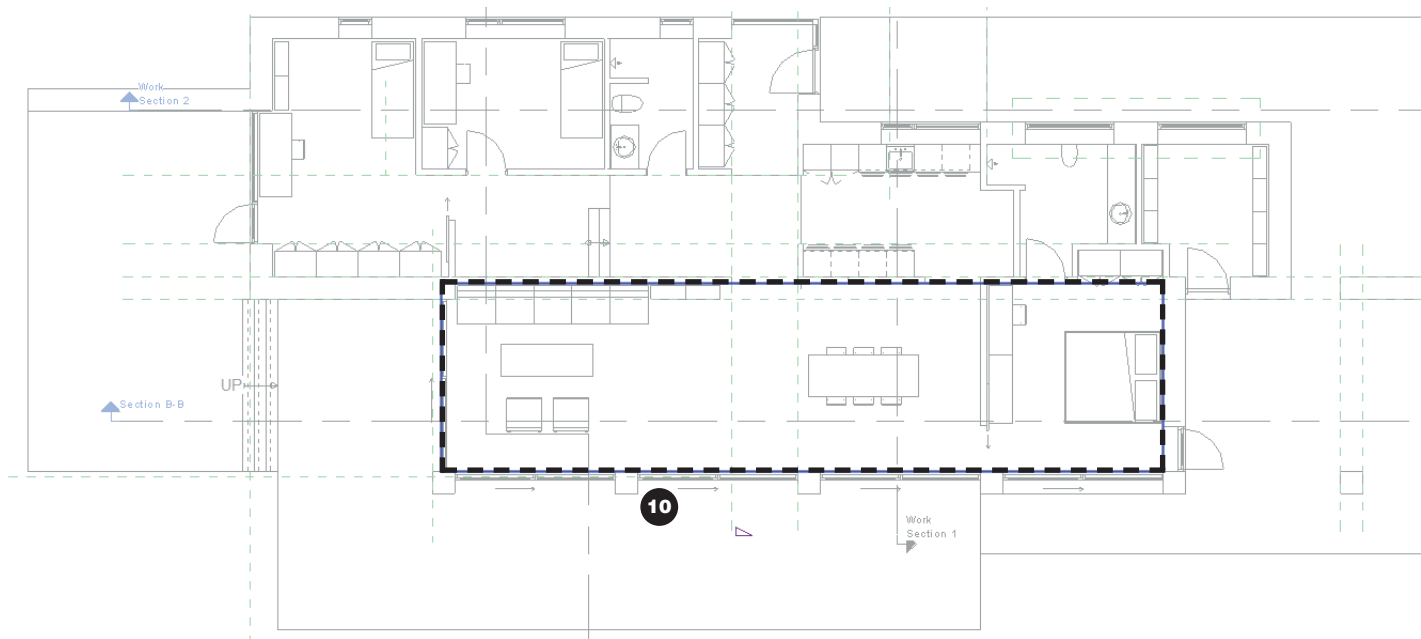
5 In the Quick Access Toolbar, activate **Thin Lines Mode** for better orientation.

6 **Copy** the new Roof from *this* Endpoint

7 to *this* Intersection.

8 Select the upper Roof and set **Rafter Cut** to **Two Cut - Square** and **Fascia Depth** to **250**.

Thin Lines



Double-click on the lower Roof to **Edit Boundary**.

9 Revit will ask you to pick a View - set to **Level 1**.

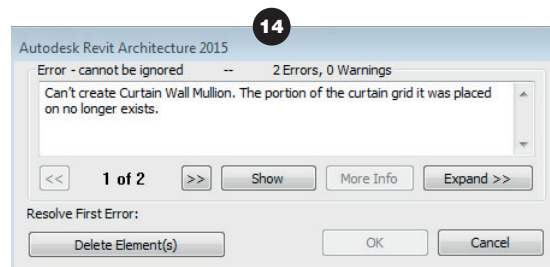
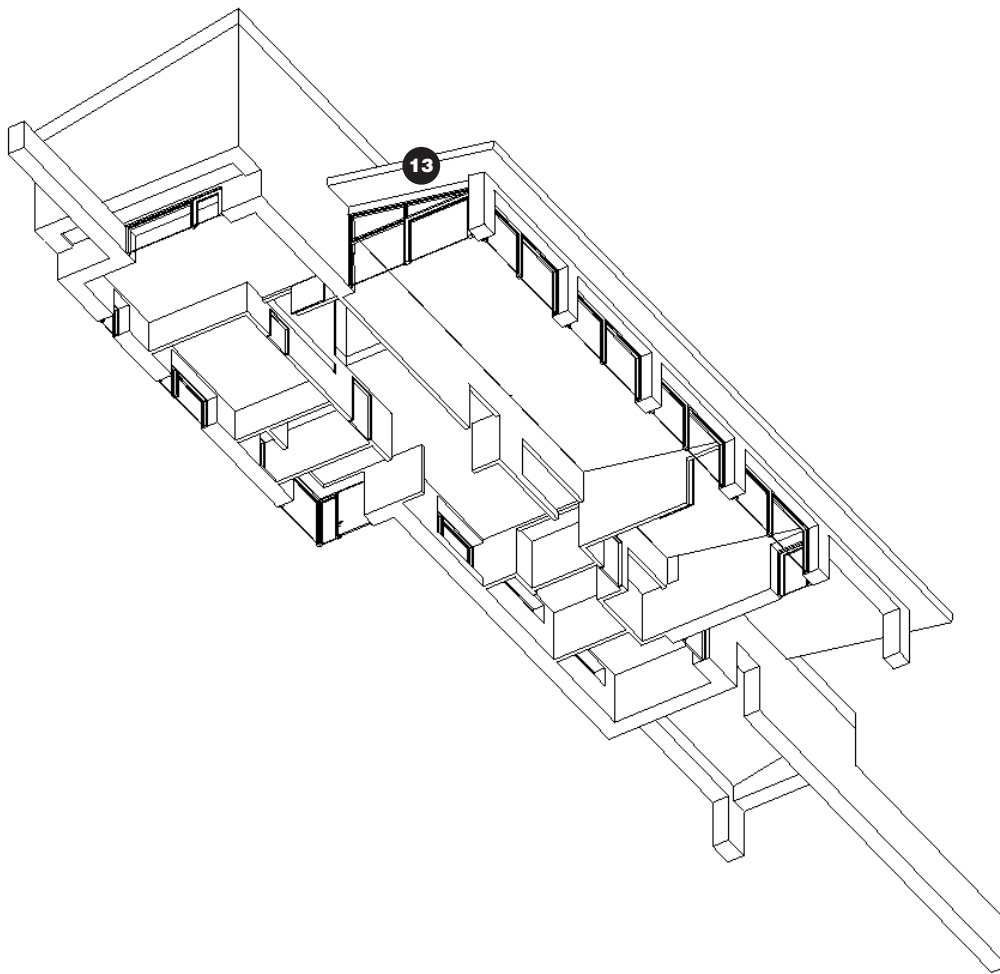
10 Align and Constrain the Roofs Boundaries to the edges of the living/dining room. Except to the west - here, Align and Constrain to the external face of the Curtain Wall.

Create Roofs without eaves
Go to **Level 3**.

Set **Underlay** to **Level 1**.
Create **Roof by Footprint**.
Pick **Basic Roof Generic - 500mm**.
Set **Base Offset from Level** to **0**.

11 Draw a Roof over the kitchen and the bathroom. Create edges aligned to external faces of Walls. Set only northern edge to **Define Slope**, and set **Slope** to **12.00°**. **Finish Edit Mode**.

12 Go to **Level 4** and create a similar Roof using the same settings.



Finalize connections

Set up a new *WIP 3D Section View* for inspecting the model from below.

Set the **Section Box** to cut away the Floor at *Level 1*. It may be an advantage to switch off **Shadows**.

Attach Walls to Roofs wherever necessary.

13 The Curtain Wall west of the living area should be Attached to the lower Roof immediately above it.

14 When Attaching, an Error may warn you that a the top Mullion of the Curtain Wall has to be deleted in the process. Accept this and create a new

Mullion at the top.

Where no intersection lines between intersecting elements are visible, **Join** the elements.

In the process, it can be necessary to adjust the Views **Section Box** to get a close enough view in different locations of the model.

Apertures

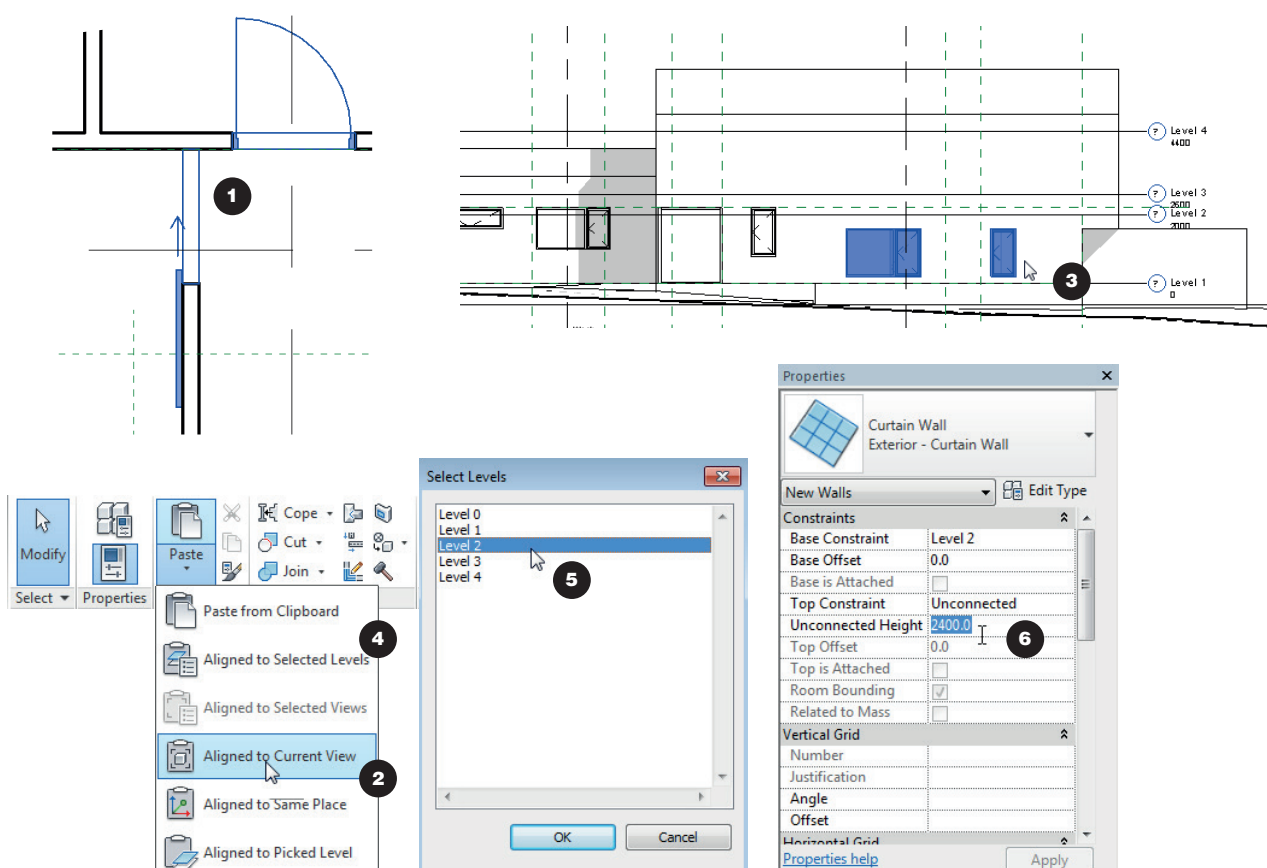
Some aperture elements to be inserted on the upper Levels are identical to the ones on the lower Levels, and should be positioned exactly above.

It is easy to copy and paste Elements from one Level to the same position on another, using the **Paste Aligned to Selected Levels** or **Paste Aligned to Picked Level** tools.

Other aperture elements must be modeled from scratch.

For corner Windows, common Window Families can not be used. Predefined Corner Window Families may exist, but are not available in the BIMbogen template.

Instead of spending time setting up a new Family at this stage in the project, we will make use of the freedom of design when working with Curtain Walls.



PROCEDURE/ Placing apertures

Copy to clipboard

Paste Aligned to Current View

Paste Aligned to Selected Levels

Copy and Paste Doors

Go to Level 0.

1 Select Doors to be placed in identical positions on Level 2 (mezzanine level). Hold down CTRL while pressing C (CTRL+C) to **Copy** them to the computers clipboard. Go to Level 2.

2 Insert the copied Doors in the right position immediately this way:
Tab **Modify** > **Paste** (from clip-

board) > **Aligned to Current View**.

Copy and Paste Windows

Go to Elevation 3.

3 Select Windows on Level 0 to be placed in identical positions on Level 2. Hold down CTRL while pressing C to **Copy** them to the computers clipboard.

4 Insert the copied Windows on the right level in the right

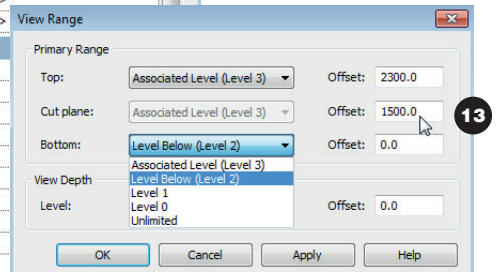
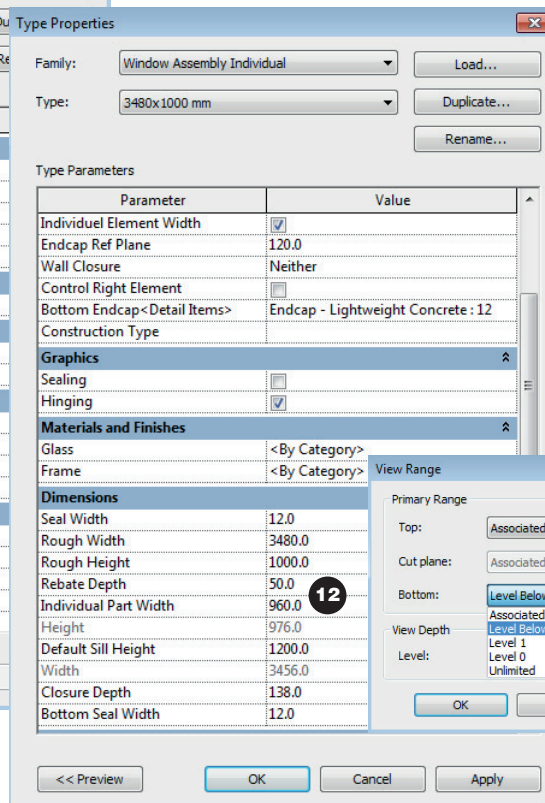
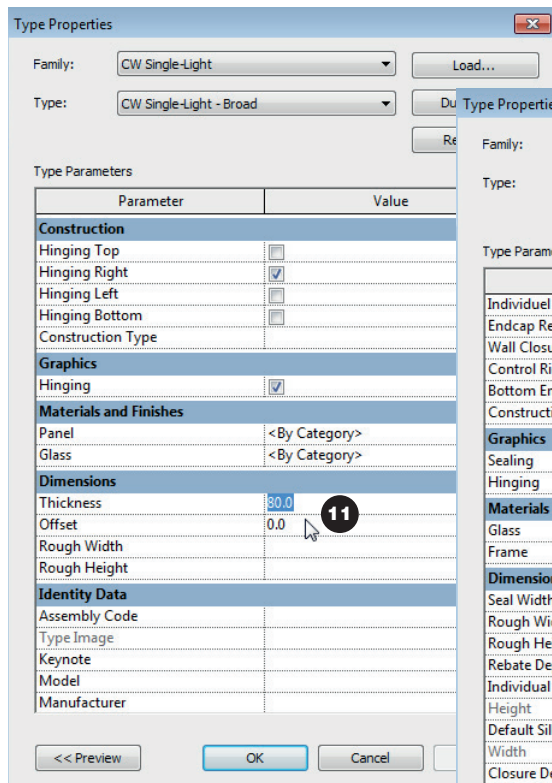
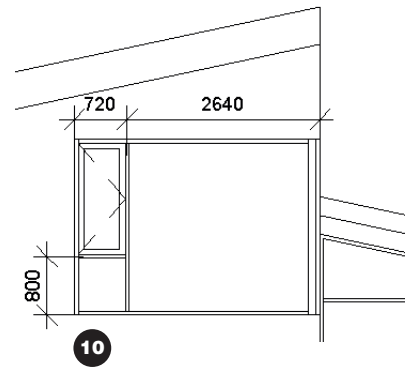
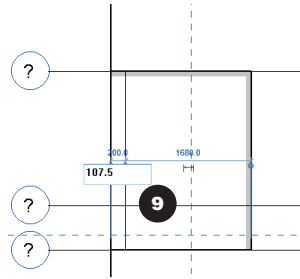
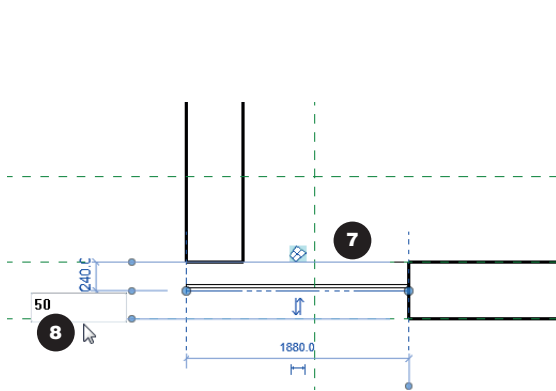
position immediately this way:
Tab **Modify** > **Paste** (from clipboard) > **Aligned to Selected Levels**.

5 Select Level 2.

Create corner glazing

Go to Level 2.
Start creating an embedded **Curtain Wall**.

6 Set it to have **Unconnected Height** of 2400.



7 Draw first a part embedded in the southern external Wall, clockwise all the way to the Wall corner.

8 Set rebate depth to 50.

9 Set up this Curtain Wall with **Mullions**, an **Empty** Pane and a square Mullion towards the Wall corner, exactly like when you created the glazing at the entrance.

Go to **Level 2** again and create another Curtain Wall according

to the revised plans on page 1 of the *Reference Sheet*.

10 Go to *Elevation 2* and create **Curtain Wall Grid** and **Mullions** as shown. For the hinged frame, Select the **Curtain Wall Pane** (use the TAB key) and change its Family to *CW Single-Light*.

11 Set up a new Type, name it *CW Single Light - Broad* and change its **Thickness** to 80.

Remaining apertures

Insert and adjust the remaining Doors and Windows according to the revised plans and elevations in the *Reference Sheet*.

12 These are the Properties of the two Windows at **Level 3** in the south facade.

13 If some Windows are not visible in the View **Level 3**, click **View Range** in View Properties and adjust as shown.

5.4/ STAIRS AND RAILINGS

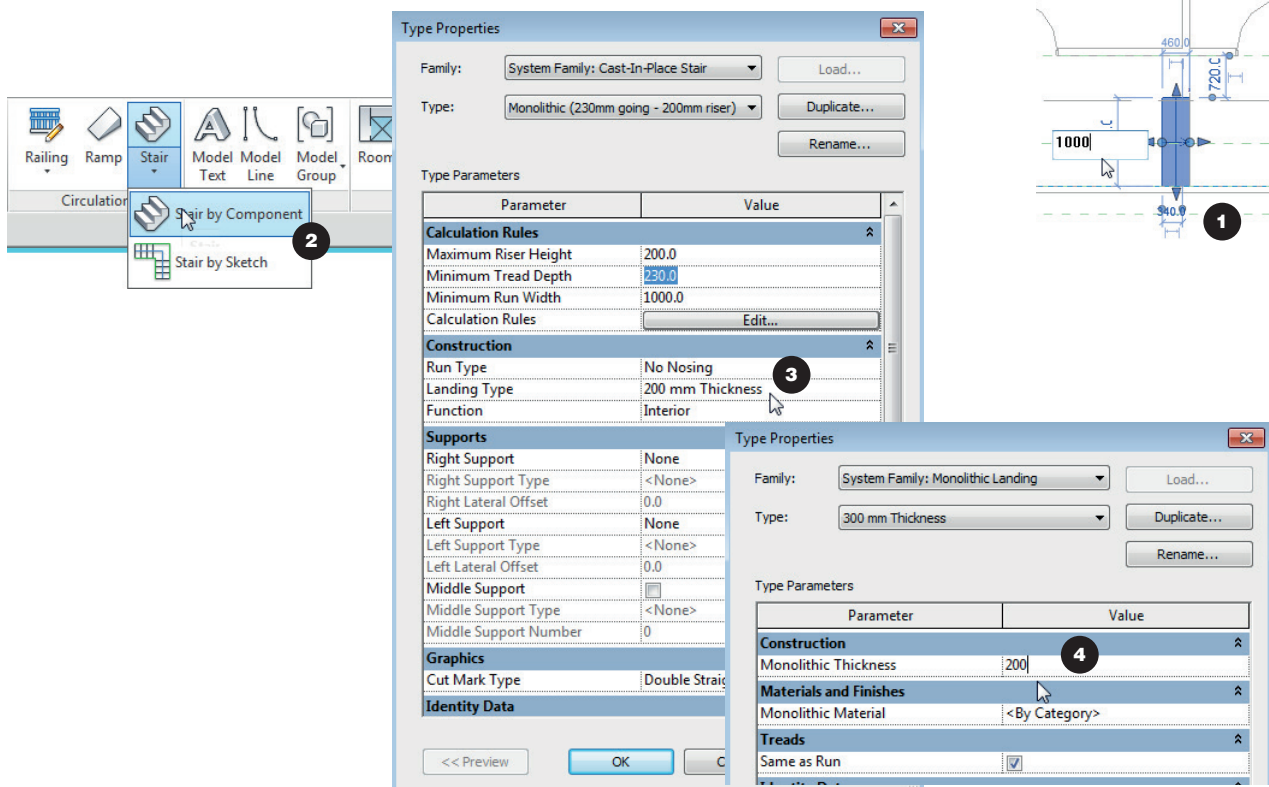
In Revit, **Stairs** and **Railings** can be created with a high degree of automation. Like it is the case with many other features in Revit, to gain the full benefit of automation, freedom of design is somewhat restricted. Revit operates with two Stair tools:

Stair by Component and **Stair by Sketch**. Stair by Component is the fastest and easiest for common stairs. This tool creates Stairs consisting of Runs, Landings and Supports.

Stair by Sketch is best for custom made and special stairs. This tool converts a 2D sketch to 3D stairs.

Stairs created by Component can be converted to Stair by Sketch - not the opposite.

Railings in particular is a heavily parametric Category, of which it can be hard to control the design visually without some practice. In Chapter 4.4, a short introduction to Stairs were made. Here, different Families and Sub Components are described.



PROCEDURE/ Creating the main stairs

Stair by Component

File: Revit Case Study 5.4 p74

Preparations

Go to **Level 1**.
Move **WIP Section 2** to cut the internal Stair. Orientate it to view towards the south.
Double-click on the internal Stairs to **Edit** it.

1 Now inside the Stairs, Select the **Run**. Adjust its width to **1000**, make sure its northern end is still Aligned to the Wall. **Finish Edit Mode**.

Set up Stair Type

2 From the **Architecture** Tab, Start the **Stair by Component** command.

3 In **Type Selector**, Duplicate a Type from the **Cast-In-Place** Family and set up as shown.

Notice, when clicking to adjust the **Landing** Type, the Type Properties of the **Landing** opens.

4 Here, set up a new Landing Type with **Thickness 200** and click **OK** to get one level up, back to the **Stair Type**.

5 In the **Options Bar**, set **Location Line** to **Run: Left** and **Run Width** to **1000**. Tick **Automatic Landing**.

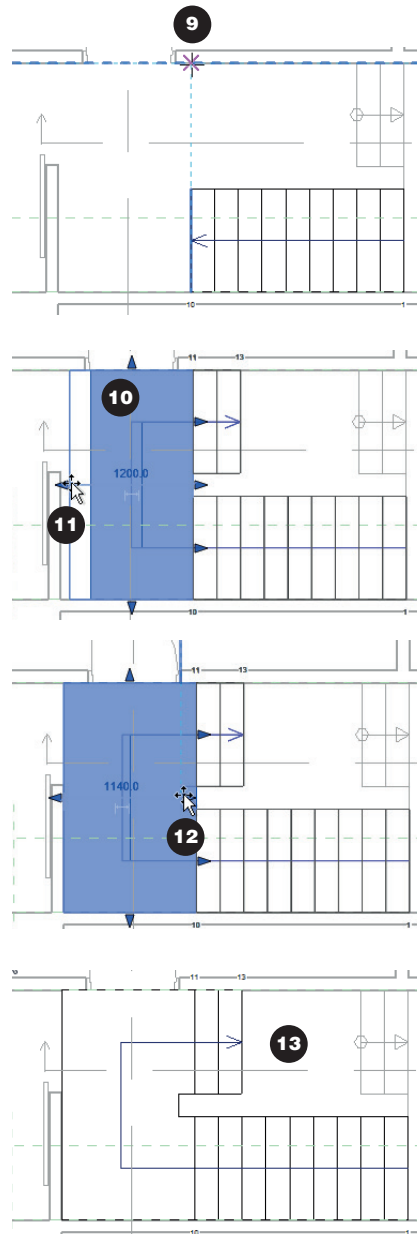
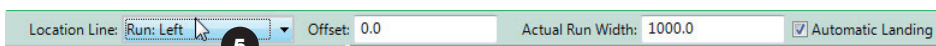
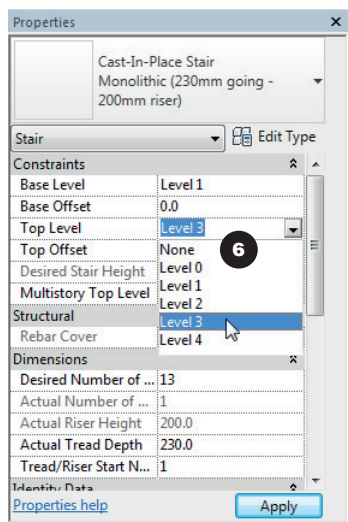
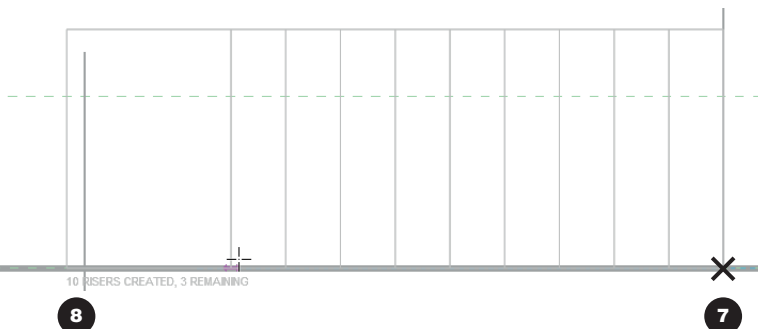
6 Notice in the **Properties**, the Stairs are set to span from **Level 1** to **Level 2**. Change **Top Level** to **Level 3**.

Main stairs

We will create the main stairs consisting of two Runs and two Landings.

Both Runs will be created using **Stair by Component**.

For the Landings, one will be created automatically and the other will be drawn by sketch.



Create Stairs

7 Click here to start drawing the **Run**.

8 Notice that the number of steps created and remaining is seen while drawing. Click to finish drawing the first **Run** at 10 steps.

9 Click here to start drawing the second **Run**. Click to finish the second Run at 0 remaining.

Modify and create Landings

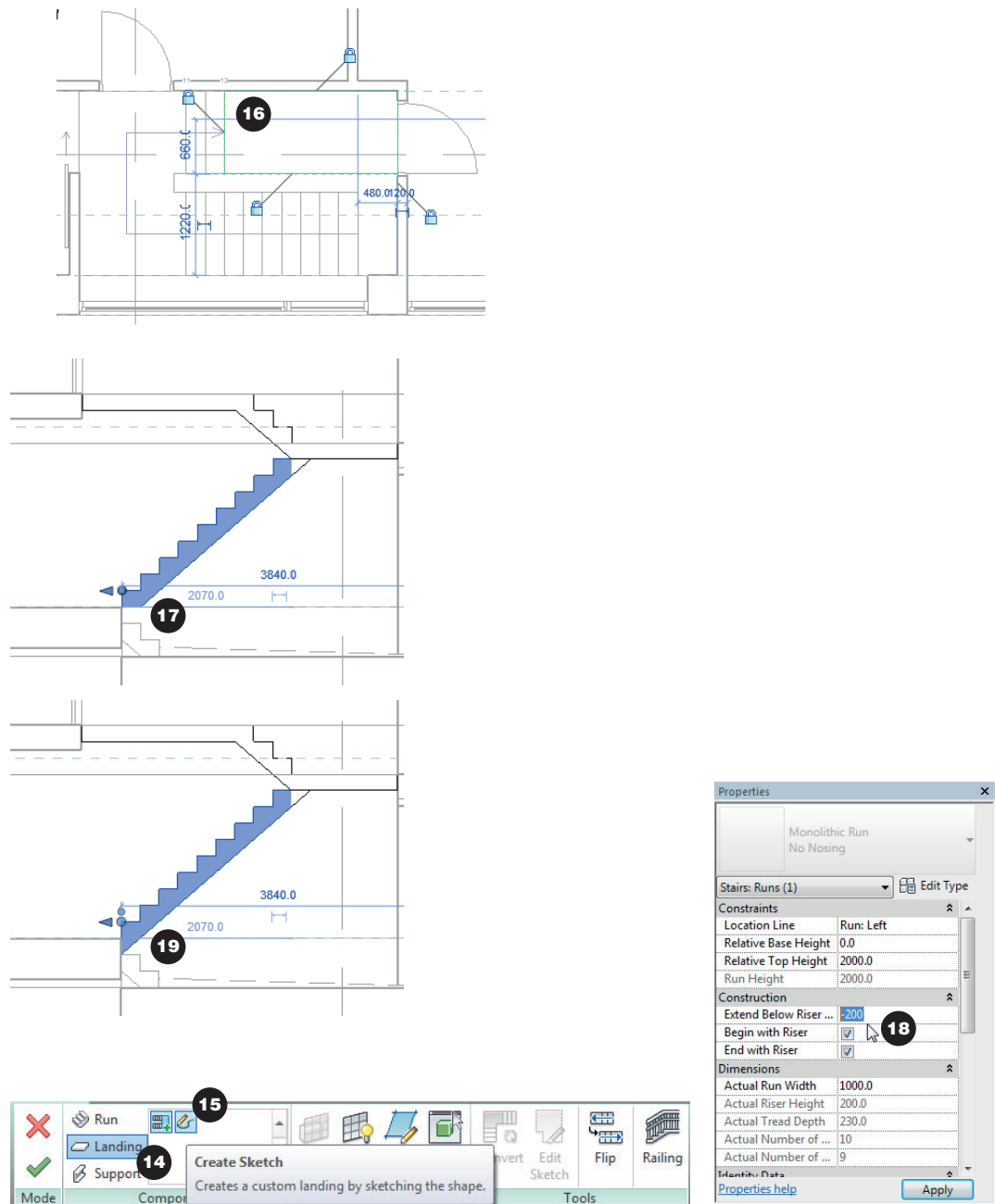
10 Notice that a **Landing** connecting the two **Runs** is generated automatically. Notice also that we are still working in the Stair - the rest of the model is grayed out.

11 Select the Landing and Drag its edge to align to the Wall face - do *not* use the **Align** command, as this would cause the Run to be relocated.

12 Drag this Control to Align to the Door edge to the north.

13 The stair should now look like this. Do not Finish Edit Mode.

Run



Landing

Rectangle

Go to Level 3.

14 From the **Contextual Modify Tab**, create a **Landing Component**.

15 Pick **Create Sketch**.

16 Now sketching the Landing, pick the **Rectangle** tool and draw the Landing like this. Constrain its edges to the Wall edges.

Finish Edit Mode to exit the Landing. Now we are back in the **Stairs Edit Mode**.

Review Stairs

Go to *WIP Section 2*.

17 The lower Run needs to connect to the Floor. Select the Run.

18 In the **Runs Instance Properties**, set **Extend Below Riser Base** to -200.

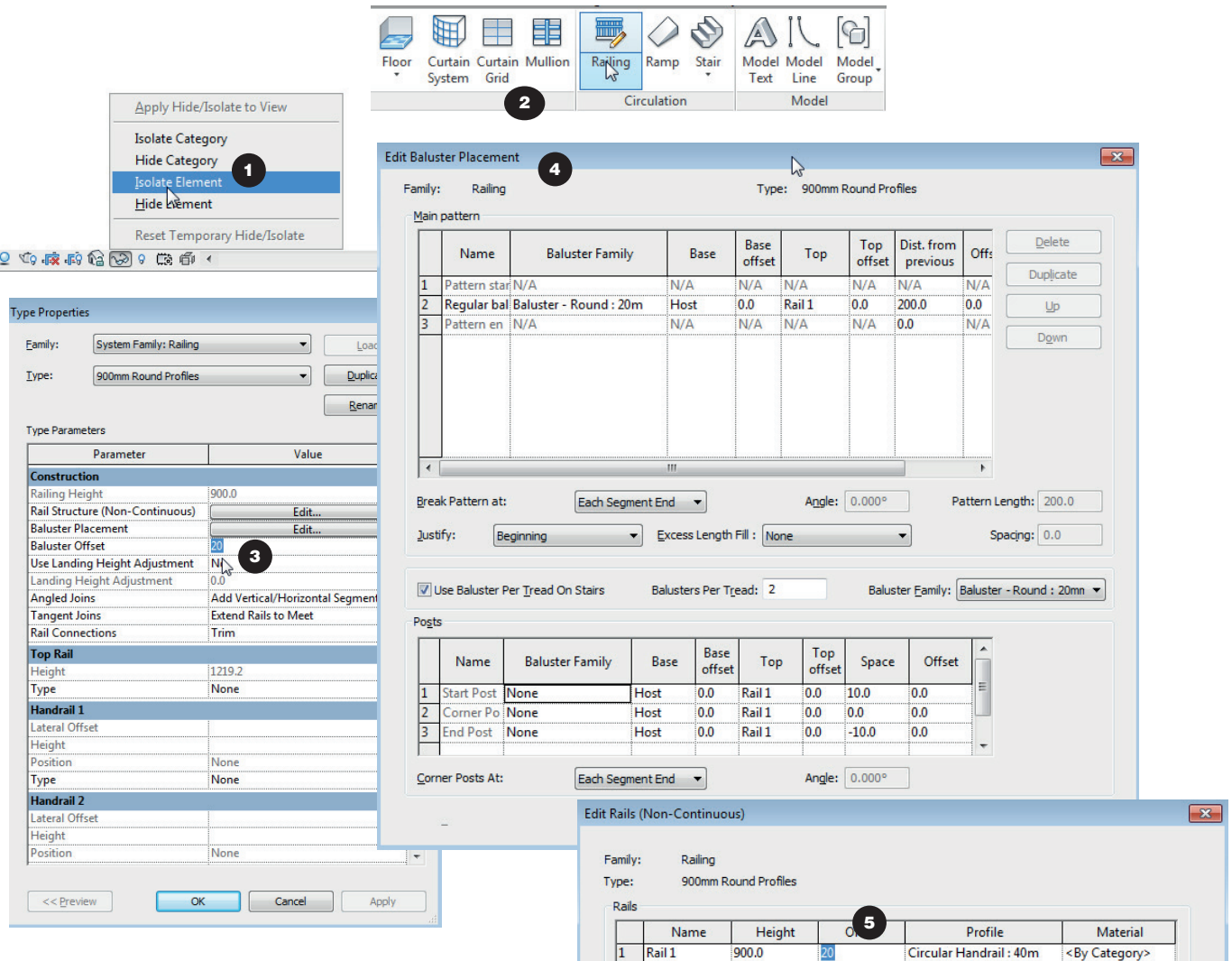
19 The Run should now look like this. **Finish Edit Mode**.

Notice that **Railing** is generated automatically. Select the Railing and Delete it - we will create a new to control its geometry in detail.

Railings

Railings in Revit can be hosted by **Stairs**, **Floors** or **Ramps** - or they can be free-standing, associated with a Level. Railing consist of the sub-components

Rails and **Balusters**, evenly spaced along the **Path** of the Railing, distributed according to rules set up in the **Railing Type**.



PROCEDURE/ Placing Railings

Prepare Views

Go to **Level 1**.
Select all internal Stairs and go to **(3D)**. The Stairs will still be selected.

1 In the **View Control Bar**, click **Temporary Hide/Isolate** > **Isolate Element** to see only the Stairs.

Set up Railing Type

Go to **Level 1**.

2 In the **Architecture** Tab, start the **Railing** > **Sketch Path** command.

3 In the Type Selector, pick **900mm**, **Duplicate** and name the new Type **900mm Round Profiles**. Set **Baluster Offset** to **20**. Click **OK**.

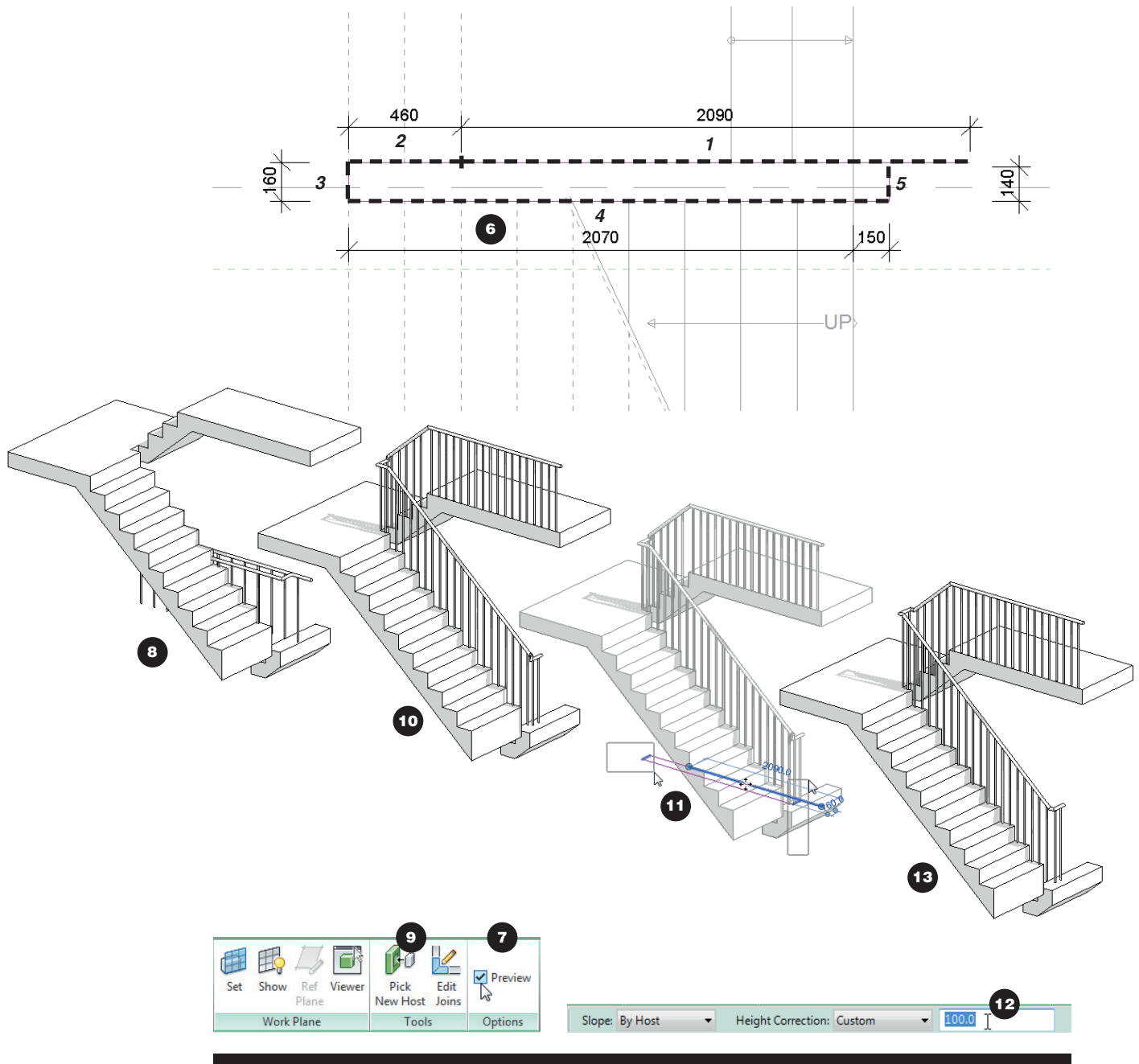
4 Click **Baluster Placement** and set up as shown. Click **OK**.

5 Click **Edit Rail Structure (Non-Continuous)**. Set **Offset** of Rail 1 to **20** and choose a **Circular Handrail: 40 mm**.

Temporary Isolate

Railing - Sketch Path

Baluster Placement



Edit Rail Structure

Pick New Host

Create Railing I

6 Draw 5 segments - it should have *exactly* the Line segments and dimensions shown. Go to (3D).

7 In the **Contextual Modify Tab**, tick **Preview** to see how the Railing would look if finished now.

8 The Railing will probably look like this.

9 To let the Railing be Hosted by the Stairs, go again to the **Contextual Modify Tab**, **Pick New Host** and click on the Stairs.

10 Now the Railing should look like this.

For security and a smoother course of the handrail, the horizontal parts should be positioned higher.

11 To adjust their height, **Select** one of these three Line segments.

12 In the **Options Bar**, set **Height Correction** to *Custom height: 100*.

Do the same for the two other segments, one at the time.

Finish Edit Mode.

13 The Railing should now look like this.

The Railing should be positioned above the Stairs. If this is not the case, Select it and click the **Flip Control** (double arrow).

Create railing II

Create Railing for the Stairs to *Level 0* in a similar way.

5.5/ DESIGN OPTIONS

To document the flexibility of the layout, we will set up two different furnishing options. In Revit, multiple alternative designs can coexist in the same model. This can be practical not only for different furnishing options like here, but also e.g. different partitioning can be kept in the model. A View can be set up to show a certain Option - this will be explained further in the book.

Design Options

Design Options are parallel virtual realities in the project.

Options can be activated and deactivated - the simplest way to do this is through the panel in the Status Bar.

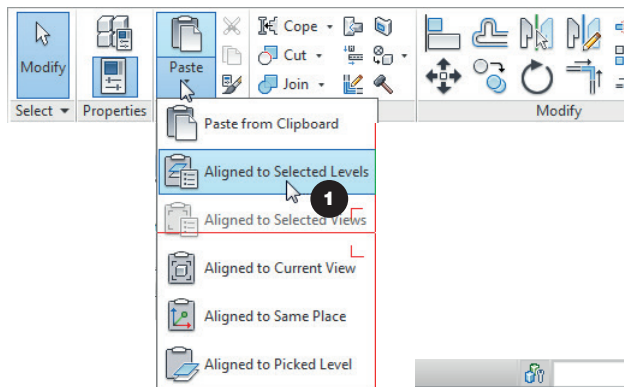
An Option can contain Elements. If an element is contained within an Option, it is only present in the project when this Option is active.

Objects can be moved or copied between Options.

To work with Options, a Set of Options must first be created. Within this, any number of alternative Options can be created. One option is primary - it will be present in the project unless another Option in the Set is activated. In the Status Bar you can control whether elements in Options are selectable or not.

Overruling direction constraint

Some Components - furniture etc. - snap to horizontal or vertical directions when being Moved. To overrule this, hold down the SHIFT while moving.



PROCEDURE/ Setting up alternative furniture Plans

File: Revit Case Study 5.5 p79

Furnish upper floors

Go to **Level 0**. Select furniture to be copied to Level 2 and **Copy to clipboard** (CTRL+C). Go to **Level 2**.

1 In the **Modify** Tab, click **Paste > Aligned to Selected Levels**. Rearrange furniture in Plan and insert more as required.

Go to a **WIP 3D Section View** and adjust to see into rooms at the upper Floors.

If furniture is floating in the air, it is not placed on the correct Level. It can be placed on the correct Level using the **Pick New Host** command and clicking on the floor of the proper Level..

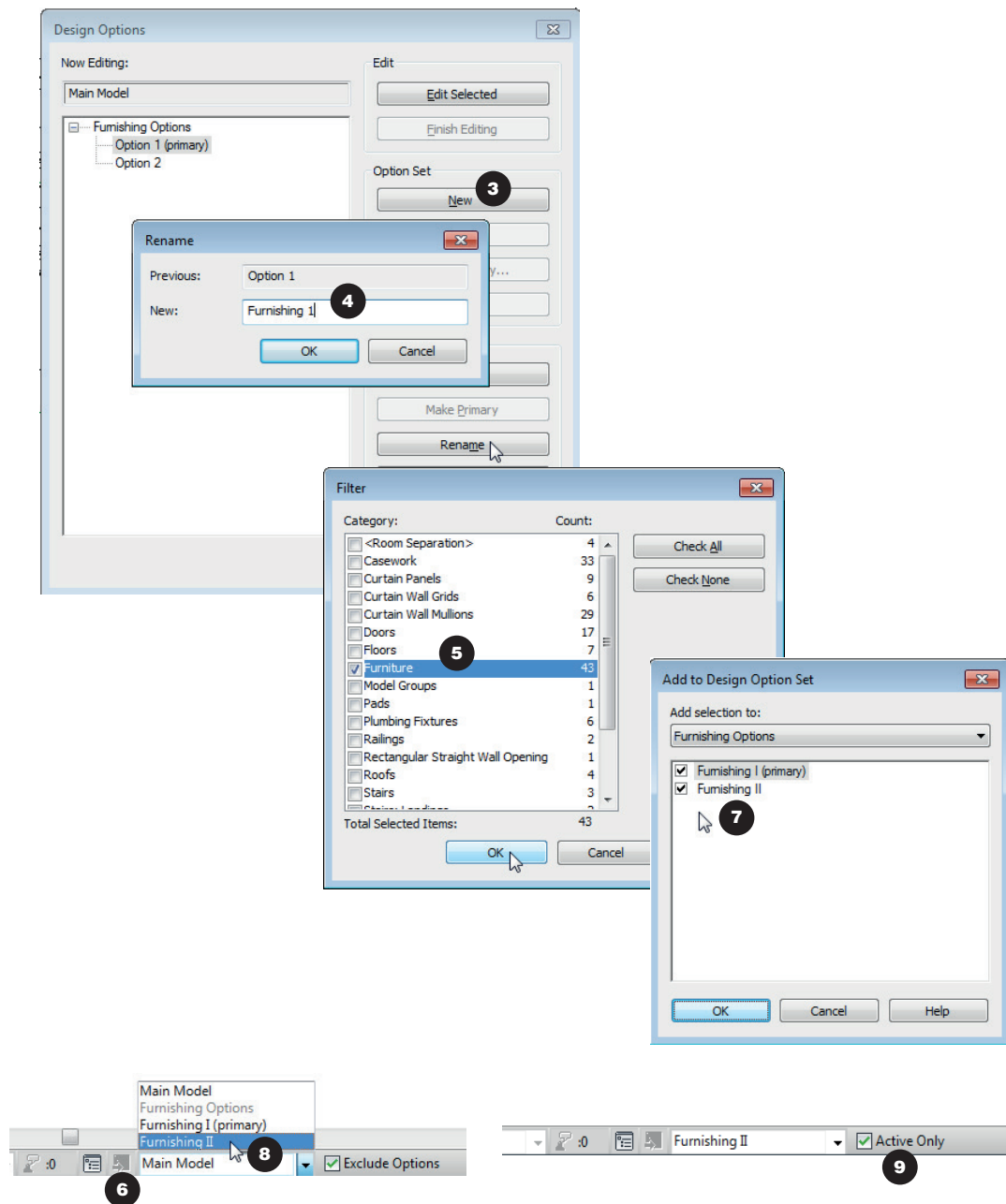
Set up Options

2 To set up alternative furnishing Options, click on the **Design Options** icon in the **Status Bar** or tab **Manage > Design Options**.

Copy to Clipboard

Paste Aligned to Selected Levels

Design Options



Add to Set

3 In the menu appearing, click **New Option Set**. A **Set** with one **Option** so far (the Primary one) is now created. **Rename** the Set to *Furnishing Options*.

4 Create another Option in the Set by clicking **New Option**. Name the Options *Furnishing I* and *II*. Close the dialog box.

Add elements to Options
Go to (3D) and Select all objects.

5 By filter, isolate the Category **Furniture** to be Selected only.

6 In the **Status Bar**, click **Add to Set**.

7 In the box appearing, tick both boxes in order to add all Furniture to both Options. Now the two Options contain identical elements.

8 Activate the non-primary **Option Furnishing II**. Only the furniture contained here will be seen.

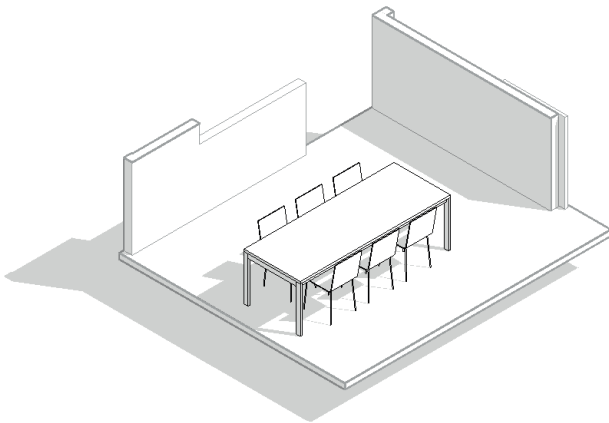


Figure 5.5.1
Different Design Options within the same Revit file
Design Option Furniture I

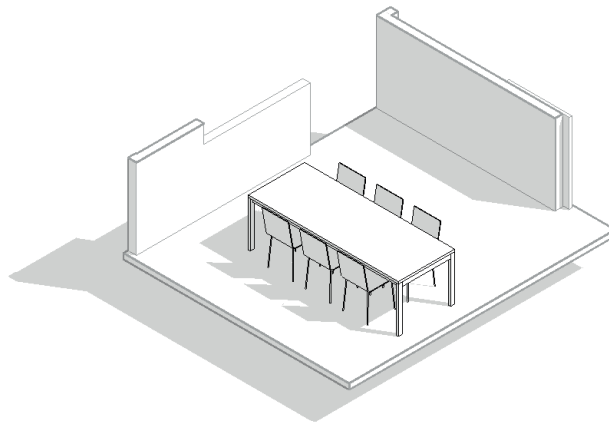
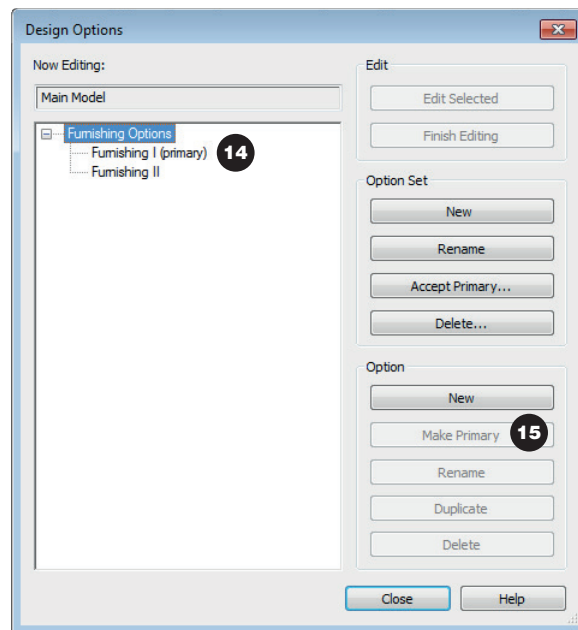
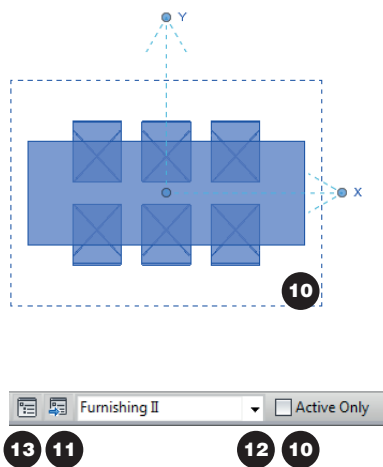


Figure 5.5.2
Design Option Furniture II



9 Elements not in the Option can not be edited while the Option is active, unless **Active Only** is *unticked*. Go to Floor Plan and rearrange some furnitures to alternative positions. Delete furniture and/ or insert new as you see fit. If several pieces of furniture has been *Grouped* together (e.g. dining table and chairs),

they have not been included in the Option.

10 Uncheck **Active Only** and Select the dining group.

11 Click **Add to Set**. Finalize arranging the furniture on both Levels.

12 Return to *Main Model* via the **Status Bar**.

13 Click **Design Option** to open settings.

14 *Furnishing I* is set to be **Primary** and objects will be visible in all views

15 If you want to have object from *Furnishing II* visible, select *Furnishing II* and click **Make Primary**.

Make Primary

Alternative furnishing on Sheets

Before, we set up two different furniture arrangements, using the tool Design Options. To display both options in the project, we need to set up a set of alternative Floor Plan drawings, showing the alternative furniture arrangement.

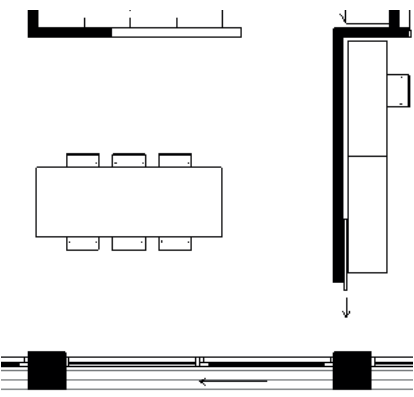


Figure 5.5.3
Ground Floor Plan with Furnishing I
Design Option applied

In Revit, a **View** can be set up to display certain **Design Options**. We will now create a new View of each Floor Plan and assign the alternative (non-primary) Option to each of them.

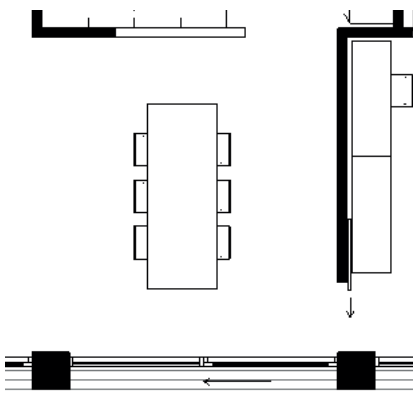
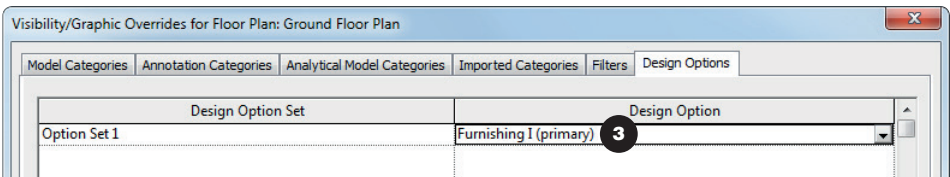
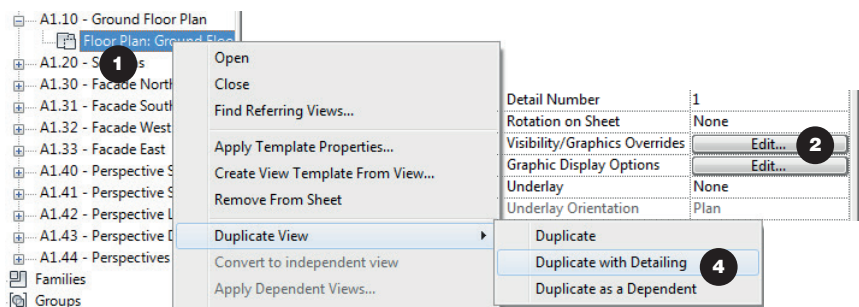


Figure 5.5.4
Ground Floor Plan (Alternate) with Furnishing II
Design Option applied



PROCEDURE/ **Setting up Floor Plans with alternative furnishing**

Apply Option I

- 1** Go to *Ground Floor Plan*.
- 2** In **Properties** click *Edit* on **Visibility/Graphics Overrides**.
- 3** On the **Design Options** Tab choose *Furnishing I (Primary)* from the drop-down. Nothing really changed because the *Primary* Design Option is already visible in all Views.

Duplicate View

- 4** Create a copy of *Ground Floor Plan*. Right-click and **Duplicate View > Duplicate With Detailing** to duplicate not only the model, but also Annotation. Name the new view *Ground Floor Plan (Alternate)*.

Apply Option II

- Apply *Furnishing II* to *Ground Floor Plan (Alternate)*.
- Create a new Sheet and drag *Ground Floor Plan (Alternate)* on to it.
- Create a drawing showing alternative furnishing of the upper Floor Plans using the same method.

5.6/ FINISHING THE MODEL

Adding 3D detailing to the project is the final *modeling* action before setting up the project to generate output.

After this, there will be some more 2D detailing to do, finalizing surfaces with materials to control their visual appearance.

3D detail finishing

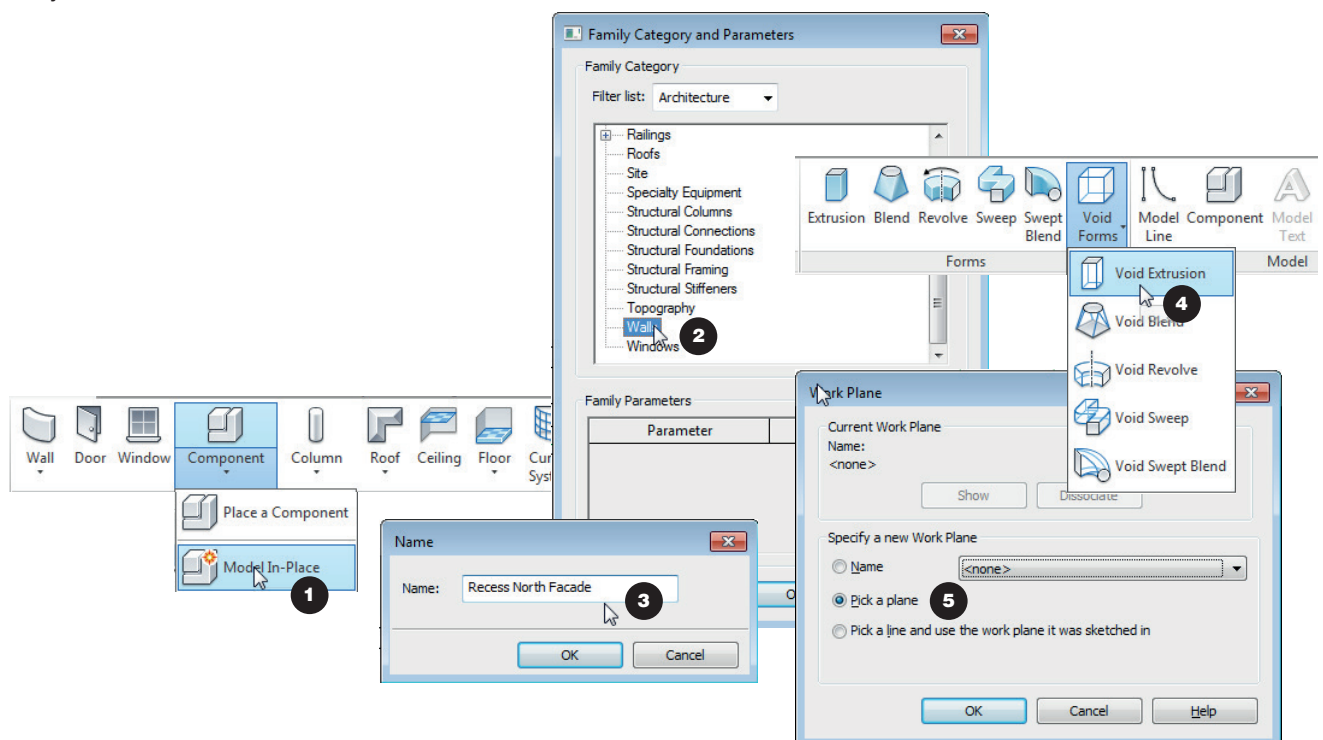
- Is small model elements like gutters, drain pipes, roof profiles, wall recesses, sweeps and reveals.

Some of these are predefined Revit families, and some must be custom-made in a project, downloaded or acquired in other ways.

Model In-Place

To create freely shaped elements or generic geometry, the tool **Model In-Place** can be used ('In-Place' as opposed to creating Family files and loading them into the model). Here, generic geometric tools are available to create Extrusions, Revolves, Sweeps or Composites of these.

Models created In-Place must have a **Category** assigned - Wall, Windows etc. They can be created as **Solids** or **Voids**. Voids can be subtracted from solid geometry, like in the example below.



PROCEDURE/ 3D detail finishing

Wall recess

Go to Elevation North.

1 In the Tab **Architecture**, click **Component** > **Model In-Place**.

2 Pick Category **Walls**.

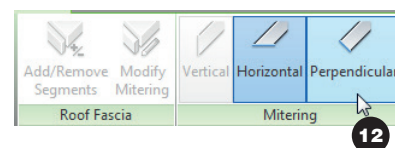
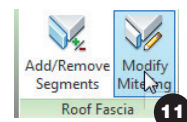
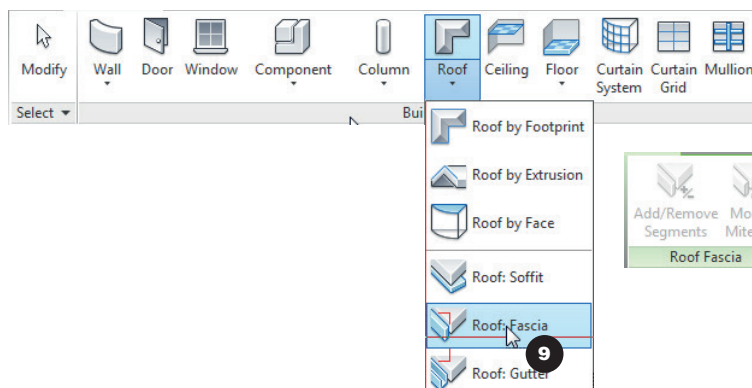
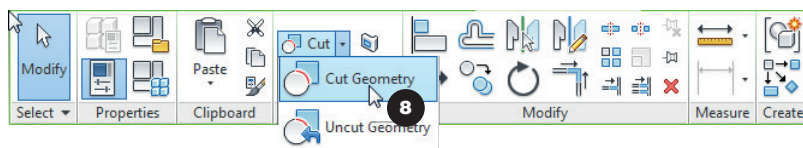
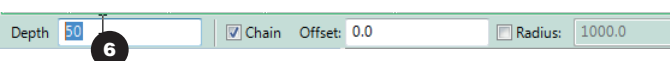
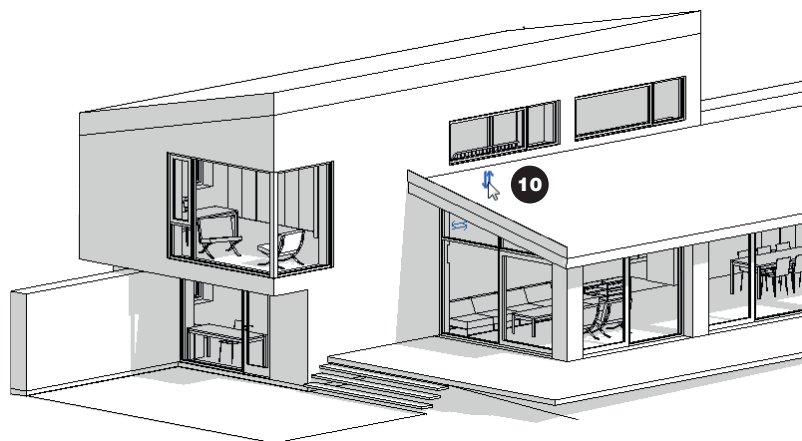
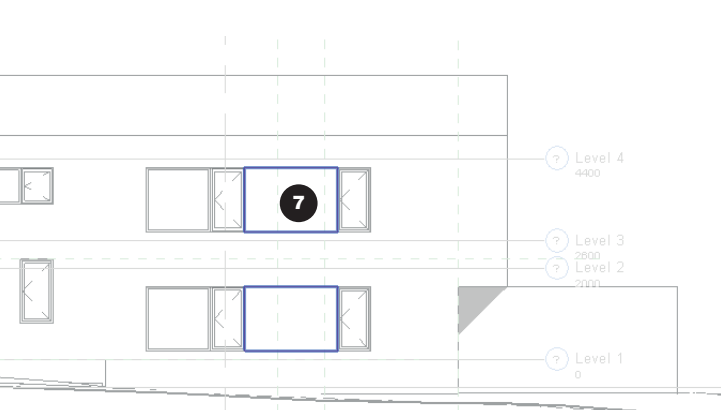
3 Name the Model *Recess North Facade*.

4 Now modeling in the In-Place Editor, click **Void Forms** > **Extrusion**.

5 Click on **Pick a Plane**. Click OK and select an external face of a Wall in the facade of the tallest part of the building.

6 In the **Options Bar**, set **Depth** to 50.

Model In-Place



Cut Geometry

Roof: Fascia

Modify Mitering

7 Draw rectangles between the Windows. **Constrain** the edges. **Finish Edit Mode**.

8 Back in the In-Place Model, start the **Cut Geometry** command. Watch the Status Bar. Pick the **Void** and the **Wall** above, then the Void and the Wall below to subtract the Void from both Walls. **Finish Model**.

Fascia Boarding

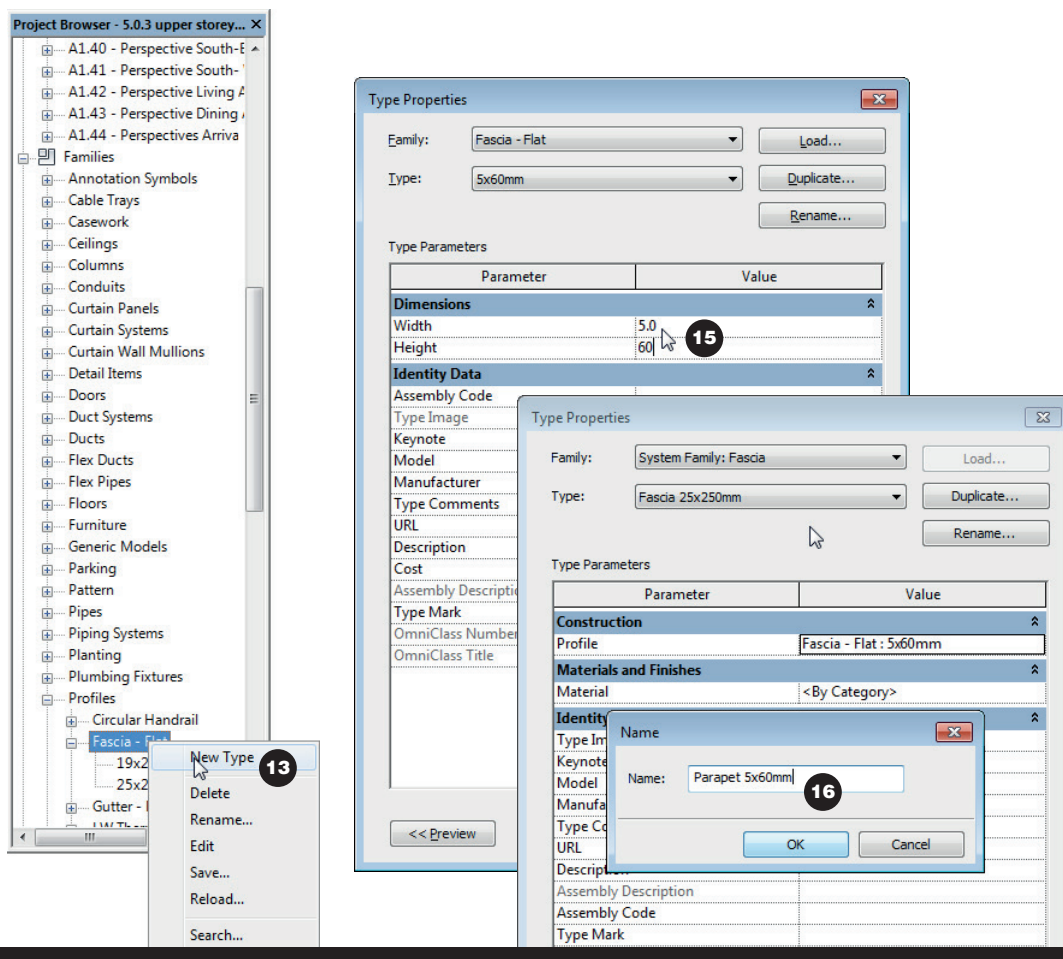
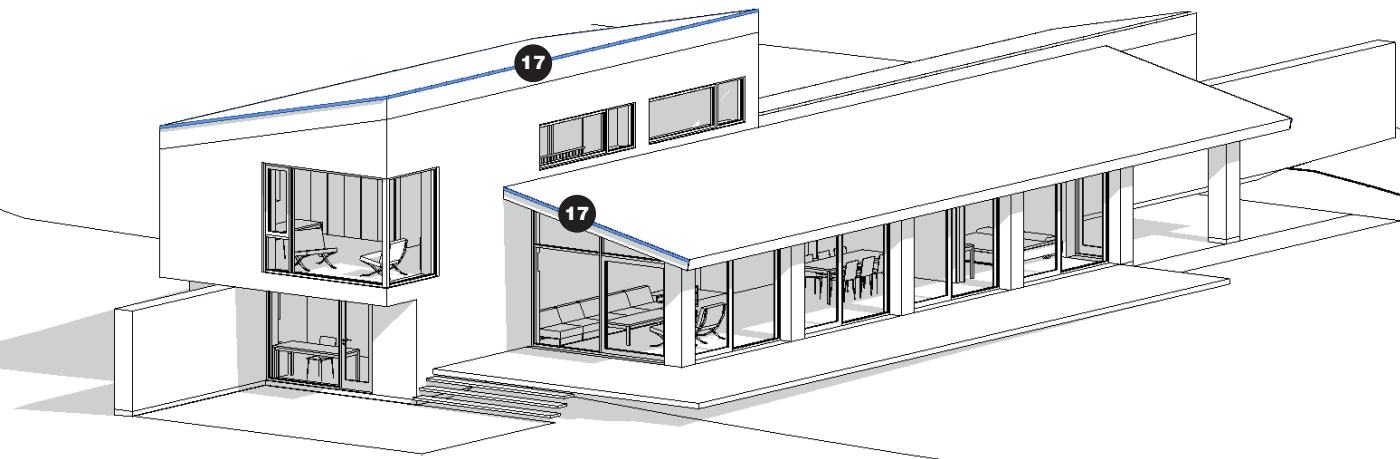
Go to (3D).

9 In the Tab **Architecture**, click **Roof** > **Roof: Fascia**. Select Type: *Fascia 25x250mm*.

10 Click on the upper edges of the ends of the southern Roof with eaves to add Fascia Boarding. Flip by **Flip Control** to cover the Roof ends.

11 Select the boarding - in the **Contextual Modify Tab**, click **Modify Mitering...**

12 ... and set to *Perpendicular*. Click on both lower ends.



Parapet profile

13 In the **Project Browser**, expand the groups **Families** > **Profiles**. Right-click **Fascia - Flat** and pick **New Type**.

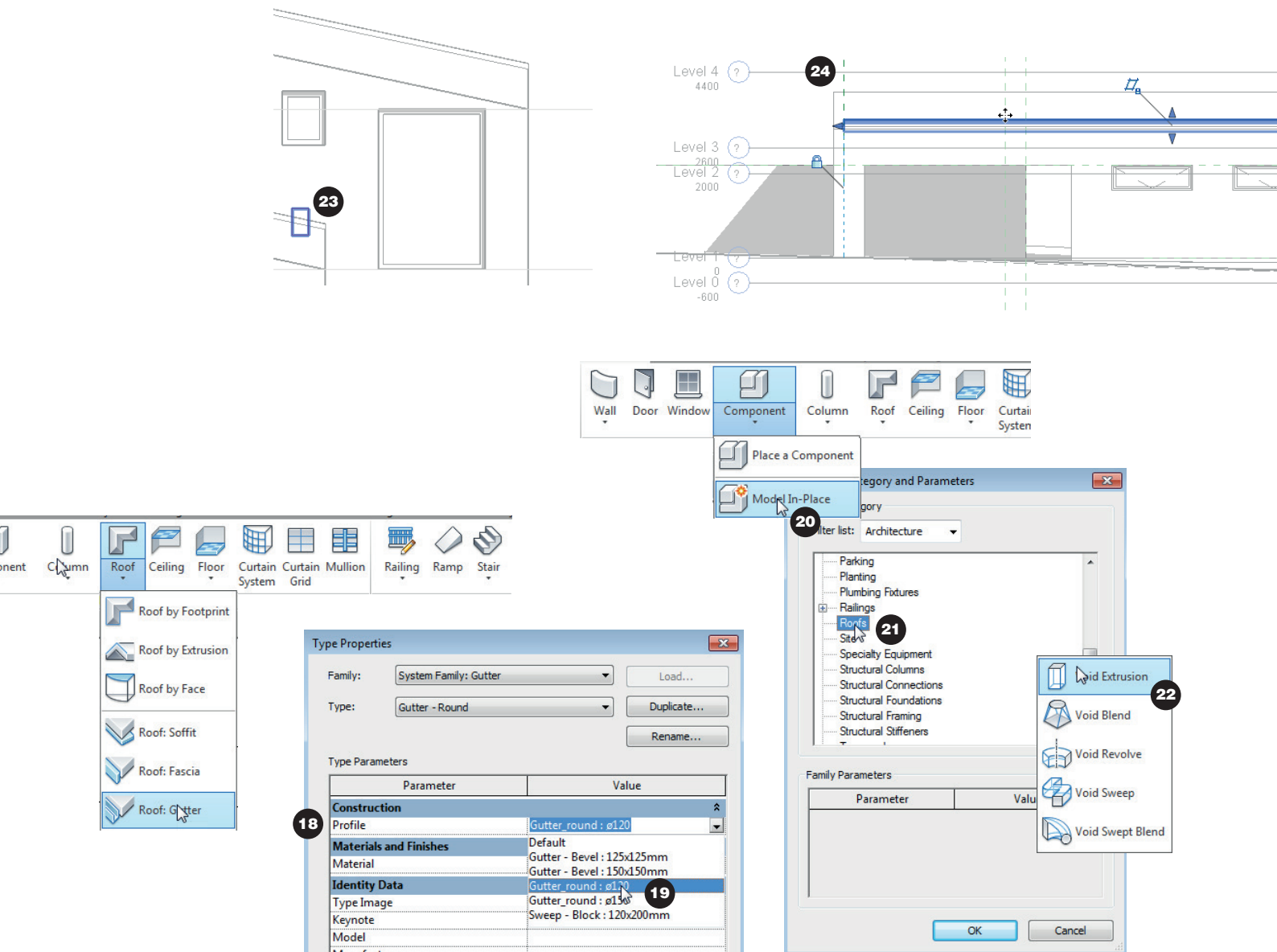
Name it *5x60mm*. Right-click the new Type, pick **Type Properties**.

15 Set dimensions according to the name.

16 Start the Fascia command again and set up a new Type named *Parapet 5x60mm*. Set **Profile** to the one just created.

17 Click on all the upper edges of the Roofs with no eaves - and the upper edges of the Fascia created before (Fascias can host Fascias). **Flip**.

Profiles



Roof: Gutter

Gutters I

Go to (3D).

18 In the **Architecture** Tab, click **Roof** > **Roof: Gutter**. Set up a new Type named **Gutter - Round**.

19 Set **Profile** to *Gutter_Round: ø120*. Click **OK**.

Click on the horizontal edge of the southern Roof to place the **Gutter**.

Gutters II

Go to Elevation *East*.

20 To create gutters embedded in the Roofs with no eaves, start the **Model In-Place** command.

21 Pick **Category: Roofs** and name the Model *Gutter - Embedded 1*.

22 Start creating a **Void Extrusion**. To select a Plane, click on the face of the Wall with the entrance Door (use **TAB** if necessary). Set **Depth** to any value - we will adjust afterwards.

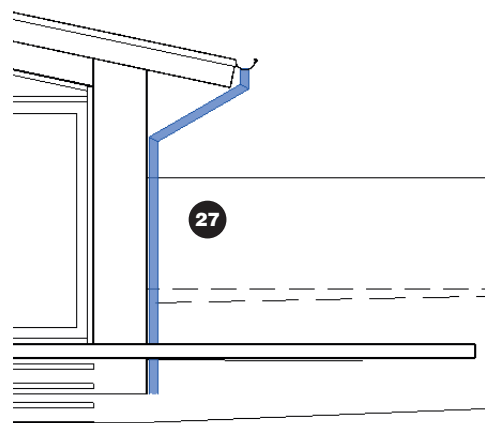
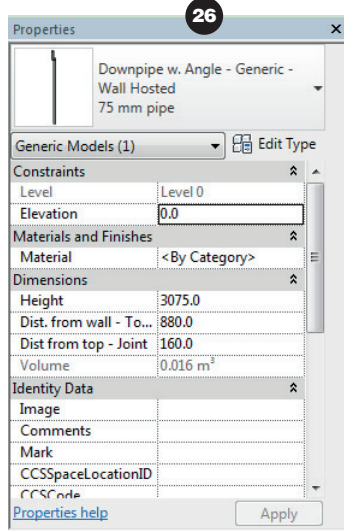
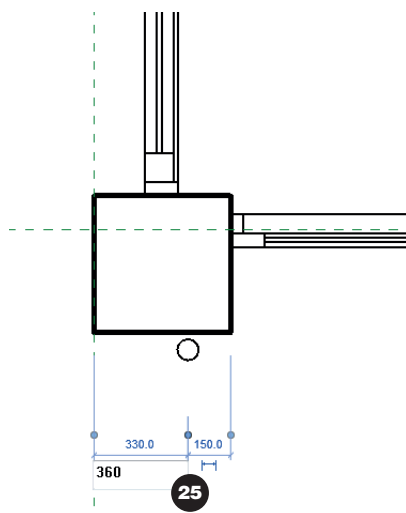
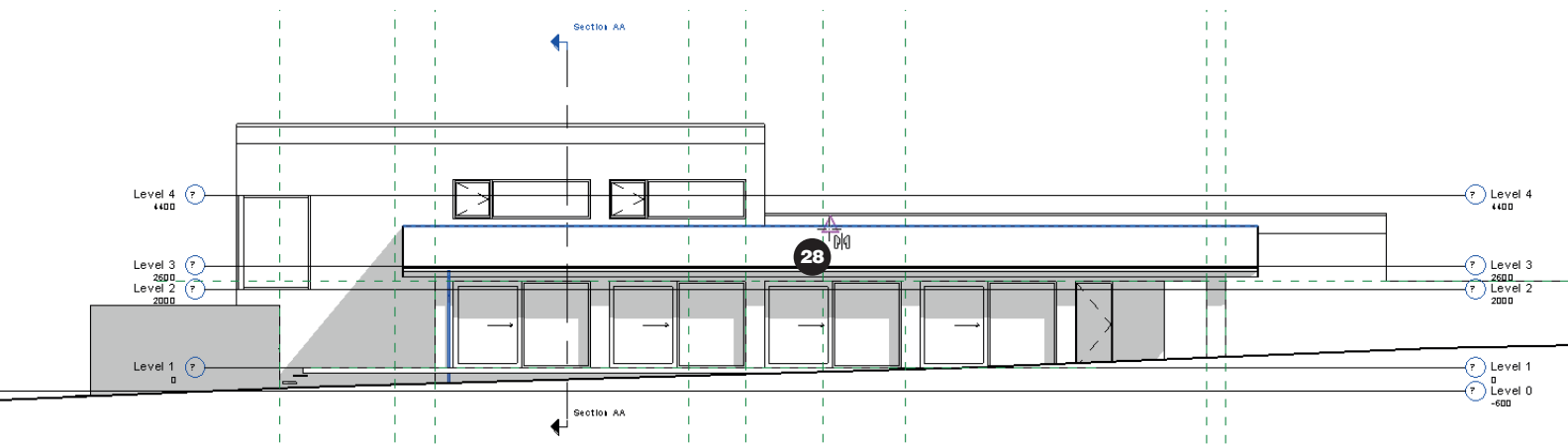
23 Draw profile as shown.

Go to Elevation *North*.

24 Set up a Ref Plane 240 mm from inside the Wall end, Pin the Ref Plane and Align and Constrain the **Void** to here.

Subtract **Void** from **Roof**, using the **Cut Geometry** command. **Finish Edit Mode**.

Create an embedded gutter in the upper Roof in a similar way. Tip: Go to *Elevation 4*, copy the **Void** used before in position, go to *Elevation 3* and adjust ends.



Drain Pipes

Go to **Level 0**.
Start the command **Component**. In the Type Selector, pick **Downpipe w. Angle - Generic - Wall Hosted 75 mm Pipe**. Click on Wall to place the **Component**.

25 Relocate here.
Go to **Elevation West**.

26 Select the Drain Pipe and adjust **Instance Properties** approximately as shown.

27 The Drain Pipe should look approximately like this.

Go to **Elevation South**.

28 With the Pipe selected, start the **Mirror - Draw Axis** command. In **Options Bar**, tick **Copy**. Click on the midpoint of the Roof. Drag up and click to specify the mirroring axis in order to Copy the Pipe into the right position.

Component

Drain Pipe

Mirror - Draw Axis

Propose landscaping

A proposal for new landscaping elements is a part of the design proposal.

In this case study, this will be exemplified only by placing Plantation.

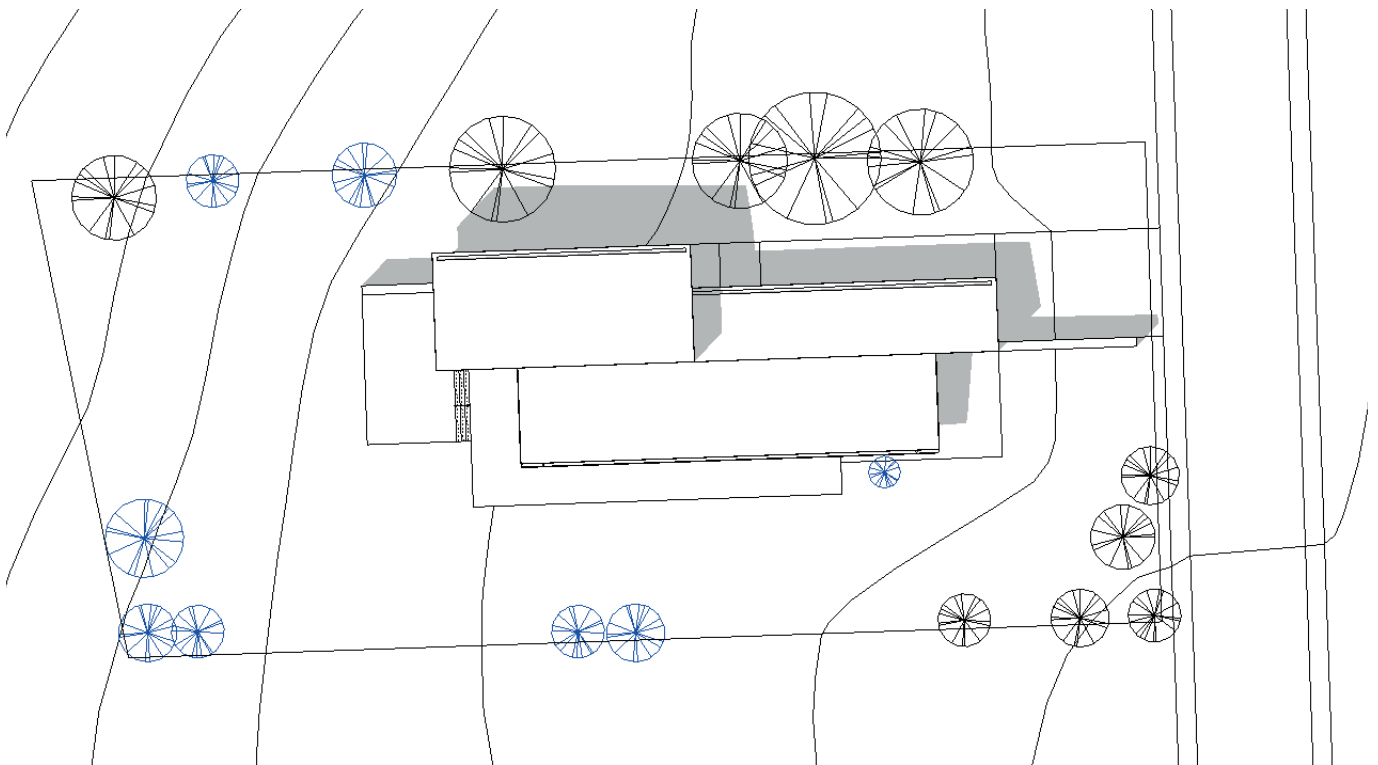
The choice of 3D Plantation elements available in the DanEDU setup and in the BIMbogen template is limited. To supplement it, you can try to browse free internet sites for hedges etc.

Notice however, that adding many landscaping elements with a high degree of 3D detail to the model can make the file size

grow and burden the graphic memory of your computer, slowing down the real-time response while working.

Therefore, if working with large sites with many site elements, it is good practice to keep terrain and site elements in a separate **Site Model** linked into the **Building Model**.

In general, it is also best to keep the detail level of the site components used at an absolute minimum.



5.5.1 Proposed Plantation

Red ash along northern site boundary.

Hawthorn along southern site boundary.

PROCEDURE/ Landscaping

Place Plantation

Go to *Site*.

Go to the Tab *Massing & Site* and start the command **Site Component** to place proposed

new Plantation. Distribute as wished or approximately as shown.

Duplicate Types to create variation in heights. Rotate 'ran-

domly' to avoid repetitive visual appearance on output elevation drawings.

Surface stitching and finishing

Finally, we will add symbolic hatching to surfaces to indicate materials, using **Fill Patterns**.

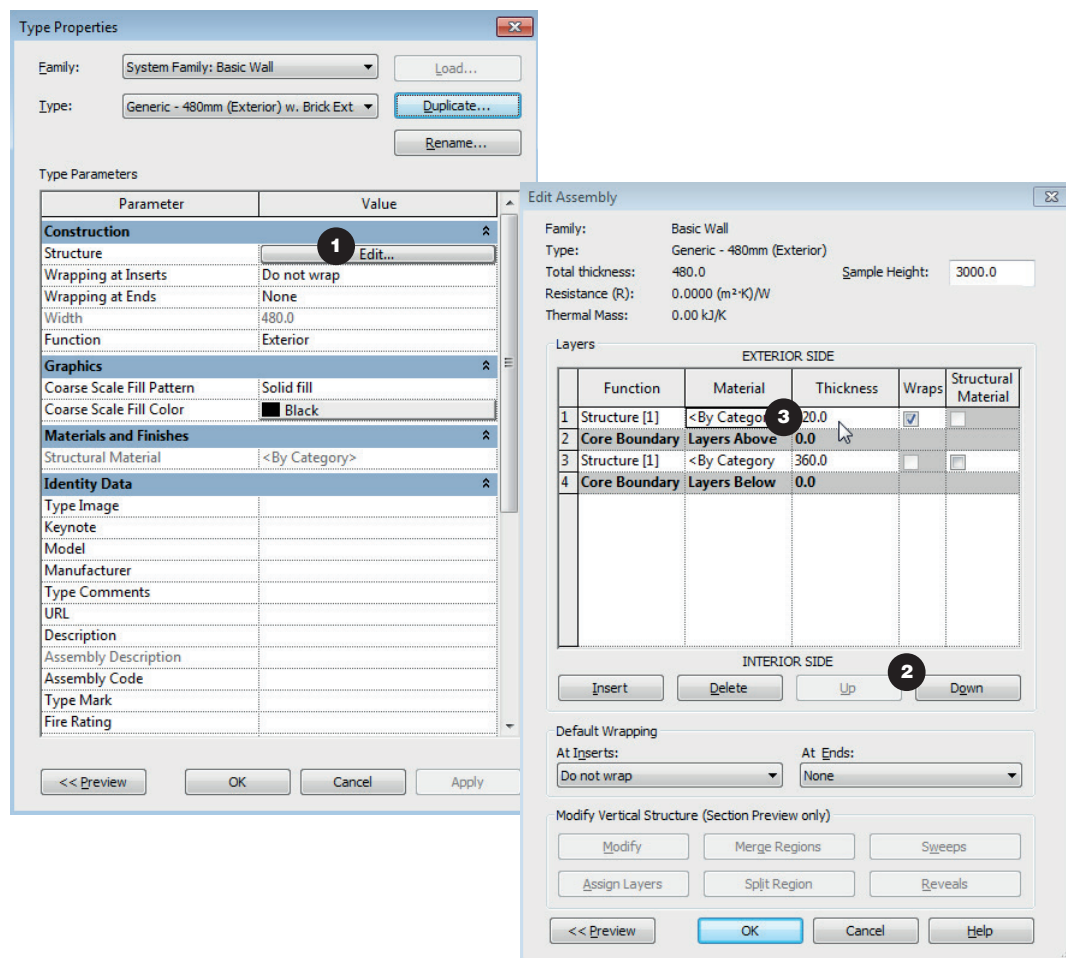
At this stage, materials may not be decided for in detail, so we will keep the representation of materials on a generic level.

It is assumed that brick has been finally agreed for the external Walls, so we will show generic brick courses.

To do this, we will edit the Structure of the Walls, adding a layer. This is done *only* to

arrive at a certain visual expression and *not* to specify the assembly of the Walls yet, as this is not to be specified at this project stage.

Some model 'stitching' is required in order to achieve visually seamless surfaces. Here, the Revit commands **Join** and **Un-join** are used.



PROCEDURE/ Finishing and stitching the surfaces

Assign Wall Material

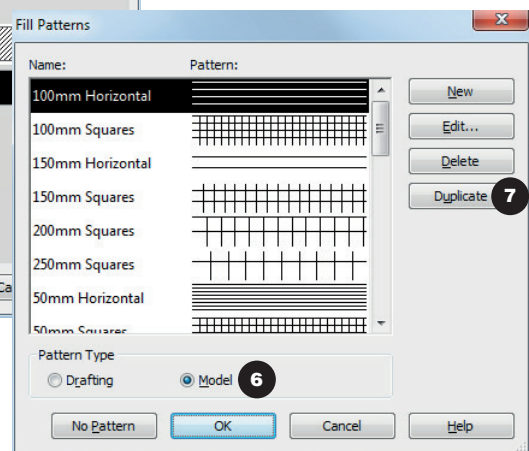
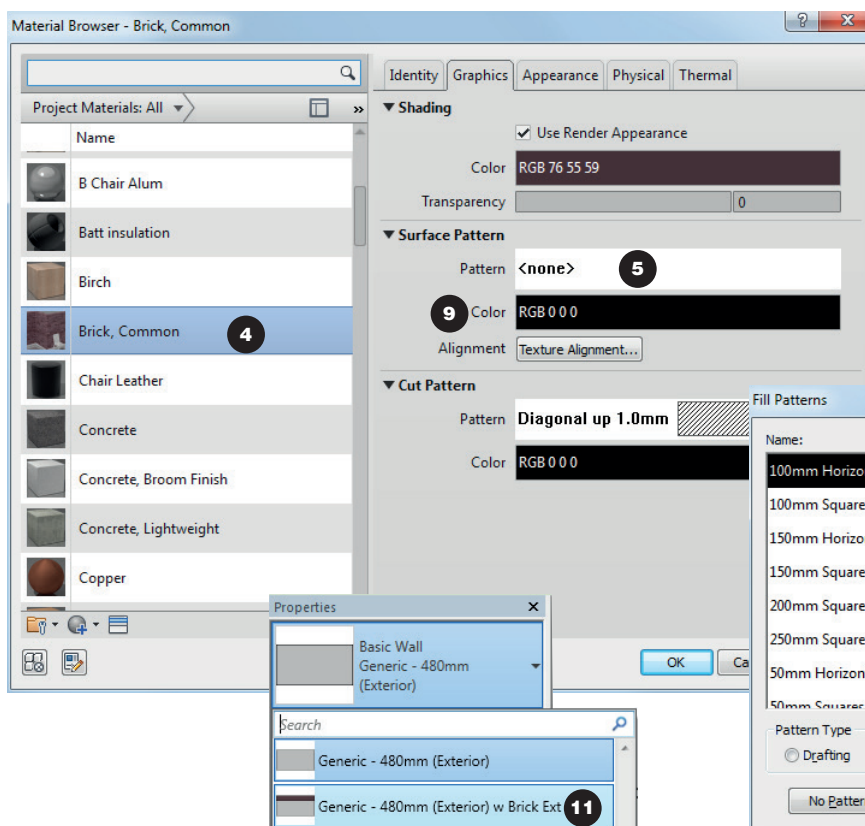
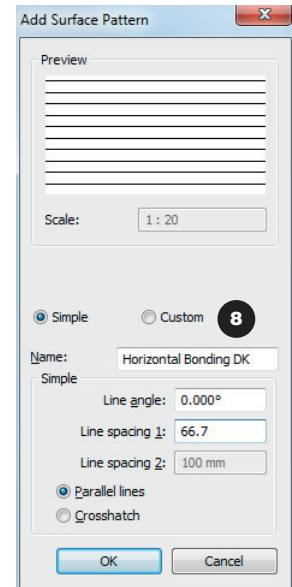
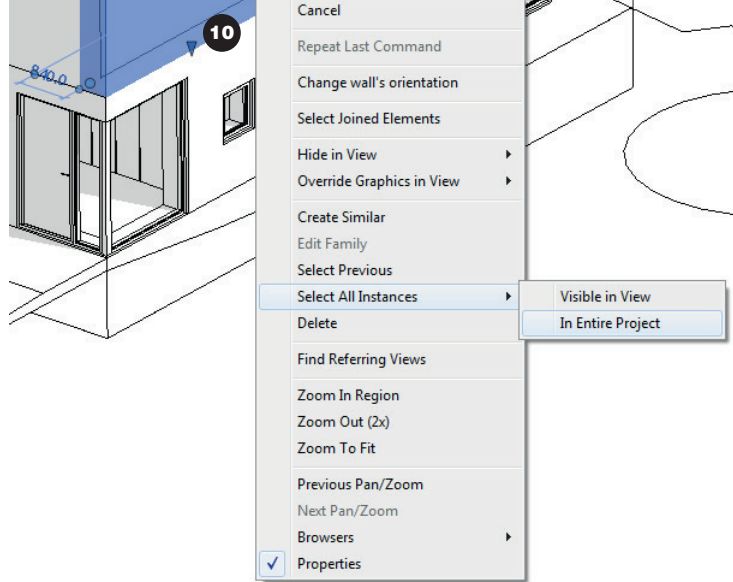
Go to (3D).

Select an external Wall and **Edit Type**. **Duplicate** and name new Type *Generic - 480mm (Exterior) w. Brick Ext.*

1 Edit Structure and click **In-**
sert to add a **Layer**.

2 Set up the Layers like this
using **Up** and **Down** buttons.
Remember to change **Thick-**
ness.

3 Click here to appoint another
Material to the external Layer.



Surface Pattern Material Browser

4 In the **Material Browser** appearing, scroll to **Brick, Common** - or type **Brick** in the Search field at the top.

5 At **Surface Pattern**, click on **Pattern**.

6 Click for **Model Patterns** (non-symbolic Patterns with fixed dimensions).

7 Select **Horizontal 100mm** and click **Duplicate**.

8 Set up and rename the new Fill Pattern as shown.

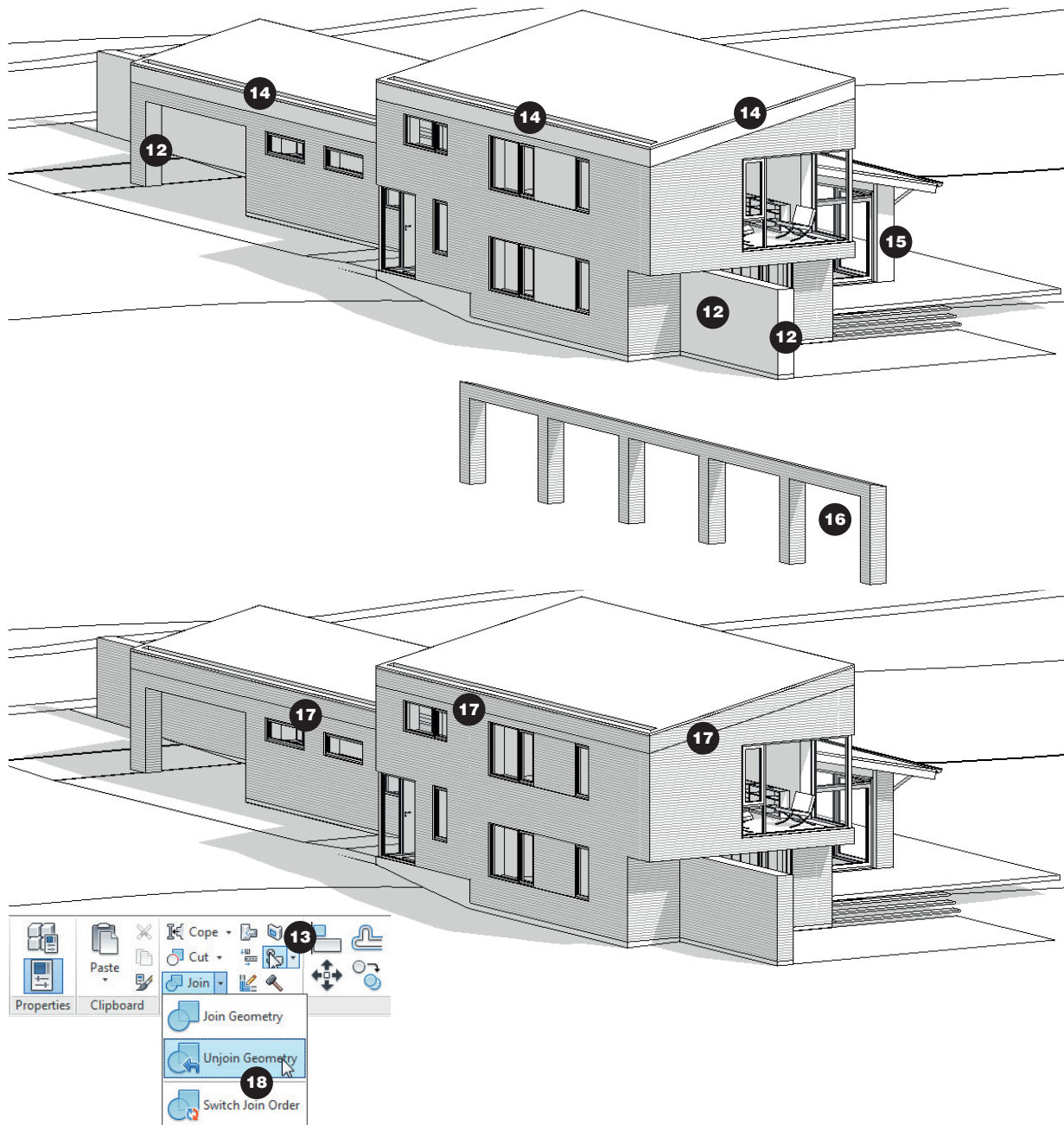
9 Set color to Black. Click **OK** > **OK** > **OK**.

10 Select one of the other External Wall in the project, Right-Click and **Select All Instances In Entire Project**.

11 In **Properties** select **Generic - 480mm. (Exterior) w Brick Ext**.

12 Only External Wall Faces have the Pattern - not Wall ends and rear faces of exterior Walls.

13 To assign it to other Wall faces, start the **Paint** command in the **Modify** Tab. In the **Material Browser**, make sure that **Brick Common** is selected. Navigate around the building and click on Wall faces to **Paint** them.



14 Also the Roof edges should be brick - **Paint** these.

15 Select this Wall and **Temporary Isolate** it.

16 Paint the brick Material on all the faces of the Wall - also the interior face.

Reset Temporary Isolate.

Stitch wall faces

17 To 'stitch' the facades and eliminate the intersection lines between two elements with the same material, **Join** them. If faces are already joined but still seem divided, make sure they are absolutely aligned.

18 If this does not help, start the **Unjoin** command and click on one of the elements to **Unjoin** it from all other elements, and start over, **Joining** them again.

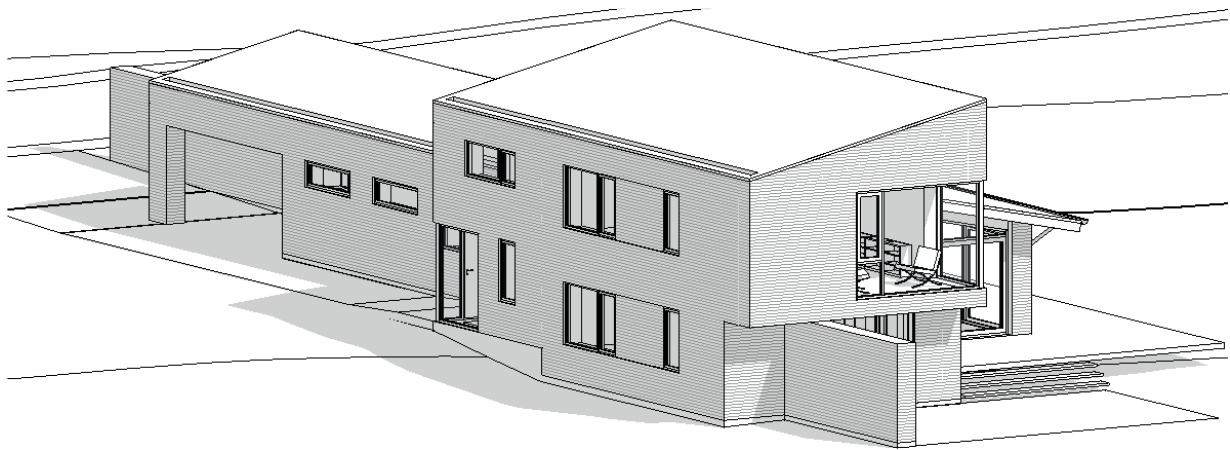
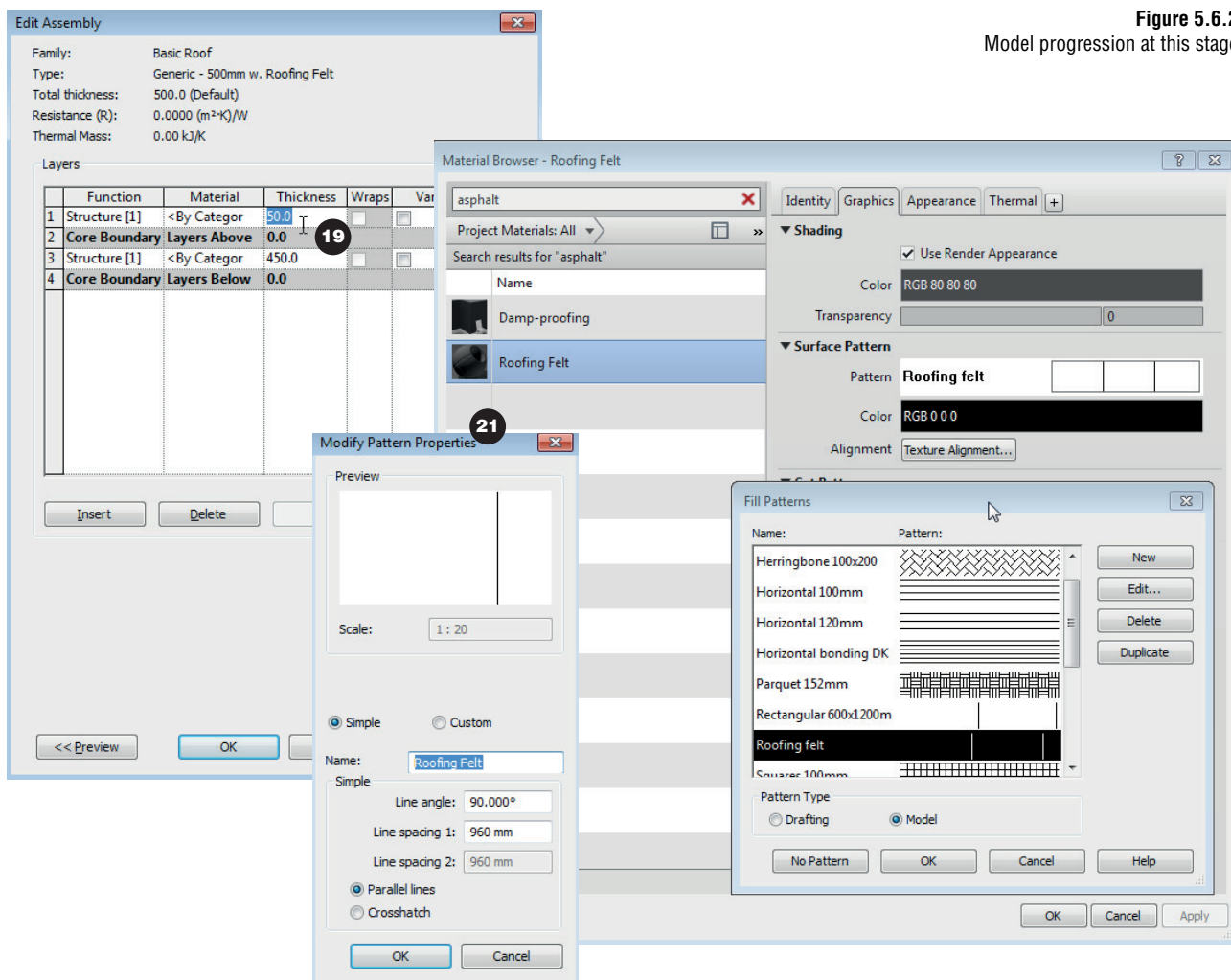


Figure 5.6.2
Model progression at this stage



Now the model should look like in Figure 5.5.2.

Assign Roof Material

Go to Site.

Select the top Roof, **Edit Type**, **Duplicate** and name it *Generic - 500mm w. Roofing Felt*.

19 Set up the Roof with a thin external Layer.

20 Make sure the total thickness of the Roof stays the same as before.

For the external Layer, assign the Material *Roofing Felt*.

21 Set up *Roofing Felt* with a Fill Pattern like shown.

Finish setting up the Roof Type.

Select the Roof over the kitchen and change its Type to the same as the top Roof.

Use the same method to set up a new Roof Type (thickness 250 mm) for the external Roof over the southern part of the building.

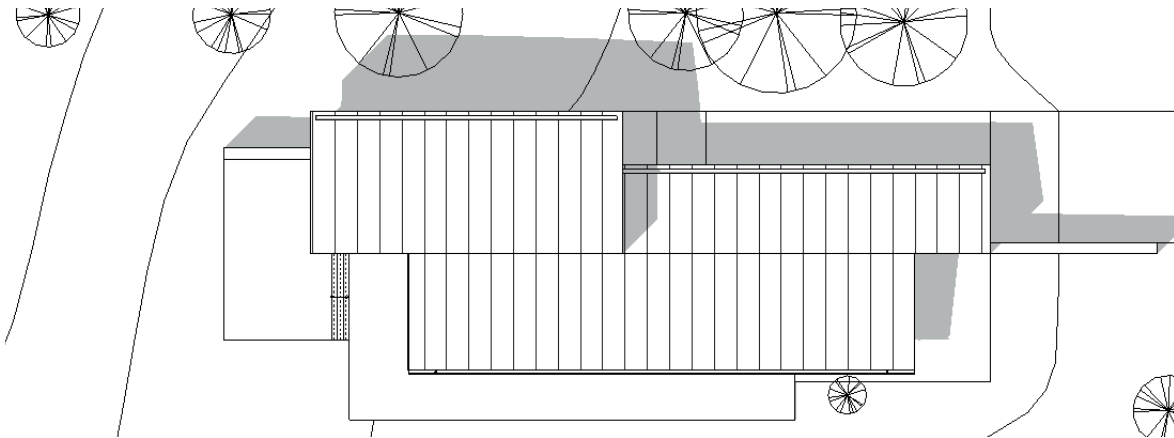
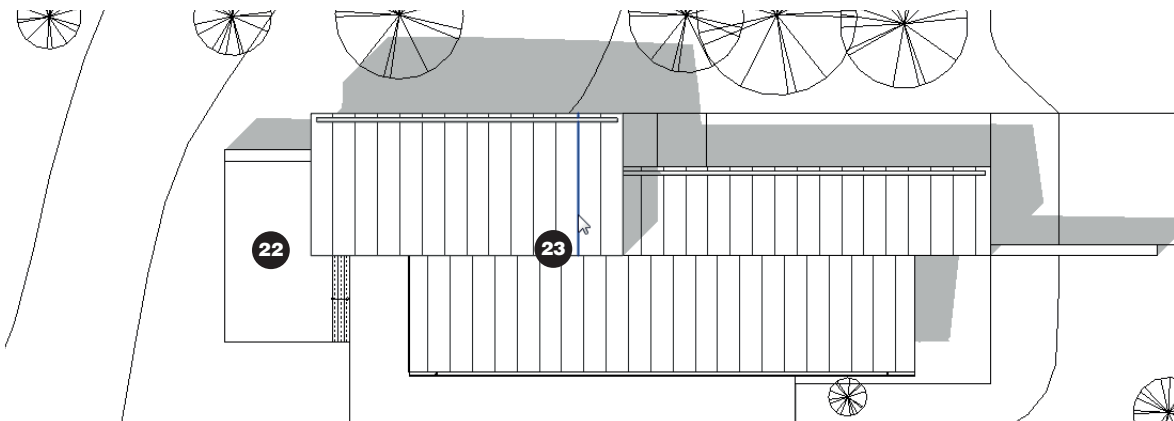


Figure 5.6.3
Roofs Fill Pattern aligned to each other

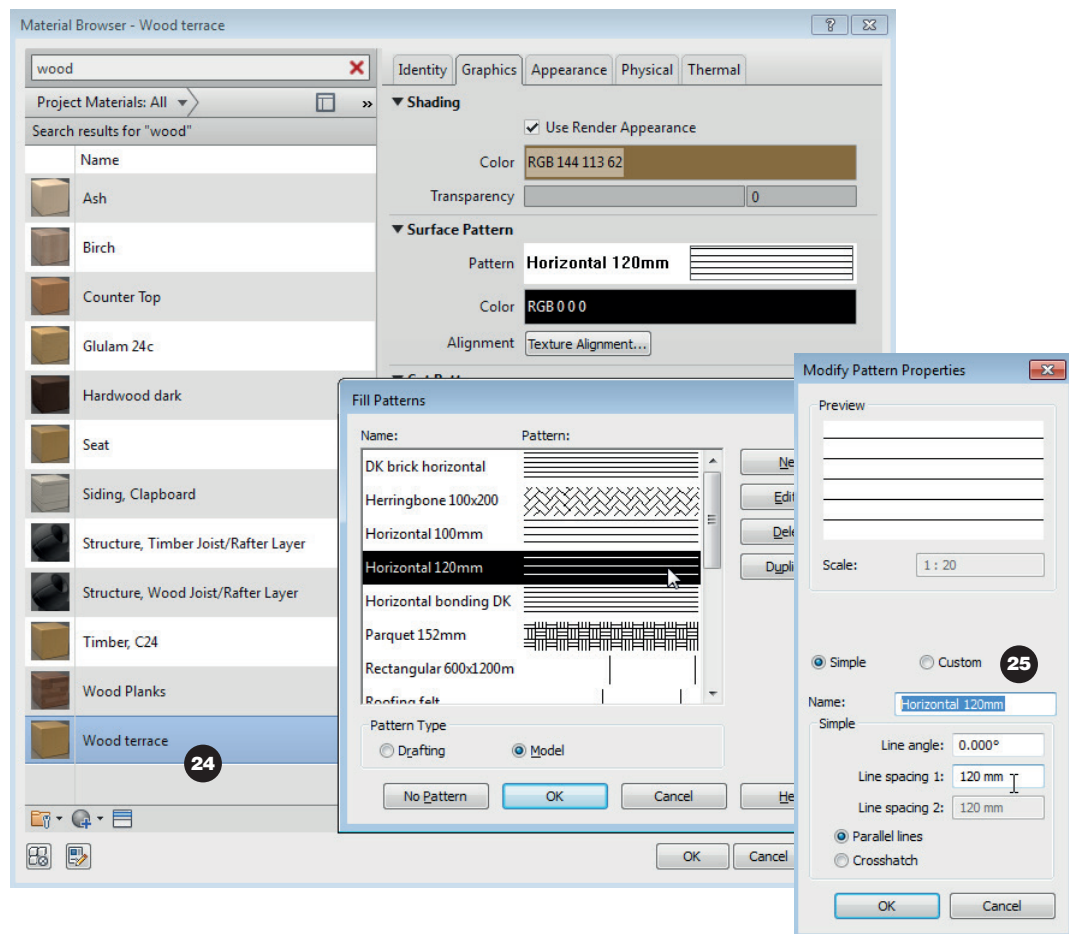
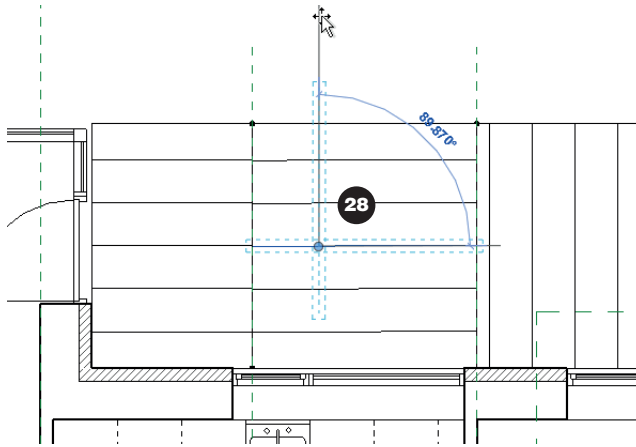


22 The Roofs will probably look like this - the Patterns is uneven.

23 Relocate the Fill Patterns on the Roofs to center the lines

on each Roof (e.g. like shown). To Select a line in the Fill Pattern: Hold the cursor still over the line, press TAB and click to Select.

Once a line in the Fill Pattern is Selected, the whole Fill can be relocated using any modify tool (**Move, Align, Rotate** etc.). The result should look like Figure 5.5.3.



Remaining Materials

Go to *Level 1*.

Select the southern terrace.

Edit Type and **Duplicate**. Name the new Floor Type *Generic - Wood 120mm (Exterior)*.

24 Set up a new Material for the new Floor Type based on the Material *Timber, C24*.

25 Set up Fill Pattern as shown.

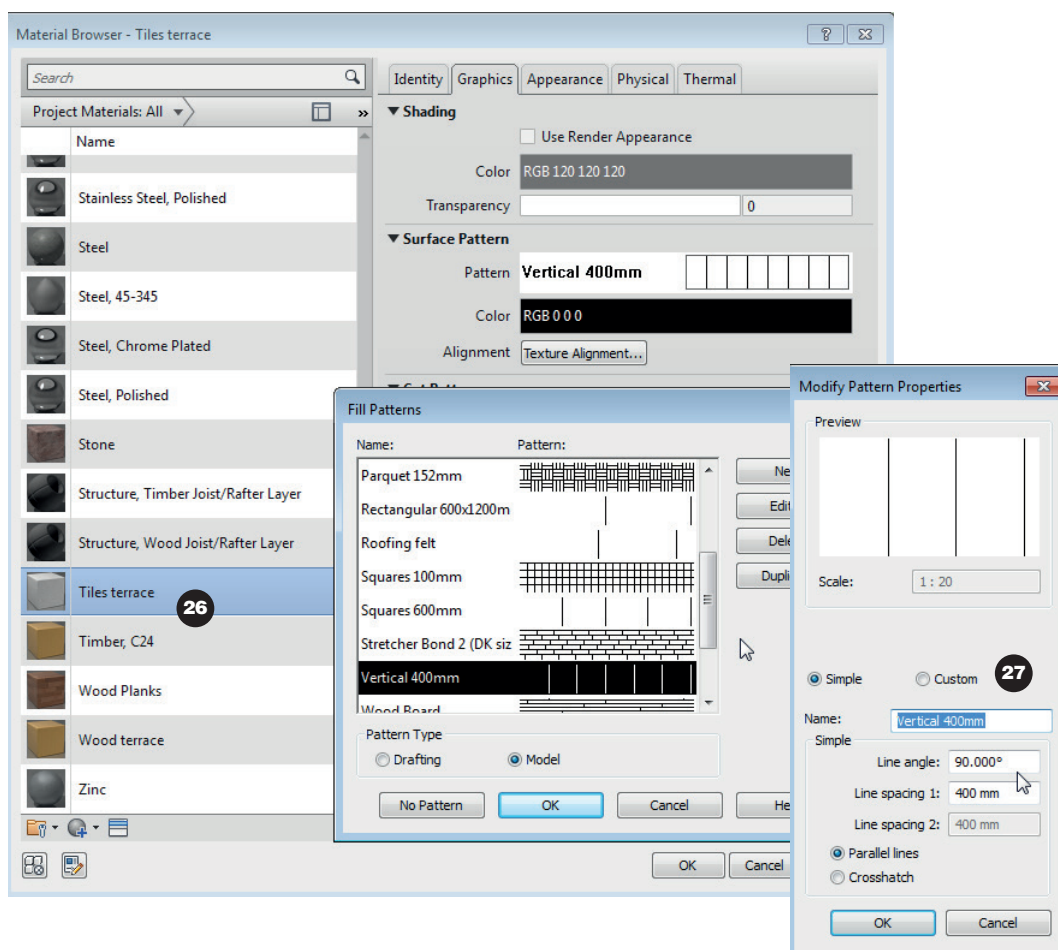
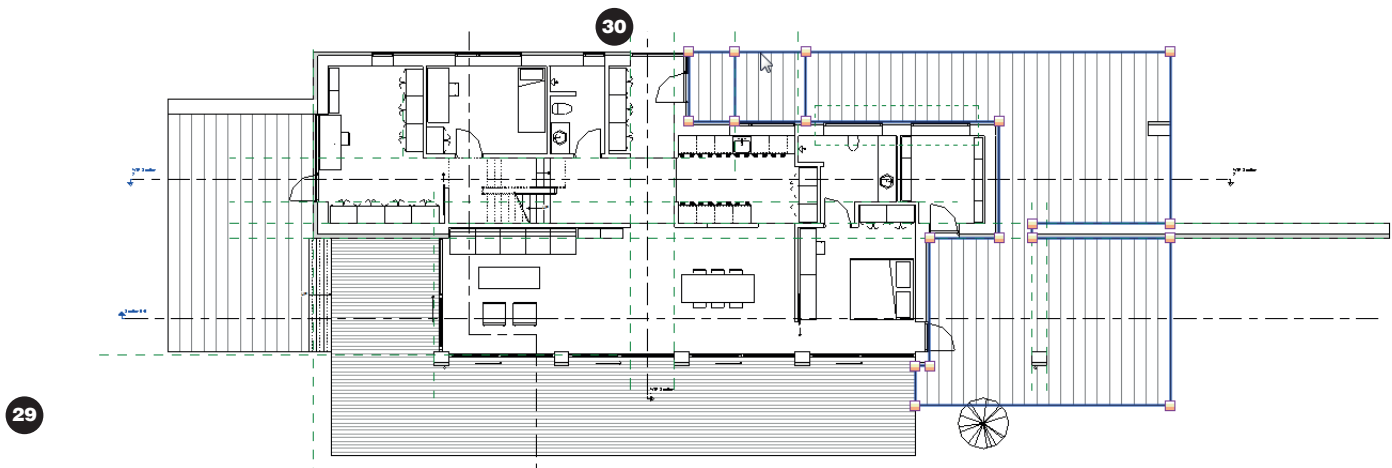
Assign also a new Floor Type for the two remaining terraces.

26 Set up a Concrete Material for the Floor Type as shown, based on the Material *Concrete, Broom Finish*.

27 Set up Fill Pattern as shown (see next page).

Finish setting up the Material. The Fill Patterns may not be oriented the right way.

28 To adjust the orientation of the Pattern, hold the cursor over a line in the Pattern and



press TAB to Select the line. This can now be **Rotated** like any other object, using the **Rotate** tool.

29 Adjust the Pattern to look like this. Use **Align** or **Move** to relocate Pattern lines.

30 Adjust the Ramp at the entrance to follow the lines in the Pattern (without making the ramp or the platform outside the entrance door smaller).

31 To do this, Select the Floor and **Modify Sub Elements**. The points in the corners of the ramp can now be relocated, using the **Move** command.

6

documentation II

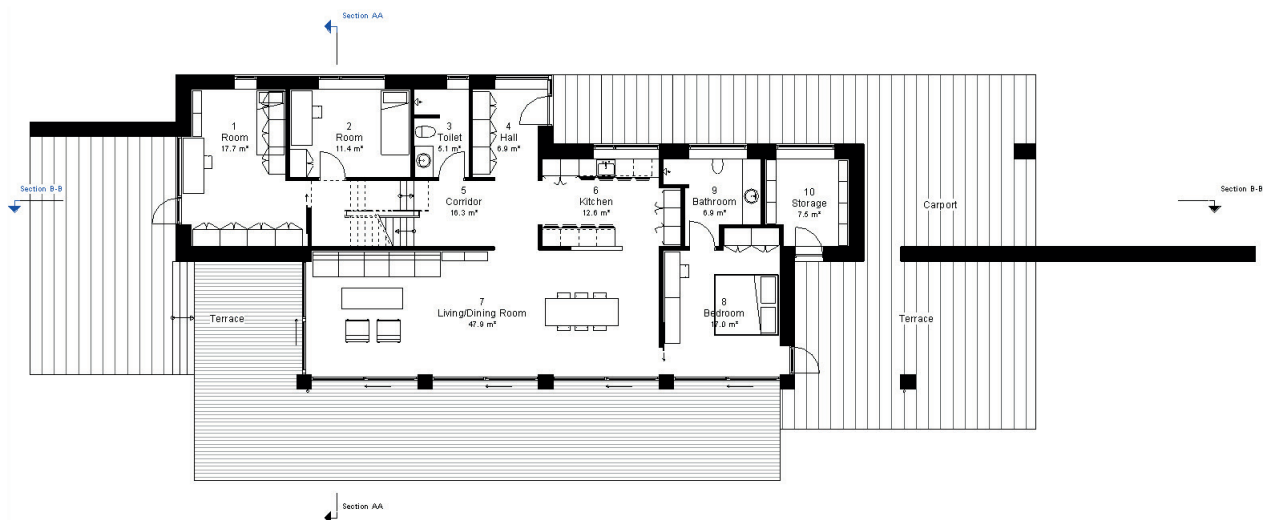
FINAL DRAWINGS

The conceptual design of the building is now assumed to be in place, and modeling work is finished. What remains to be done is to generate the final drawings. In general, these are set up by adjusting the preliminary drawings set up in chapter 3.

At this stage, a semi-advanced level of Revit skill is assumed.

Though a few new Revit tools will be described, the main part of this chapter is about refining techniques and routines already introduced, or offering methods that alternate slightly from previously applied methods.

Routines that have been introduced previously will be considered basic knowledge, and will therefore not be described in detail.



6.1/ REVISING DRAWINGS

After the first preliminary drawings were generated, detailed site information is added to the project, and the project has changed drastically. Therefore, each drawing needs to be reviewed individually to make sure that all relevant information is included.

Also, for generating the final concept design drawings, a slightly higher level of detail is introduced.

Some general issues to observe when revising drawings are listed in the table to the right. Apart from following the procedures described in the following, it is a good idea to check all the points in the list for each drawing.

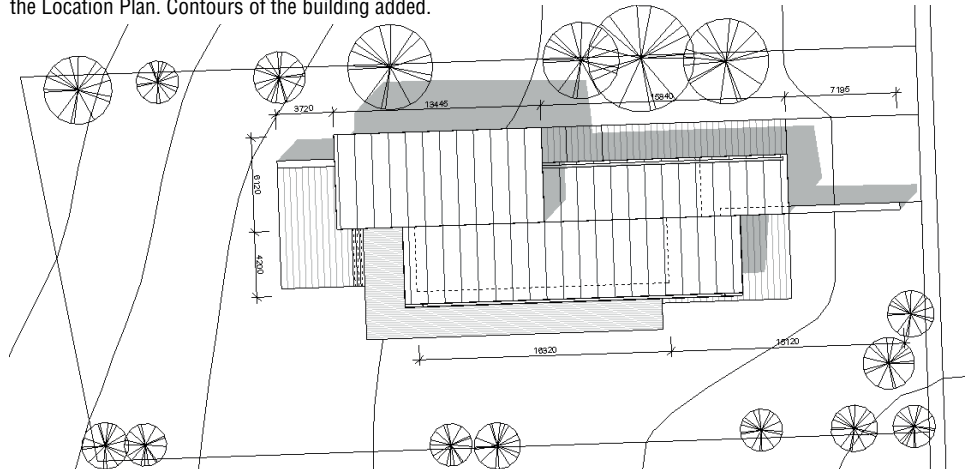
OVERVIEW/ Revising drawings

- Estimate the range of drawings. Remove/add if necessary
- Review View Cropping and Sheet size
- Review View Range
- Review object visibility - Hide/Unhide if necessary
- Review model information - add /modify 2D linework if necessary
- Review annotations - add/modify if necessary
- Review graphics: Line Weights, Patterns, Shadows, Backgrounds. Add/modify if necessary

Figure 6.1.1

Stages of the development in chapter 6.1

1. Information about terrain and surfaces shown in the Location Plan. Contours of the building added.



2. More context and detail shown in the facade elevations.



Wall and Roof contours (Detail Lines)

In two plan drawings, visual indication of lines not directly visible in the View must be shown with a dashed line: In the Location Plan, the contour of the perimeter of the building below the Roof should be

seen, and in the Ground Floor plan, the contour of the roofs and overhangs and roofs above should be visible.

We will draw them manually in 2D, using the tool **Detail Line**.

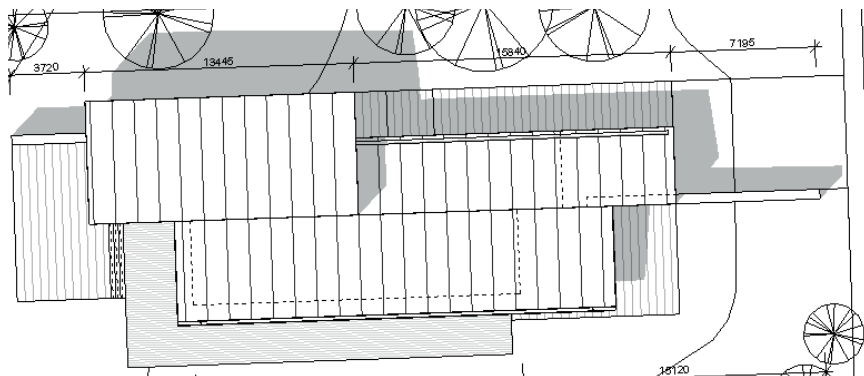


Figure 6.1.2
Location Plan with contour of the building perimeter

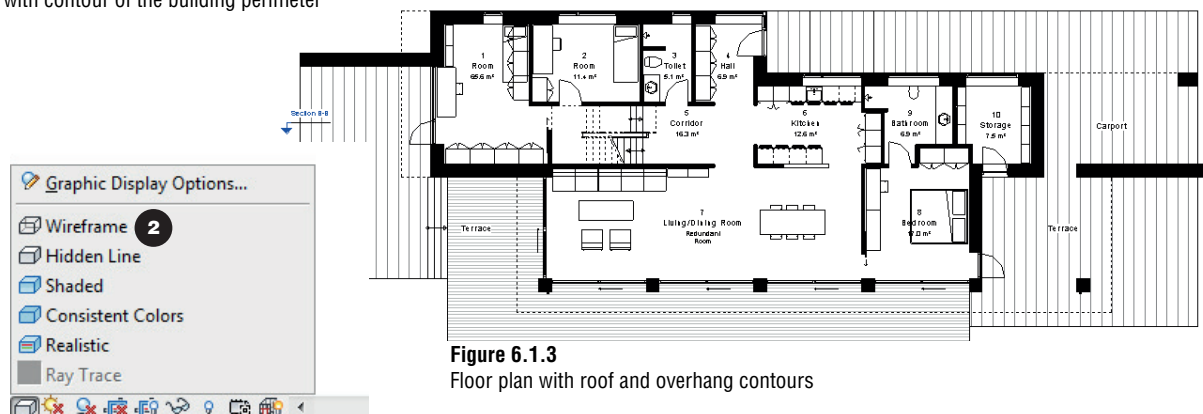
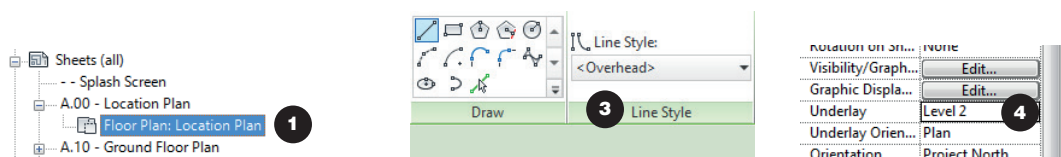


Figure 6.1.3
Floor plan with roof and overhang contours



PROCEDURE/ Adding contour lines

File: Revit Case Study 6.0 p99

1 Go to **Project Browser** > **Sheets** > **A.00 - Location Plan** and activate Floor Plan: *Location Plan*.

Draw Detail Lines

2 We cannot see through the roof. Set **Visual Style** to **Wireframe**.

3 Go to tab **Annotate** > **Detail Lines** and draw lines with Line Style **Overhead** on the external wall face. Reset Visual Style to *Hidden*. See Figure 6.1.2.

Add underlay

4 On the Ground Floor Plan we would like to see the contours of the roof edges. In the Project Browser, go to

Sheets > **A.10 - Ground Floor Plan** and open Floor Plan: *Ground Floor Plan*.

In Properties, set **Underlay** to **Level 2**. This will make the Roof edges visible.

Draw Detail Lines

Draw Detail Lines on the Roofs edges using Line Style **Overhead**. See Figure 6.1.3. Set the **Underlay** back to **None** when finished.

Underlay

Location Plan adjustments

Most of the new information to be shown in the Location Plan is generated automatically from the model. Only a few 2D lines needs to be added manually, and the north symbol must be adjusted.

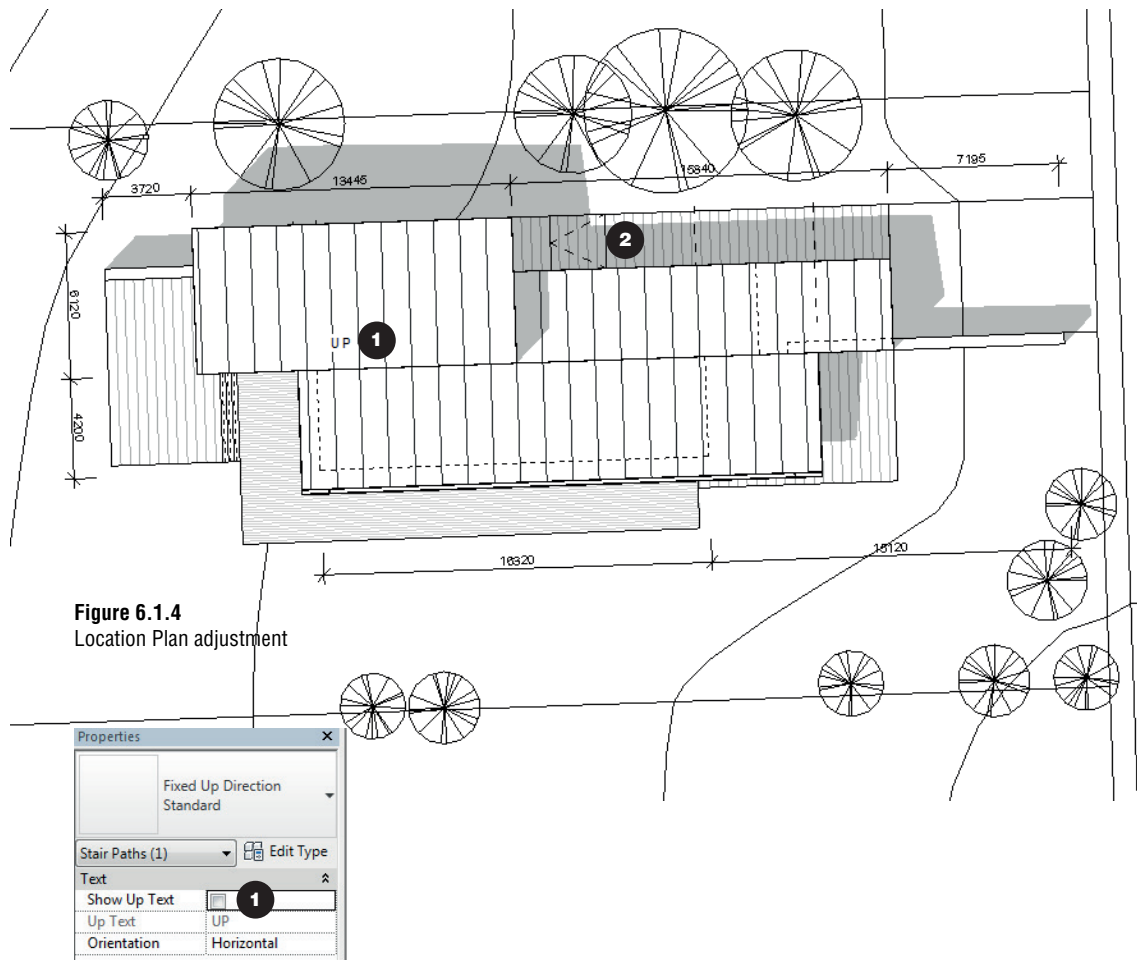


Figure 6.1.4
Location Plan adjustment

PROCEDURE/ **Adjusting the Location Plan**

Stair Path
North Arrow

Stair Paths

1 Stairs are by default shown with an UP symbol. Select the UP symbol and uncheck **Show Up Text**. Do this on both stairs.

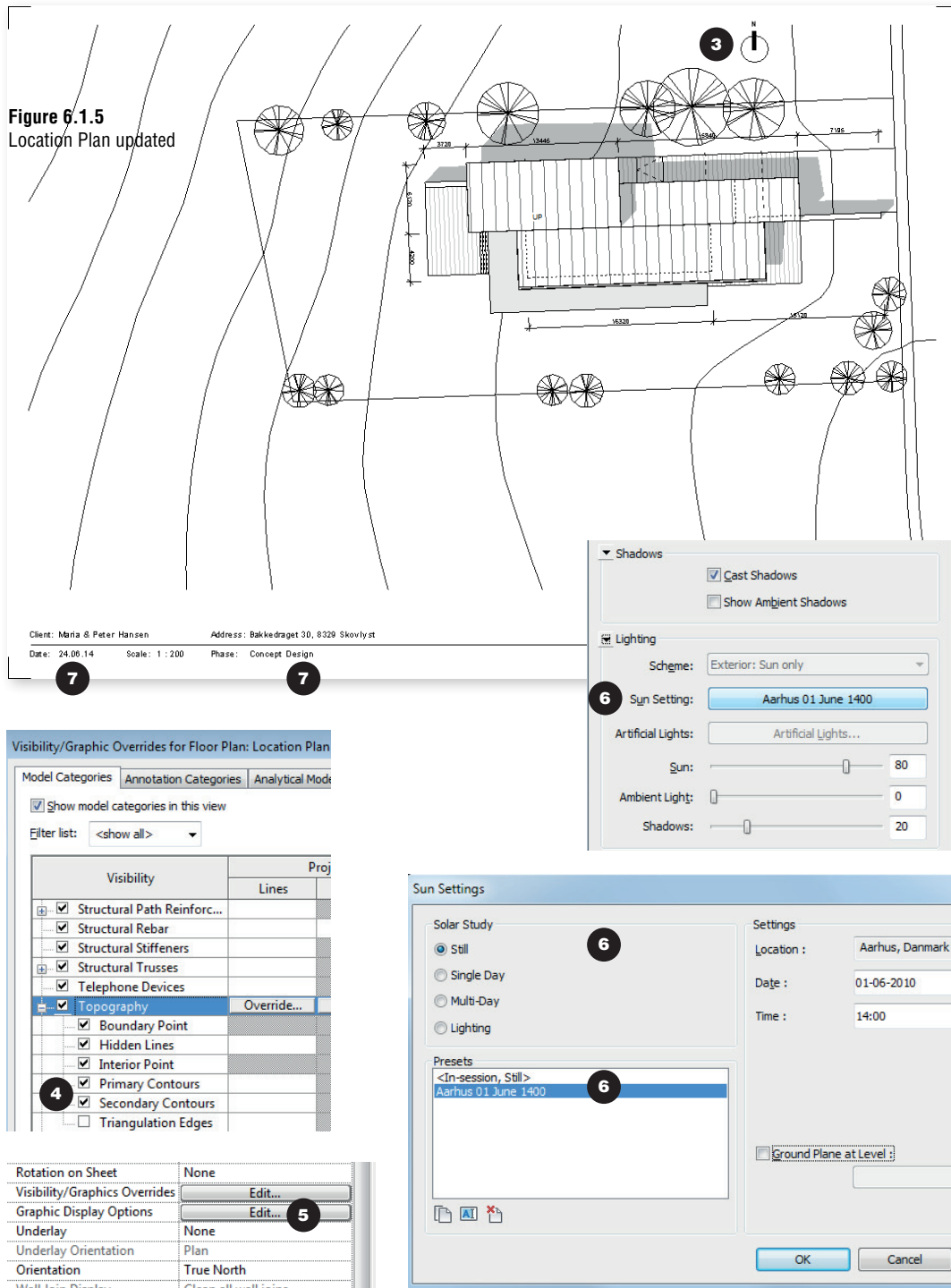
Slope indicator

2 Draw two Detail Lines on the sloped floor outside main entrance to indicate that this is a ramp. Use Line Style *Hidden*.

North arrow

3 In Chapter 4.1, you discovered that north is not precisely 0/360°. On Floor Plan *Location Plan*, **Orientation** must be set to *True North*. Check that the North Arrow symbol is straight up (0/360°). If not, Rotate it.

Figure 6.1.5
Location Plan updated



Edit Topography

4 Go to **Visibility Graphic Overrides (VG)** and open Model Category Topography. Check that **Primary Contours** and **Secondary Contours** are On.

Edit Sun Settings

5 Check that the sun/shadows settings are correct for the view. No view template is applied for the view, therefore click **Edit Graphic Display Options**.

6 Click **Sun Settings**. Check that Solar Study is set to **Still**. The Preset **Aarhus 01 June 1400** is active. Ground Plane at Level is *unchecked*.

Edit Sheet Data

7 Go to Sheet *Site Plan* and set **Phase** to *Concept Design 2*. Because this is a Project Parameter, it will be applied to all other Sheets. Set **Date** to current date. This will only be applied to this sheet.

Sheet Data

Floor Plan adjustments

Apart from adjusting the Ground Floor Plan, a drawing with the Floor Plan of the upper storeys need to be added to the project.

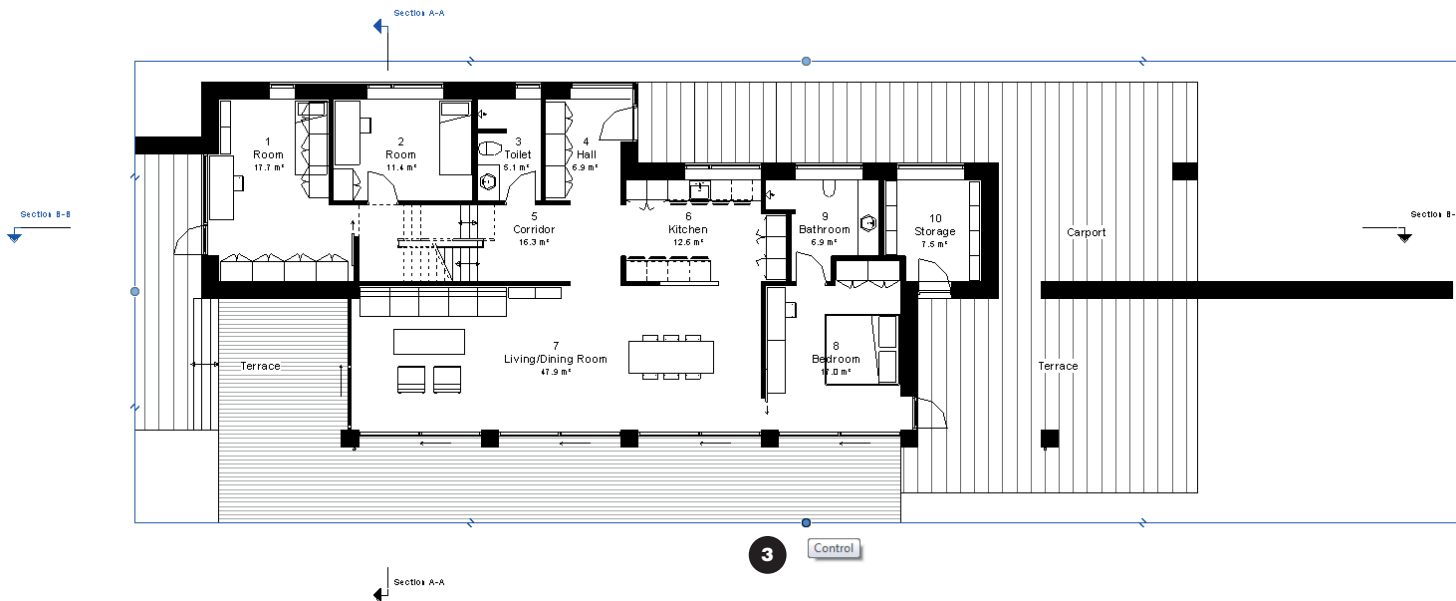


Figure 6.1.6
Adjusting Crop Region



PROCEDURE/ Adjusting Floor Plans

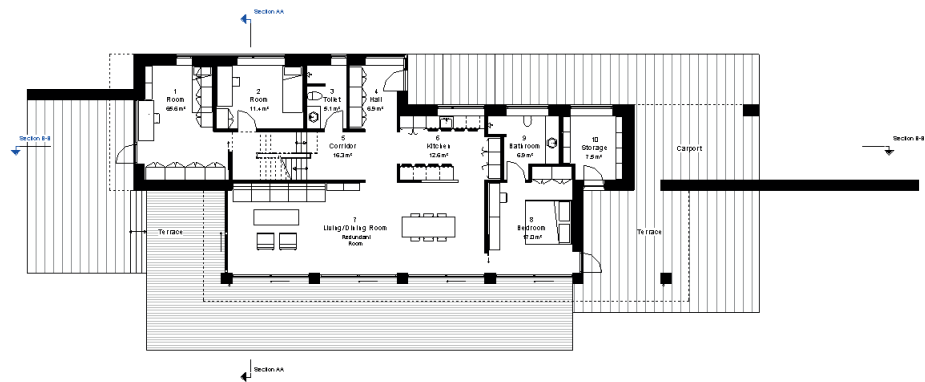
Adjust Crop Region

1 Go to **Project Browser > Sheets > A.10 - Ground Floor Plan** and open *Floor Plan: Ground Floor Plan*.

2 Click **Show Crop Region**.

3 Drag the **Controls** to resize the Cropping to make sure everything is visible.

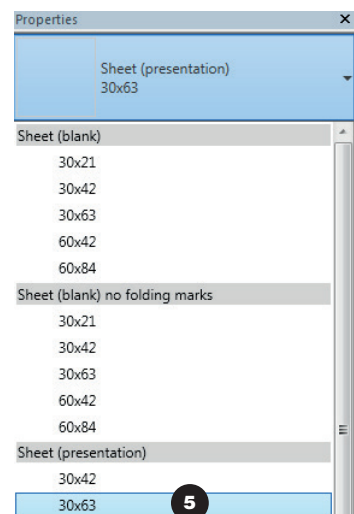
4 Hide Crop Region again.



Client: Maria & Peter Hansen Address: Bakke draget 30, 8320 Skovlyst
Date: 18.03.14 Scale: 1 : 100 Phase: Concept Design

Ground Floor Plan
A1.10

Figure 6.1.7
Ground Floor Plan after adjustment



Hide Objects

Go through the Plan View and hide objects that are not relevant:

- UP Symbol (stairs)
- Trees
- Elevation Arrows
- WIP Sections
- Etc.

5 Go to the Sheet A.10 *Ground Floor Plan*. Since the building had grown because of the garden wall towards west, the paper size increase. Select the Titleblock and select a bigger one; 30x63. Place the View so everything is inside the frame of the Sheet. See *Figure 6.1.6*.

Floor Plan - upper levels

Set up a new sheet showing the upper levels, using methods introduced previously.

Section adjustments

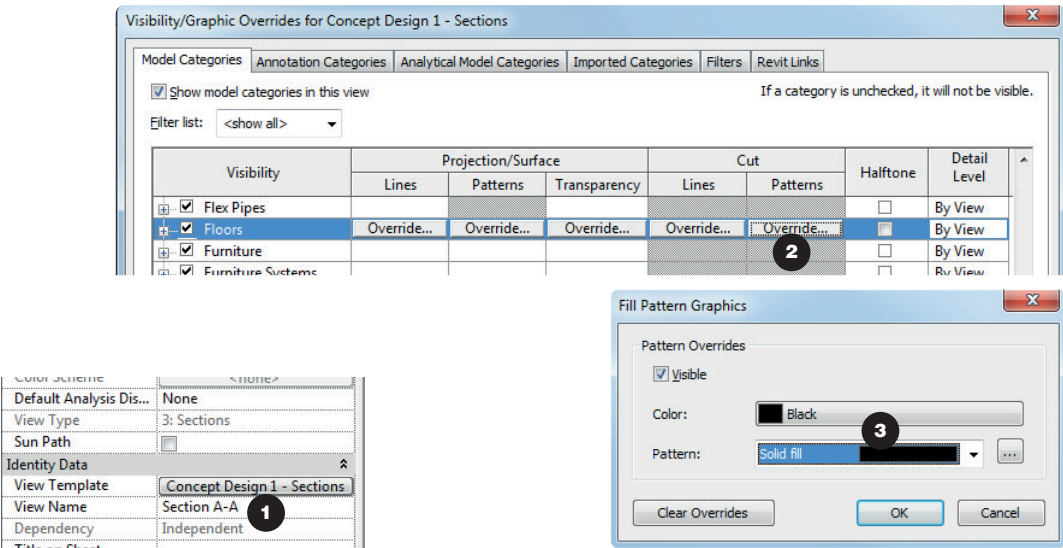
Like previously discussed, we optimized Views to display cut faces of building elements in black at the stage of concept design.

For the preliminary drawings generated in chapter 3, two methods were introduced:

- Controlling Cut Pattern by **Type** by setting **Coarse Scale Fill** to black in Type Properties.
- Controlling Cut Pattern by **View Template**

While the former method is slightly more simple, we will prefer the latter from this point, as it makes it easier to make changes.

Here, it is assumed that a View Template for the output Sections is already set up. Some changes need to be made to this Template, so it also controls the Cut Patterns of relevant building elements.



PROCEDURE/ Adjusting Sections

Overriding Cut Pattern

1 Go to **Project Browser > Sheets > A.20 - Sections** and open **Section A-A**. Turn on Crop. Resize Crop and hide Crop. Edit **View Template Concept Design 1 - Sections**.

2 Click **V/G Overrides Model**. While holding the **CTRL** select; **Floors, Roofs, Stairs, Walls** and click **Override**.

3 Set the **Override Color** to **Black** and **Pattern** to **Solid Fill**. The **Coarse Fill** will now be set to black in the four Categories.

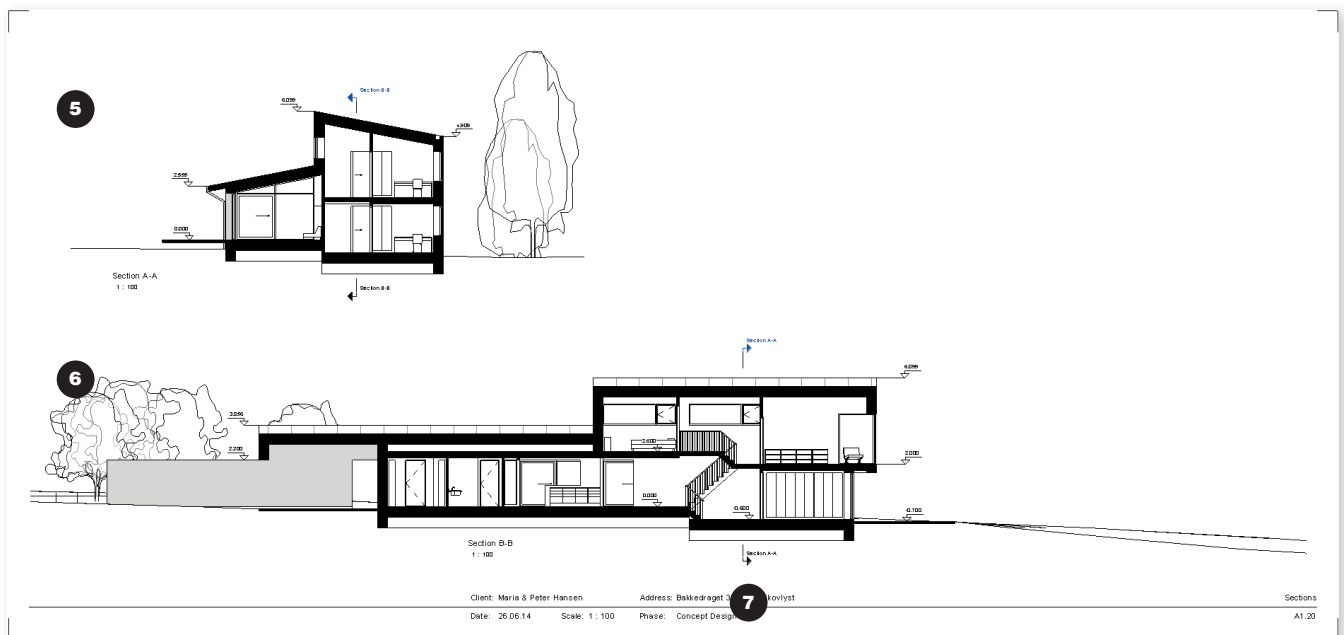
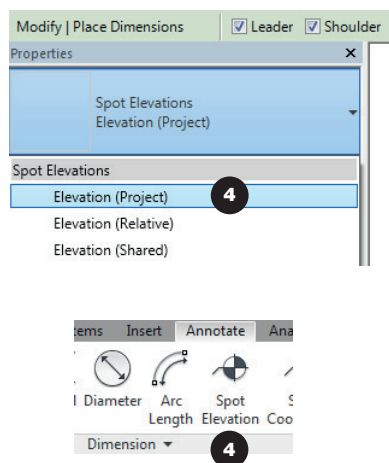


Figure 6.1.8
Sections arranged on Sheet



Spot Elevations

4 To add Spot Elevations, go to tab **Annotate** > **Spot Elevation**. Set Type to *Spot Elevation (Project)*. If you prefer to add Spot Elevation relative to the Survey

Point, set Type to *Shared* instead.

5 Add Spot Elevation to key points on *Section A-A*.

6 Make the same corrections to *Section B-B*.

Edit Titleblock

7 Select the Title Block and select the Sheet size used before.

Spot Elevation

Elevation adjustments

Like it was the case for the Sections, we will control as many settings as possible via View Template for the facade elevations

also, in order to automate adjustments as much as possible.

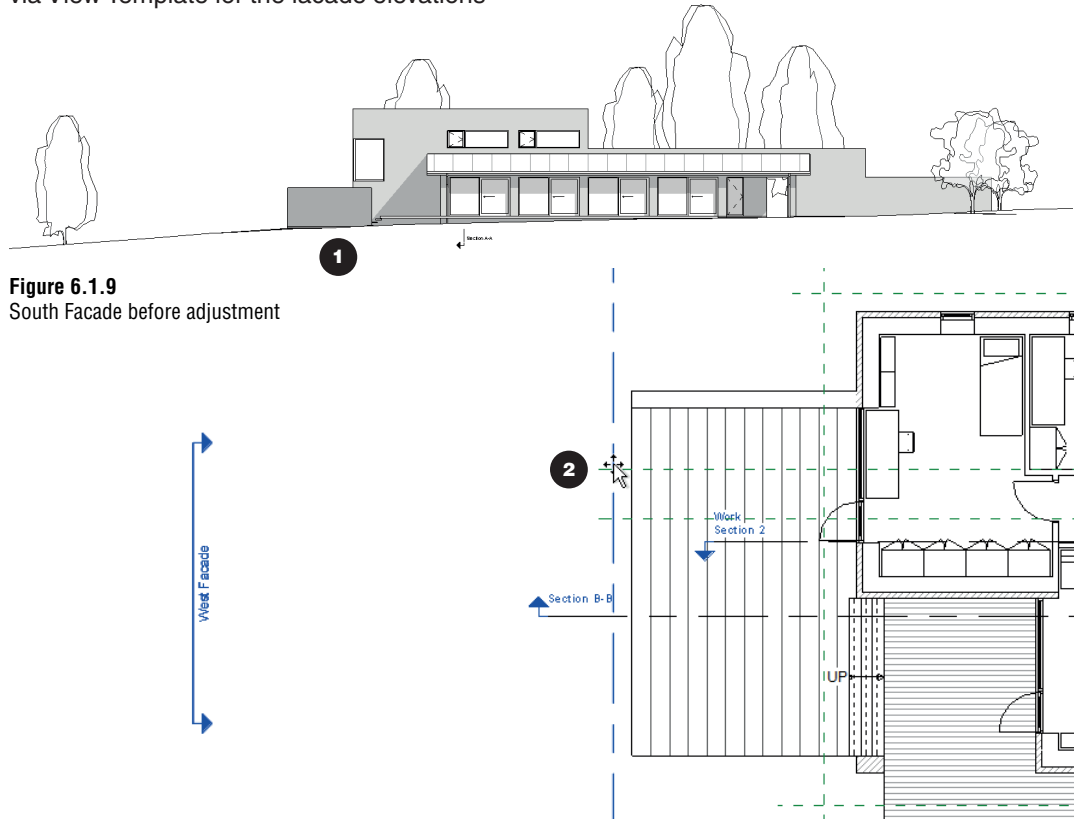
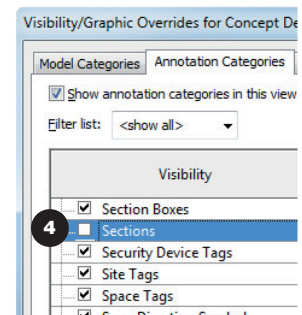
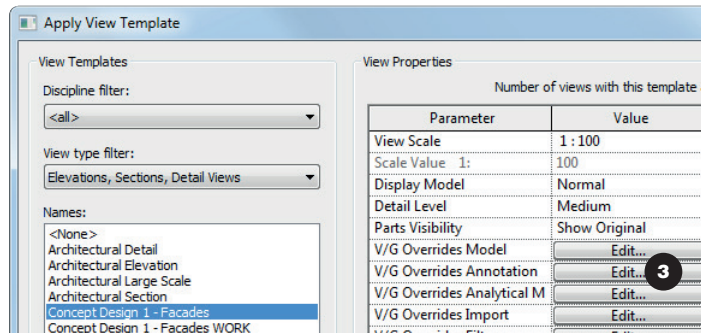


Figure 6.1.9
South Facade before adjustment



PROCEDURE/ Elevation adjustments

Adjust Crop

1 Go to **Project Browser** > **Sheets** > **A.30 - Facades South & West** and open **Elevation: South Facade**. Turn on **Crop**. Resize Crop and hide Crop again. Note that the Elevation Line cuts the garden wall.

2 Go to **Level 1** and select **West Elevation Line**. Move it to a position outside the garden wall.

Adjust visibility

3 Go to **West Facade**. Edit **View Template Concept Design 1 - Facades**. Edit **V/G Overrides Annotation**.

1 - Facades. Edit **V/G Overrides Annotation**.

4 Uncheck **Section visibility** to hide all section lines on all facades.

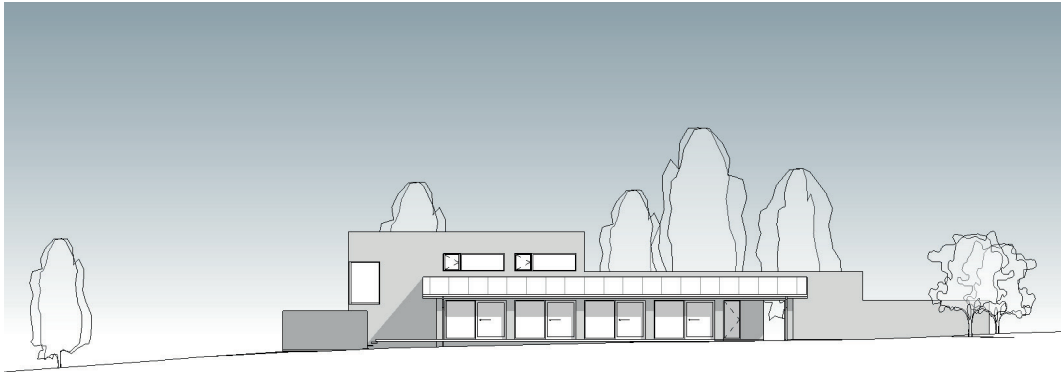
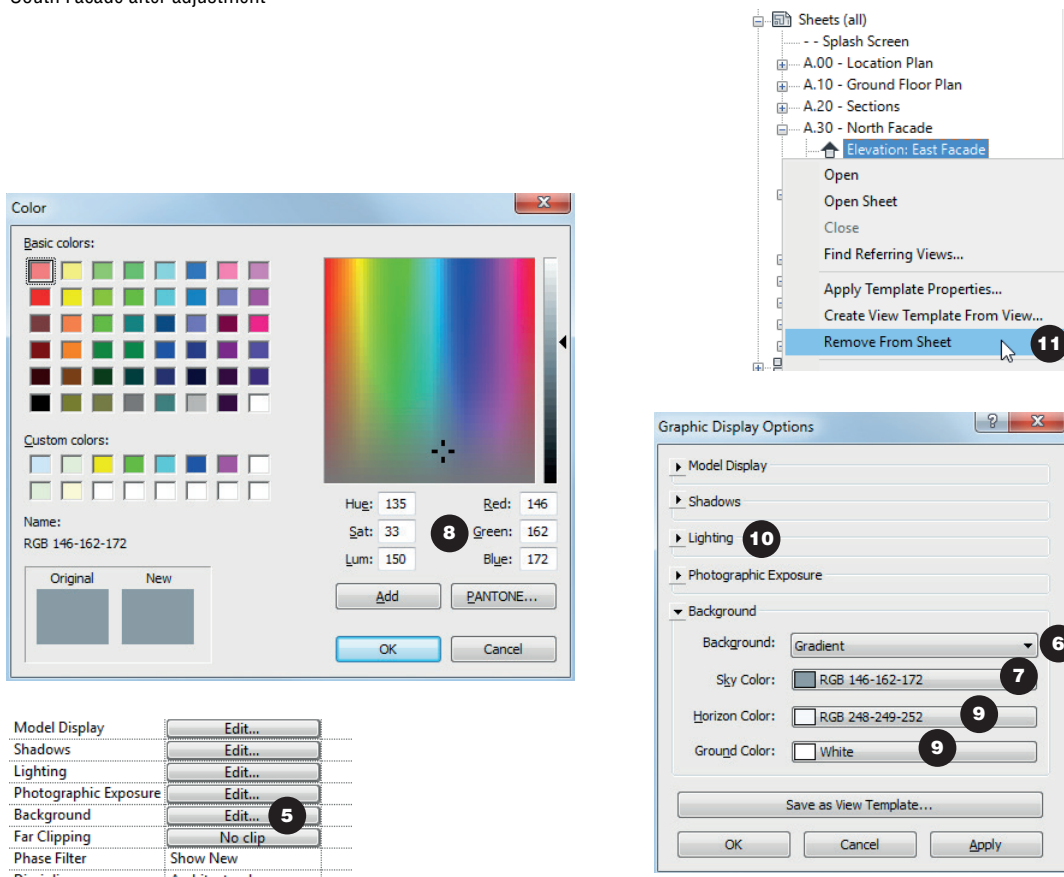


Figure 6.1.10
South Facade after adjustment



Adjust Background

5 Still in the View Template, click **Edit Background** to set a blue color as the sky:

6 Click on *Gradient* as the Background.

7 Click on **Sky Color**.

8 Set the Red, Green & Blue (RGB) to e.g. 146-162-172.

9 Set **Horizon Color** to e.g. 248-249-252. and **Ground Color** to *White*.

10 Check that **Lighting** is set to *In Session Lighting* on all Output facade Elevations.

Administrate Sheets

11 We will adjust each Sheet to show only one facade Elevation. *Right-click* on one of the Elevation Viewports on the Sheet. Select **Remove from Sheet**.

Create new Sheets and place the Elevations on the Sheet.

Background - Gradient

Perspectives

Due to the project changes, the visual appearance of the building has changed thoroughly. Therefore, we need to reconsider which Perspective Drawings to include in the project.

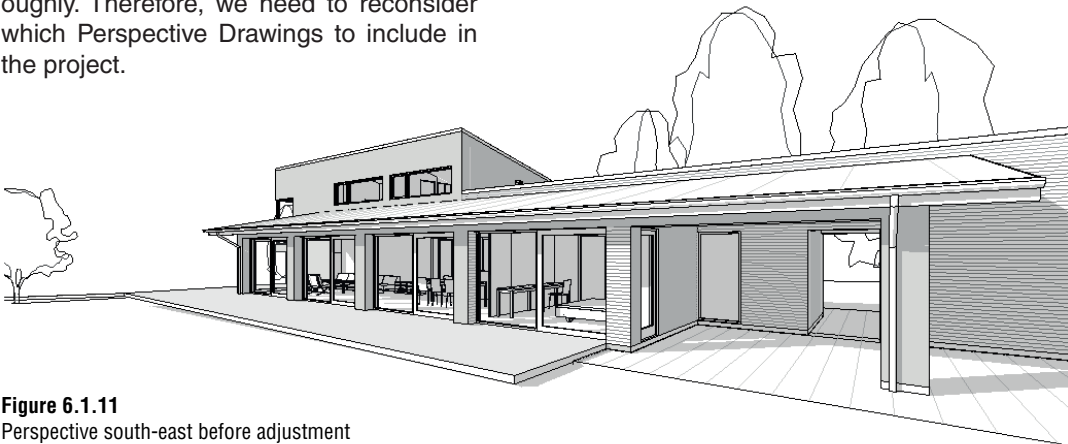
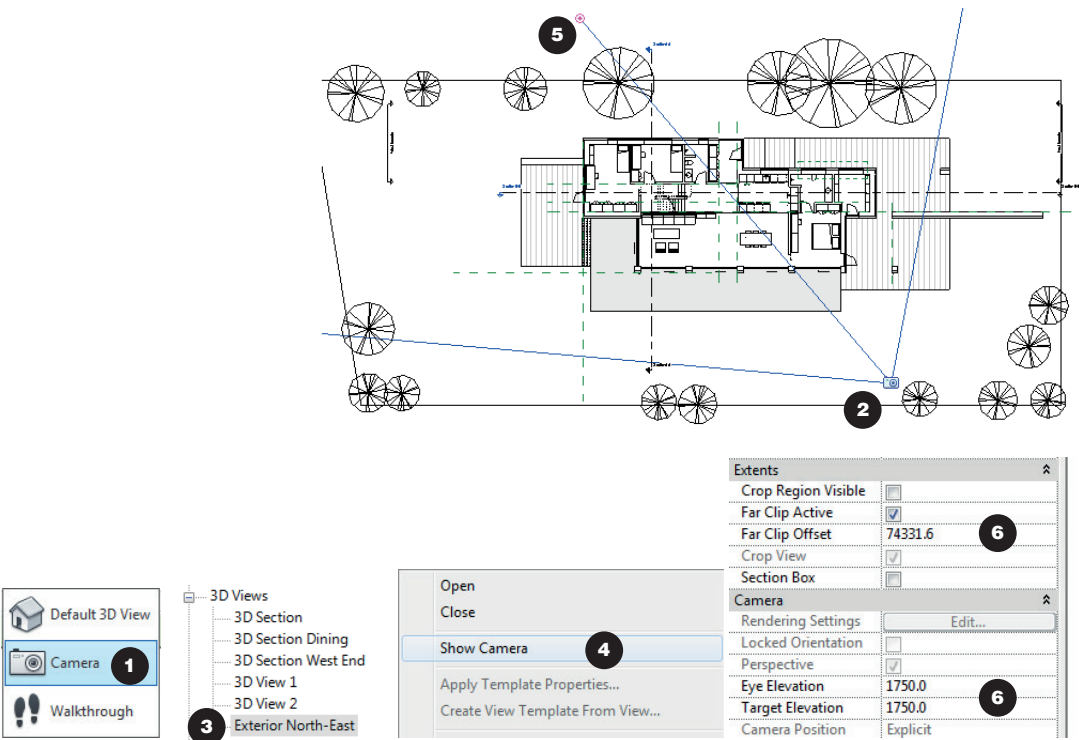


Figure 6.1.11
Perspective south-east before adjustment



PROCEDURE/ Generating Perspectives

Camera

Create New Camera

1 Create a new Camera showing the building seen from south-east. Go to Level 1 and tab **View > 3D View > Camera**.

2 Place the camera and set the target point.

Adjust Camera

3 Rename the new perspectives **Exterior South-East**. Go to Level 1. In the Project Browser right-click on a 3D Camera view.

4 Select **Show Camera**. You can then move the camera to a new position.

5 Or drag the target point to change the view direction.

6 Edit **Far Clip Offset** (distance to where elements become invisible) and set **Eye Elevation** and **Target Elevation** (measured from *Level 1*)

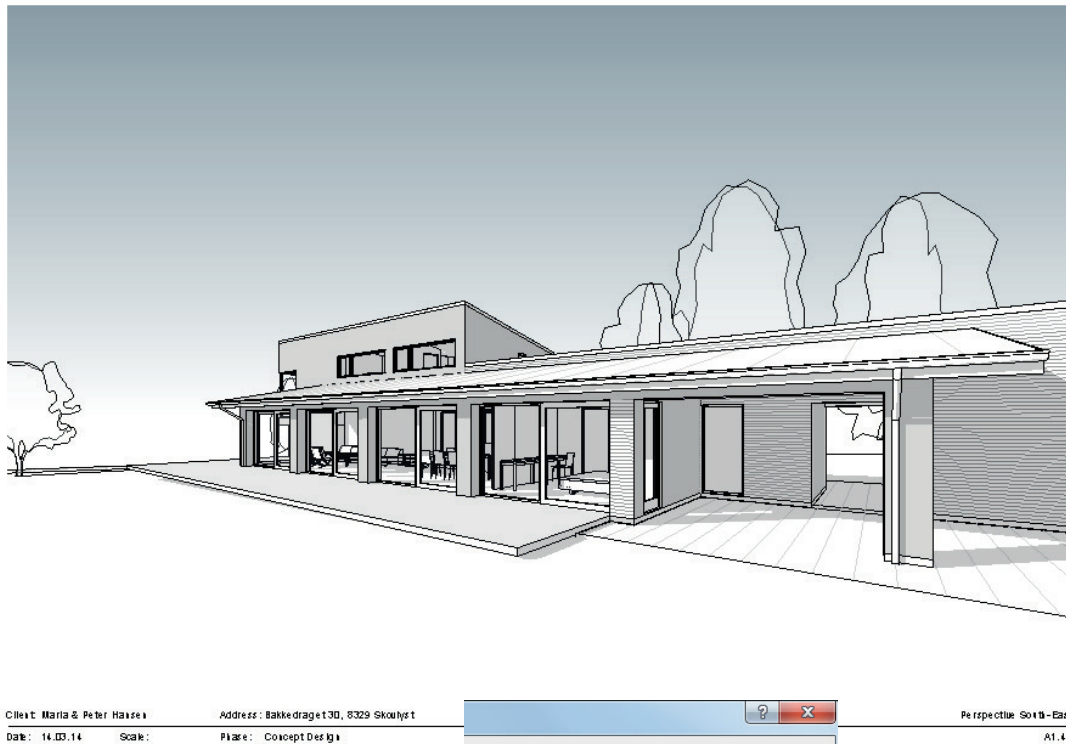
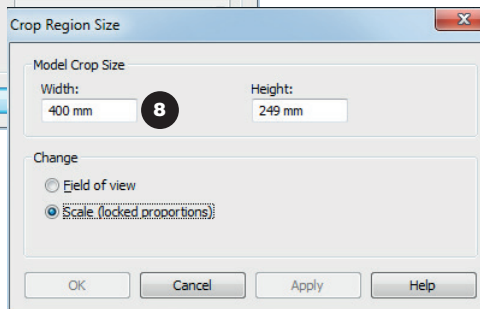
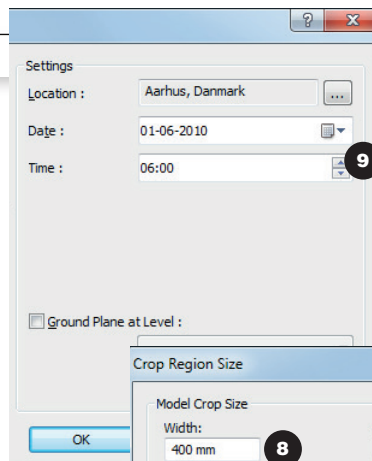
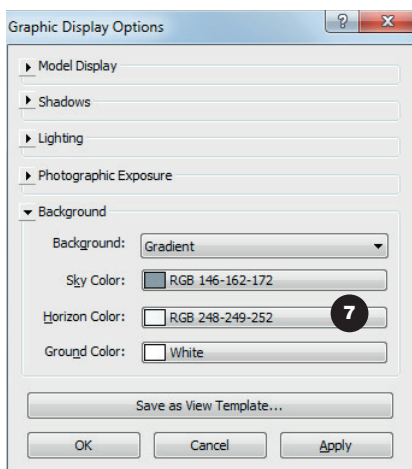


Figure 6.1.12
Perspective south-east after adjustment



Adjust Background

7 Go to the *Perspective South-East*. In the View Template set **Sky Background** to **Gradient** and adjust the Background colors as on the Output facade Elevations.

8 Select the Viewport to *Scale (Locked Proportions)*. Adjust the **Model Crop Size** to Width 400 mm. Hide the Crop.

9 Try out different lighting settings for each view.

6.2/ GENERATING OUTPUT

Sheet List

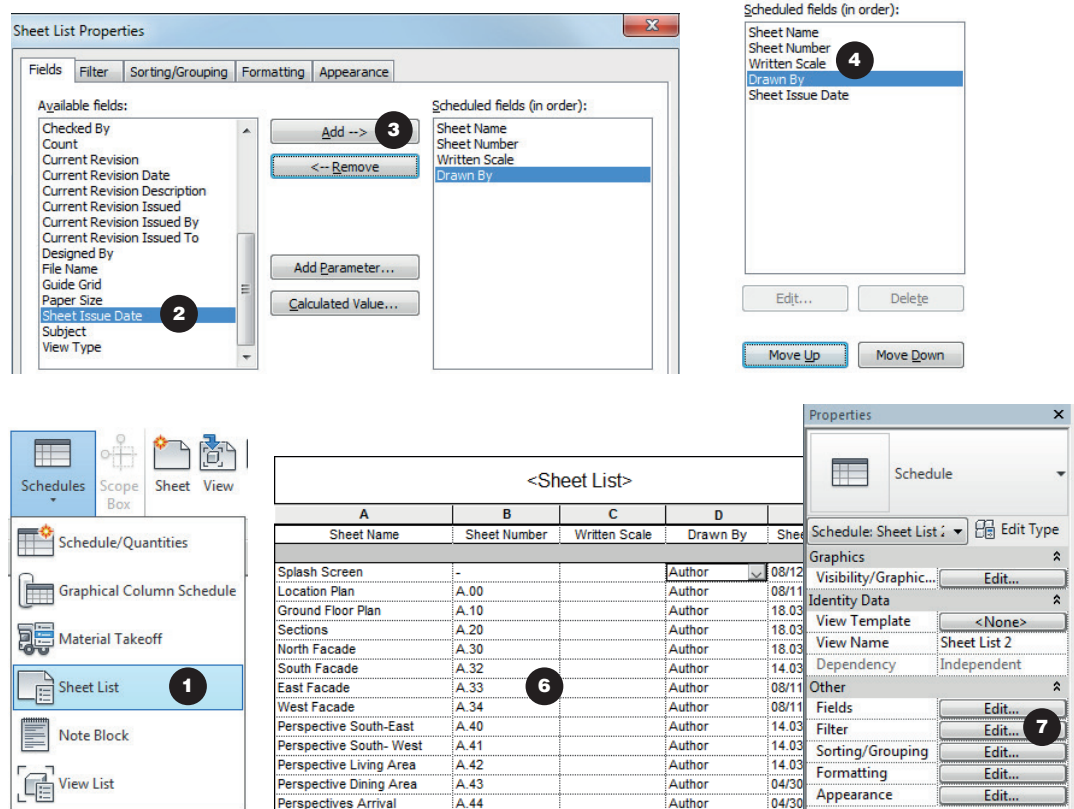
For a general overview of the drawings included in the project, we will generate a **Sheet List**. For this, a new View Family is introduced: **Schedules**.

Schedules are Views of the Building Model, displaying alpha-numeric information organized in data sheets (much like Microsoft Excel or similar software) instead of geometry.

Any Parameters existing in the project can be displayed in sheets: Window dimensions, Wall Areas, Room Areas etc.

In the later project stages, this will find a wide range of possible applications, and is at the core of the potential benefits of BIM method.

In this example, we will create a complete list of Sheets in the Project.



PROCEDURE/ Generating a Sheet List

Schedules

Create Sheet List

Sheet List

1 On the **View** Tab select **Schedules > Sheet List**.

2 Select a Field to be added to the Sheet List.

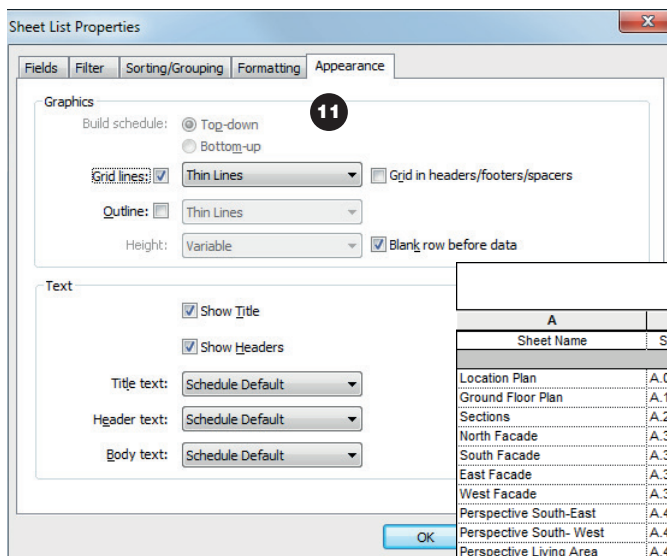
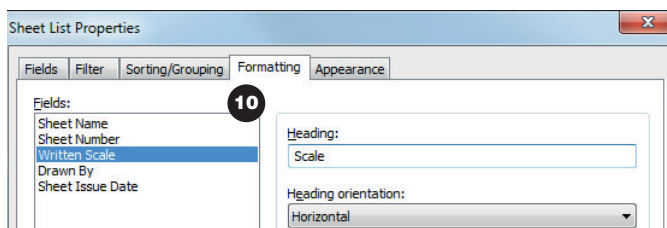
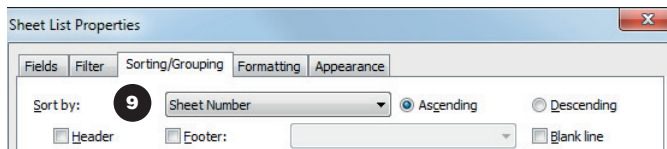
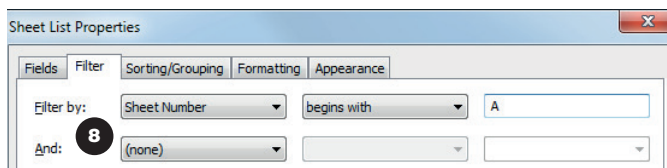
3 Click on **Add**.

4 Add these five Fields to the list in a random order (include **Sheet Issue Date**).

5 Order them by selecting a field and then select **Move Up** or **Move Down**. Click **OK** to finish.

6 First impression of the Sheet List.

7 In **Properties** click **Edit Filter**. This will open the Sheet List Properties again.



<Sheet List>				
A	B	C	D	E
Sheet Name	Sheet Number	Scale	Drawn By	Sheet Issue Date
Location Plan	A.00	1:200	NOC	11.08.16
Ground Floor Plan	A.10	1:100	NOC	11.08.16
Sections	A.20	1:100	ASR	11.08.16
North Facade	A.30	1:100	ASR	11.08.16
South Facade	A.32	1:100	ASR	11.08.16
East Facade	A.33	1:100	ASR	11.08.16
West Facade	A.34	ASR	ASR	11.08.16
Perspective South-East	A.40	NOC	NOC	11.08.16
Perspective South- West	A.41	NOC	NOC	11.08.16
Perspective Living Area	A.42	ASR	ASR	11.08.16
Perspective Dining Area	A.43	NOC	NOC	11.08.16
Perspectives Arrival	A.44	NOC	NOC	11.08.16

Edit Sheet List

8 We only want to have Sheets in the list beginning with the letter A (we do not want to add the Splash Screen). **Filter By: Sheet Number - Begin With - A.**

9 The Sheet List should start with the lowest number (A.00 - Location Plan). Click on the

Sorting/Grouping Tab. **Sort By: Sheet Number - Ascending.**

10 On the **Formatting** Tab you can adjust the headings (*Scale* instead of *Written Scale*).

11 **Appearance** Tab control borders and text in the list.

Changes will only be visible when Sheet List is placed on a Sheet. Click **OK** to finish.

12 The last three Columns are writeable fields. Note that once you have written something in a field, it can be selected by the drop down.

Sorting/Grouping

Export to Design Review

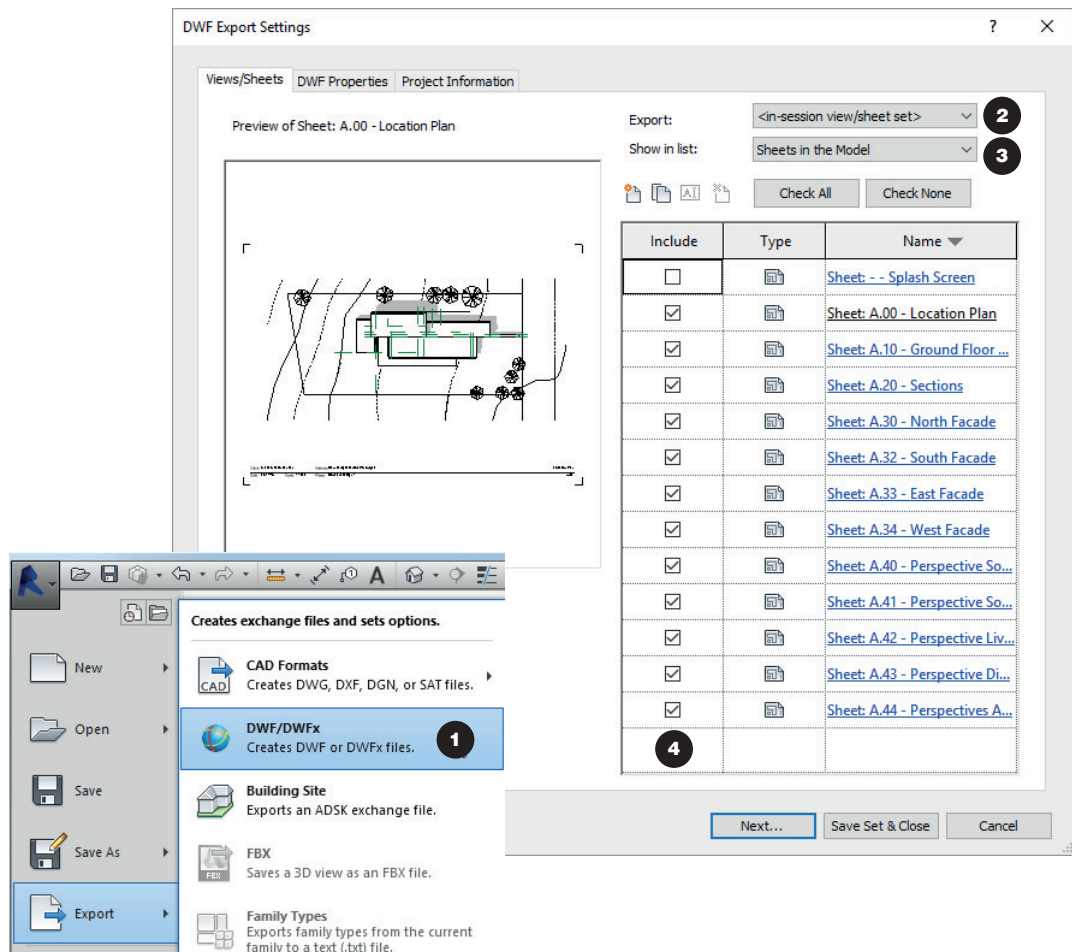
DWF™ is Autodesk's method of publishing design data. It allows for an easy-to-handle 3D model to be distributed for reviewing. For 2D Views, it offers an alternative to printing to PDF.

Software for viewing a DWF file containing a 3D model and/or 2D Views is free, but not as widespread as PDF viewing software.

Like PDF, DWF is a locked file format, but there are a number of advantages such as:

- Measure. Snap to objects.
- Mark Up. Add comments for design changes etc.
- Object Info. Quantities and areas.

The file size of DWFs is small compared to Revit project files, making it easy to distribute by email.



PROCEDURE/ Exporting to Design Review

Export DWF

Export type

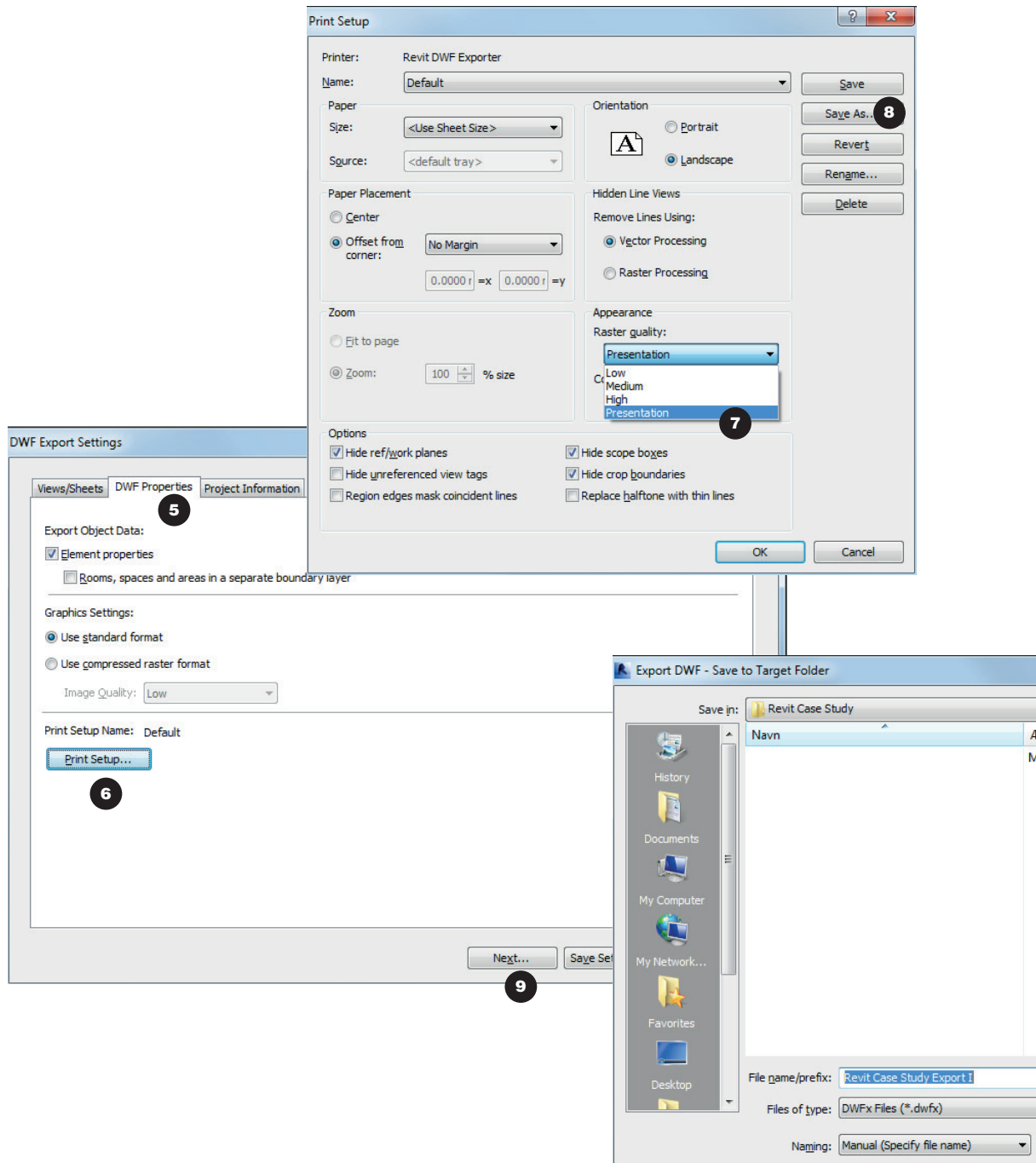
1 Go to **Application Menu > Export > DWF/DWFX**.

What to Export?

2 On the Views/Sheets tab and Export menu, select **<in-session view/sheet set>**

3 In the Show in List menu select; **Sheets in the Model**.

4 In the **Include** column, check the Sheets you want to export.



Export Settings

5 Select the next Tab; **DWF Properties**.

6 Click **Print Setup**.

7 Set the **Raster Quality** to **Presentation**. Click **OK**.

8 Click **Save As** to save the settings for future DWF Export.

Save DWF

9 Click **Next...** and save the DWF on your computer. If the exported file fail to open when you double-click it, you probably need to install a free copy of Autodesk Design Review on your PC.

appendices

A

Appendix: the context

SITE

The surroundings of the building are important design parameters.

In order to deal with these and let them inform and enrich the project, it is necessary to feed the project with information.

This appendix is dealing with setting the context. We will create a **Site Survey model**, containing the most relevant information regarding the existing conditions:

- *Location* - the whereabouts in the world
- *Orientation* - the corners of the world
- *Terrain* - elevations, slopes, height above sea level
- *Landscaping* - existing plantation etc.
- *Existing buildings* (if any)

Being able to see more accurately how the building is set in its surroundings may - and should - in turn affect the building design.

In this appendix, two common alternative methods of establishing a Site Model in Revit are introduced:

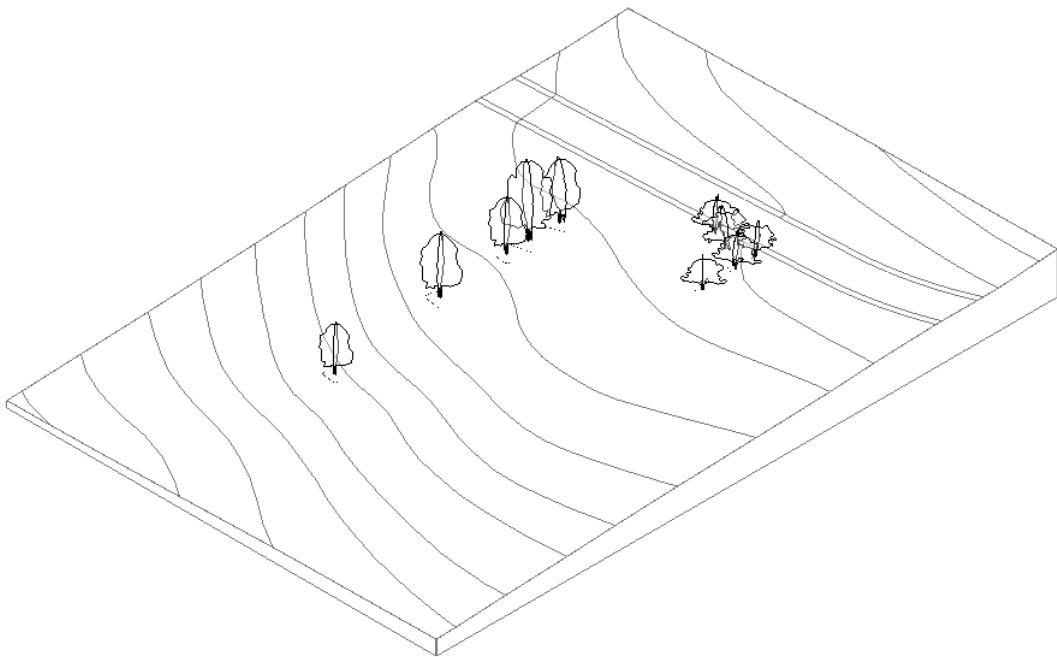
A1: Generating a Site Model based on a digital 3D survey in AutoCAD format (.DWG) as often provided by for example a professional land surveyor.

A2: Modeling a Site Model based on a scanned hard copy survey or a screenshot from a web page (JPEG, PNG or PDF format).

Decide which of the procedures to follow, and start in either section **A1** or **A2**.

Alternatively, try first the one method, then the other.

Following any of the two procedures, the result will be a Site Model of the existing conditions to be finalized in section **A.3**, and finally to be combined with the Building Model in chapter **4.1**.



A.1/ SITE FROM 3D CAD FILE

In this section, it is assumed that a professional digital CAD-file with site information is available.

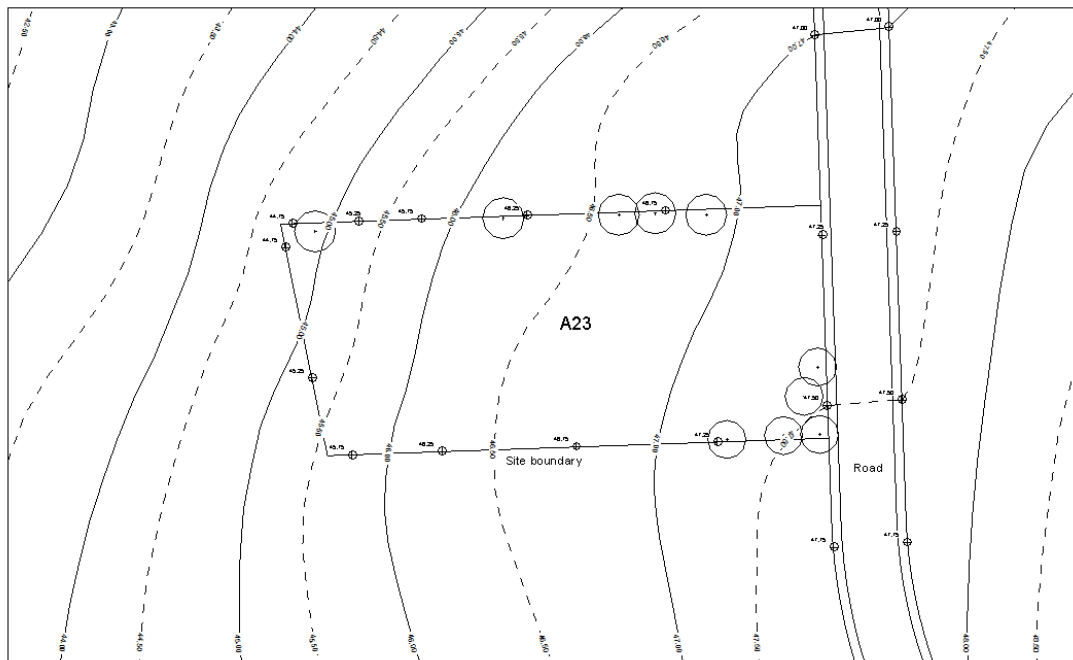
Most land surveyors will be able to supply a digital file in AutoCAD format (.DWG). Files from a surveyor will most often be formatted with units in *Meters*.

For the purpose of this exercise, a survey model named *Revit Case Study SITE SURVEY CAD* is supplied for download on *BIMbogen.dk*.

Before starting, download the file, unpack and save to your project folder.

OVERVIEW/ **Generating site from linked 3D CAD file**

- Set up Site Survey Model
- Link CAD file
- Generate Toposurface from link
- Generate Property Lines
- Generate Subregions



Set up the Site Survey Model

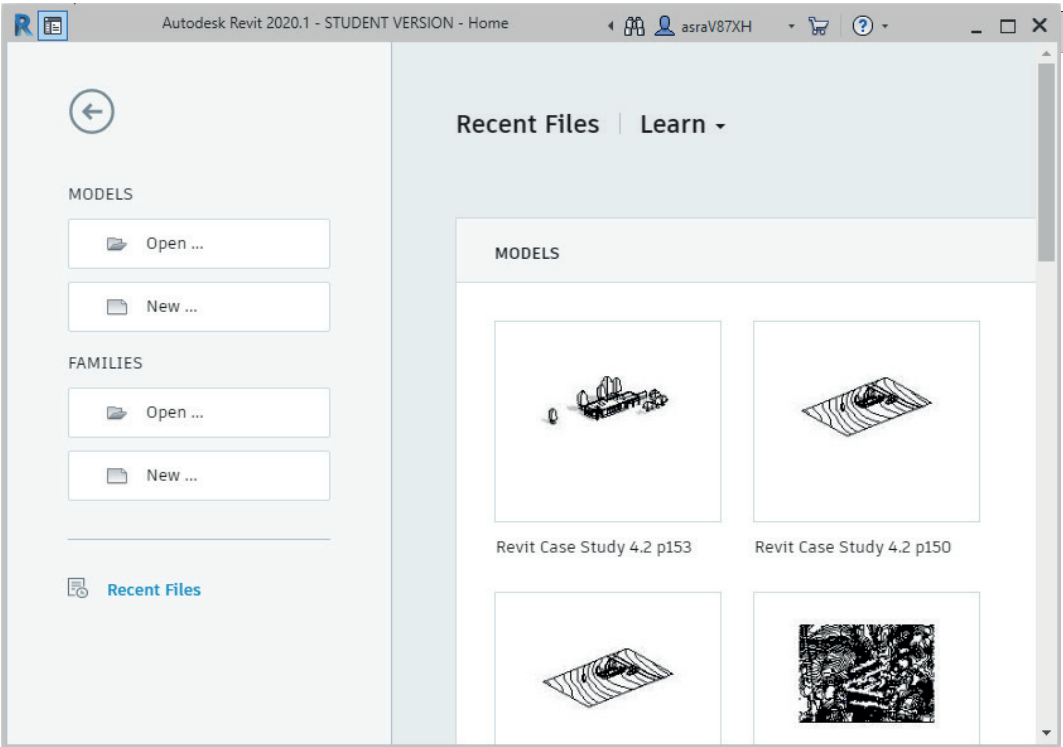
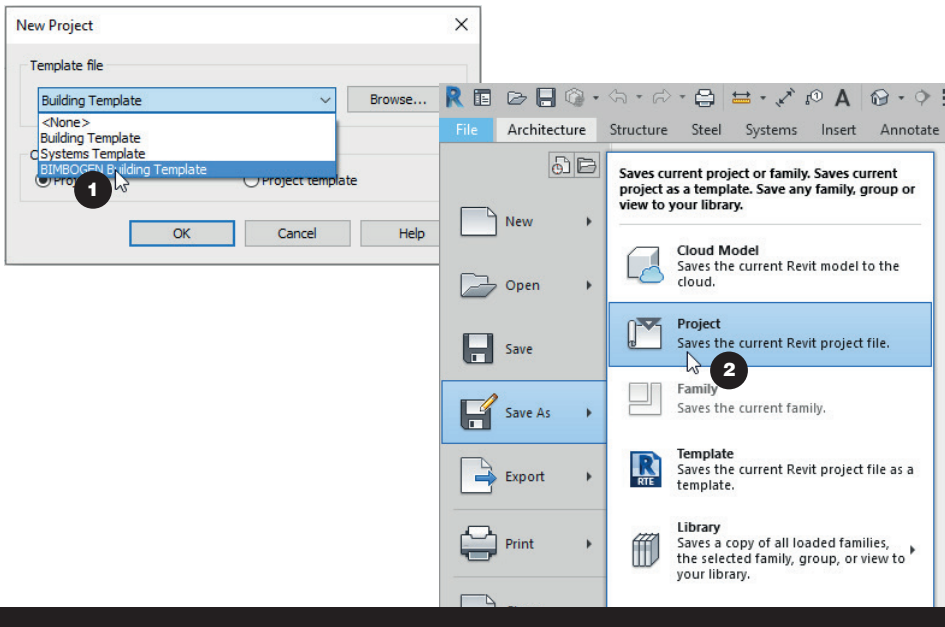


Figure A.1.1
Revit Home Screen



PROCEDURE/ Setting up Site Survey Model

Create new Model

Close any open Views to go to the **Revit Home Screen** (see Figure A.1.1).

1 Click on New > *BIMBOGEN Building Template* to create a new Project.
If your home screen does not display this Template, return to chapter 1.2 for instructions on how to add it.

2 In the **File Tab**, **Save As** a *Project* in your project folder, naming it '*Revit Case Study SITE SURVEY*'.

New Project

Save As

Information flow within and across platforms

Like any other professional CAD-tool, Revit can handle communication across digital platforms as well as transferring information from one Revit file to another.

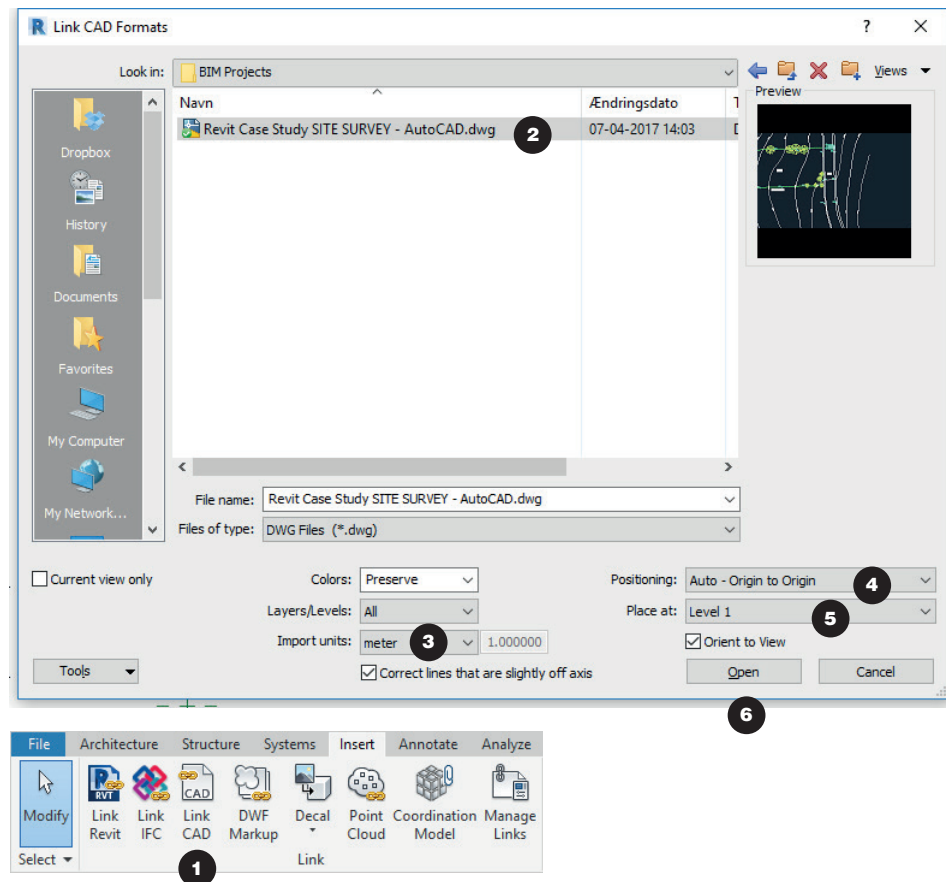
Some key concepts are:

EXPORT: To translate a Revit file - or a part of its information - to a new file with a format that can be handled in other Revit files or by other programmes.

IMPORT: To integrate information from a file formatted for use by Revit or other programmes into a Revit file.

LINK: To make information from another file - Revit or other - available inside a Revit Model by representation (not integration as when importing).

Linking, Importing and Exporting information between different CAD-programmes and converting between file formats native to different digital environments is a natural part of a modern BIM-workflow.



PROCEDURE/ Linking AutoCAD file into Revit

Link CAD

Link CAD

In Revit, go to the Project Browser and activate the Site View by double-clicking it.

1 In the Insert Tab, click **Link CAD**.

2 Browse to the folder where you keep the unzipped AutoCAD file *Revit_Case_Study_SITE_*

SURVEY_CAD and click on the file.

3 Set **Import units** to *meter*.

4 Set **Positioning** to *Auto - Origin to Origin*.

5 Set **Place at** to *Level 1*.

6 Click **Open** to link the AutoCAD file.

Review link

In the Project Browser, open the {3D} View to see the content from the linked file. Check if the Contour Levels seem to be placed in roughly the correct Z-height. See Figure A.1.2.

Generate topography from linked file

In Revit, terrain is modeled as a **Toposurface** - a surface defined by any number of points in three-dimensional space. For further explanation and how to model it from scratch, see A.2/ *Site from 2D file*. Revit can automatically generate a Toposurface from 3D topographical information in a linked file created in another CAD environment, in this case from AutoCAD.

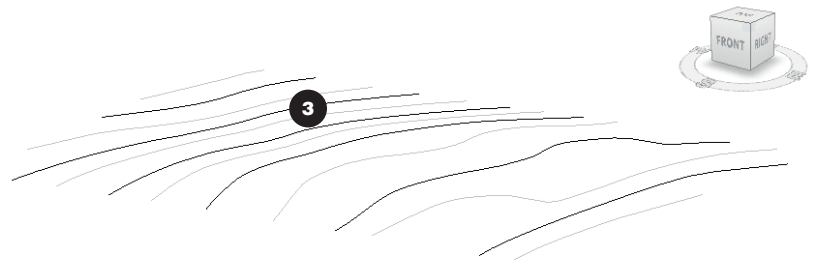


Figure A.1.2
Linked CAD file

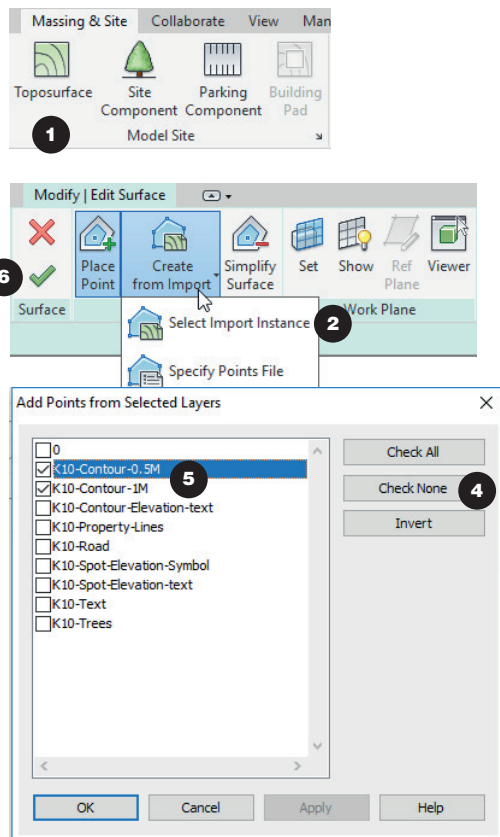


Figure A.1.3
Revit Toposurface

PROCEDURE/ Generating Toposurface from link

Create toposurface

- 1** In the **Massing & Site** Tab, start the **Toposurface** command.
- 2** Click **Create From Import** > **Select Import Instance**.
- 3** In the Drawing Area, click on the linked file.

- 4** Click **Check None** to deselect all layers.
- 5** Select these two layers (holding the terrain contours) to generate the toposurface from them. Click **OK**.
- 6** Click **Finish Surface**.

Review Toposurface

Navigate to check if the toposurface has been generated as seen in Figure A.1.3.

Toposurface, Create from Import

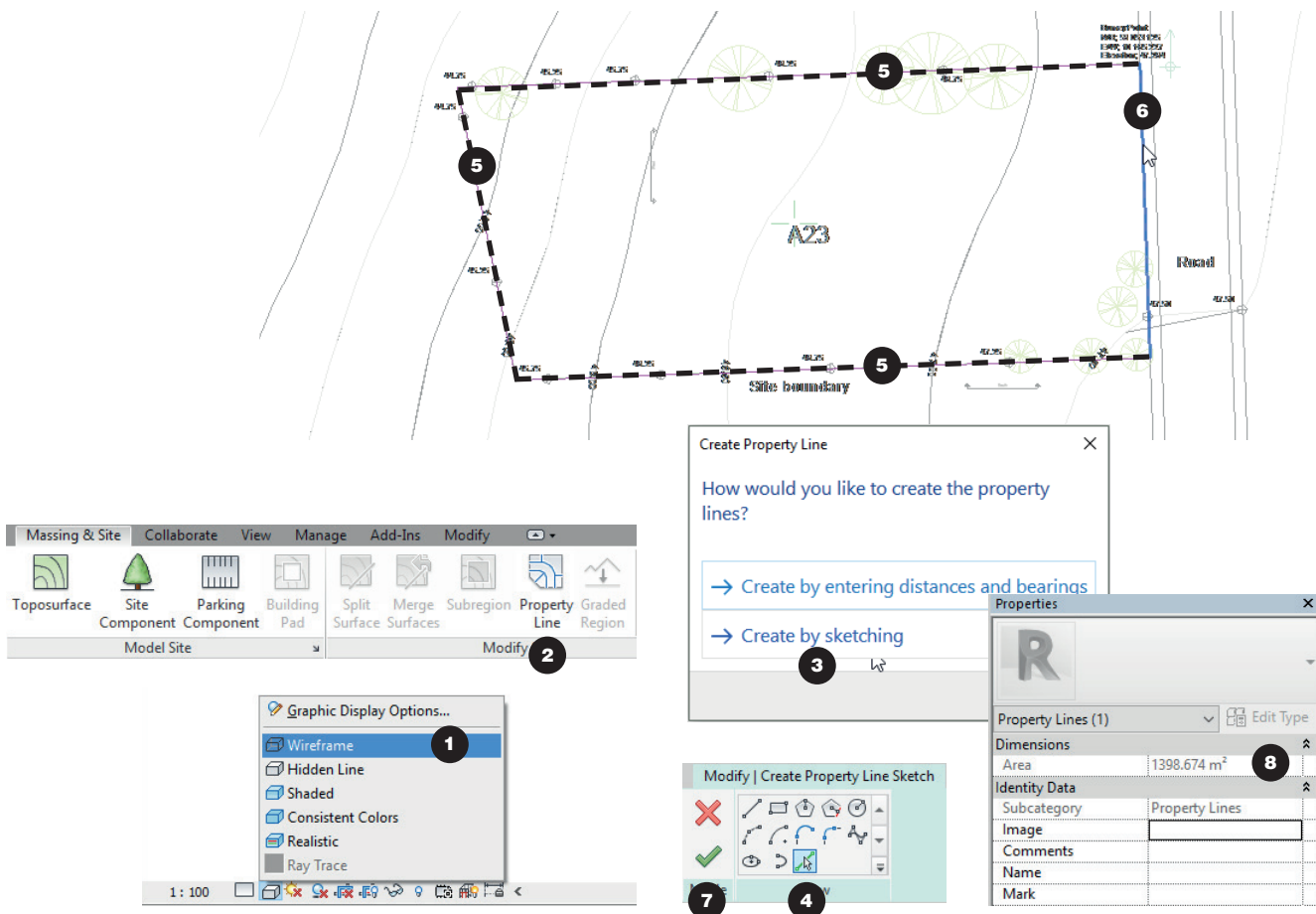
Generate more data from linked file

We will exploit further, that Revit understands the linked material. This means that we can generate objects in their exact positions from the survey file, without risk of imprecision and without losing data. Here, we will use this to create the property boundary and the road in their exact locations. To show roads, sidewalks, paved areas or

other differences in surfaces within a Toposurface, we use the tool **Subregion** to subdivide the Toposurface.

A Subregion forms part of a Toposurface, but can be assigned its own properties, differing from the rest of the Toposurface.

The boundaries of a Subregion are defined in Edit Mode using the drawing tools normally available here.



PROCEDURE/ Generating Property Line from linked file

Property Line

Preparations

Go to Plan View *Site*.

1 In the View Control Bar, set **Visual Style** to **Wireframe**.

Sketch Property Line

2 To define the boundary of the property, go to the tab **Massing and Site** and start the **Property Line** command.

3 Select **Create by sketching**. You are now in **Edit Sketch Mode** and can use the drawing tools normally available here.

4 Create the Property Lines using **Pick Lines**.

5 Click on these three lines.

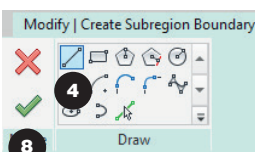
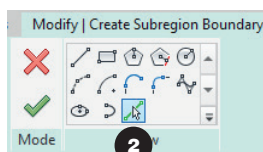
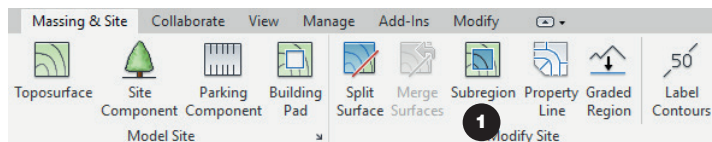
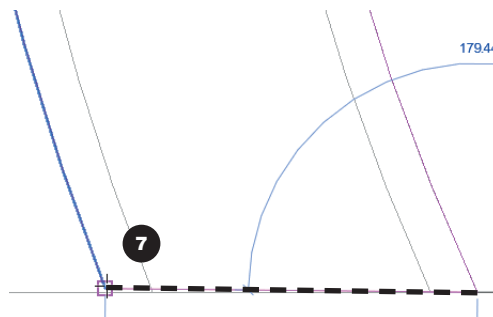
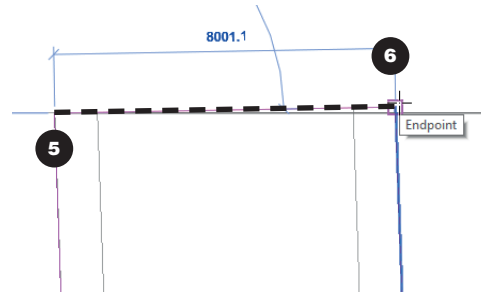
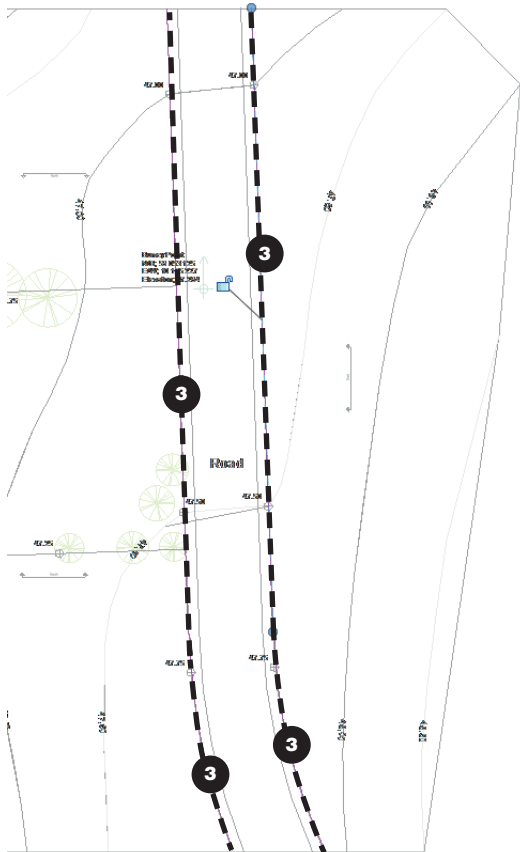
6 To generate the Property Line along the road, hold the cursor over the boundary and

click **TAB** to cycle through available lines. When the boundary is highlighted, pick it.

7 Click **Finish Edit Mode** in tab **Modify...** the Property Line is now finished.

Area check

8 Select the **Property Line**. In **Properties**, check if the **Area** is roughly as expected.



PROCEDURE/ **Generating Subregions from linked file**

Go to Plan View *Site*.

Sketch Subregions

1 Go to the tab **Massing and Site** and start the **Subregion** command.

2 Again, select the **Pick Lines** drawing tool.

3 Pick these four lines.

4 The Subregion must be a closed loop of lines. Pick the **Line** tool.

5 Move the cursor over this line end. Press TAB until **ENDPOINT** shows in the display, then click to start drawing a line from here.

6 Hold the cursor over this endpoint and press TAB until

ENDPOINT appears, then click to finish the new line here.

7 Repeat action in the other end.

8 Click **Finish Edit Mode** to finish creating the Subregion.

Proceed now to section A.3.

Subregion

A.2/ SITE FROM 2D FILE

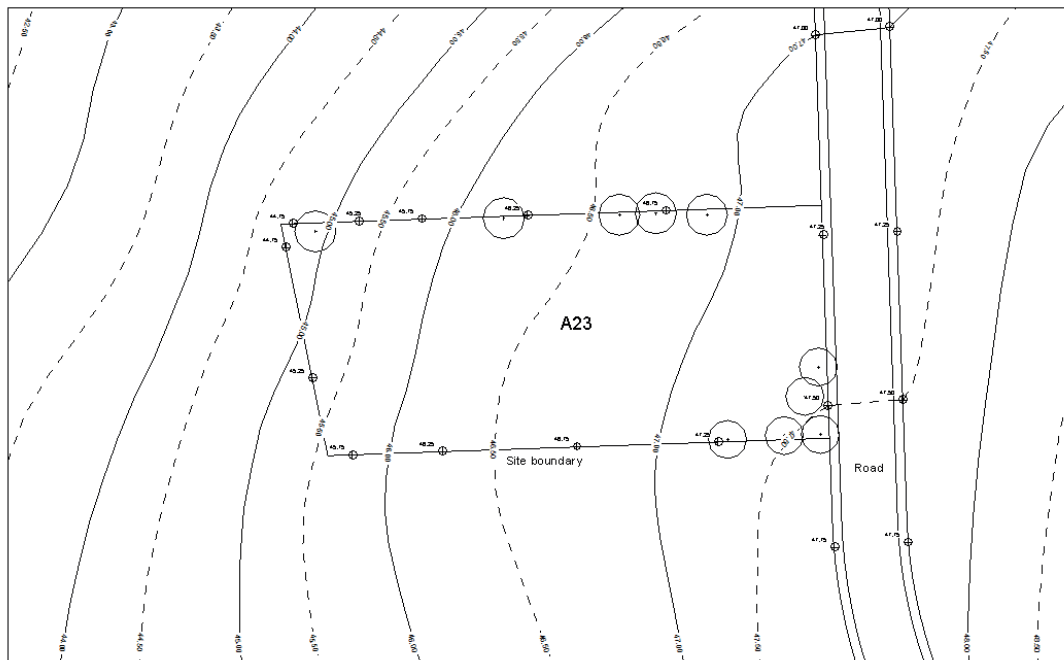
In this section, it is assumed that no digital 3D information about the building surroundings is available. This we need to establish ourselves, and in order to do so, we need to first establish reliable 2D information within a Revit Model.

In many projects, a 2D land survey plan with information about point elevations, property boundaries, bodies of water, existing buildings and plantation etc. will be available, either obtained from web platforms as image files, or in hard copy for scanning.

For the purpose of this case study, a survey plan is supplied as an image file for download from *BIMbogen.dk*.

OVERVIEW/ Modeling the site

- Set up Site Survey Model
- In plan view **Site**, insert image with site survey plan
- Adjust scale of inserted image
- Draw Property Lines
- Model 3D topography on top of inserted image
- Subdivide surface of terrain, showing hard surfaces, bodies of water etc.
- Add other existing site objects if relevant (buildings etc.)



SITE 2D/ Import a survey map

We will insert a digital image of a survey map into the Revit Site Model file, supplying a base for us to work up the existing 3D site elements.

To Insert images into a View in Revit, the image must be available in a supported image file format, for example JPG, PNG or even PDF.

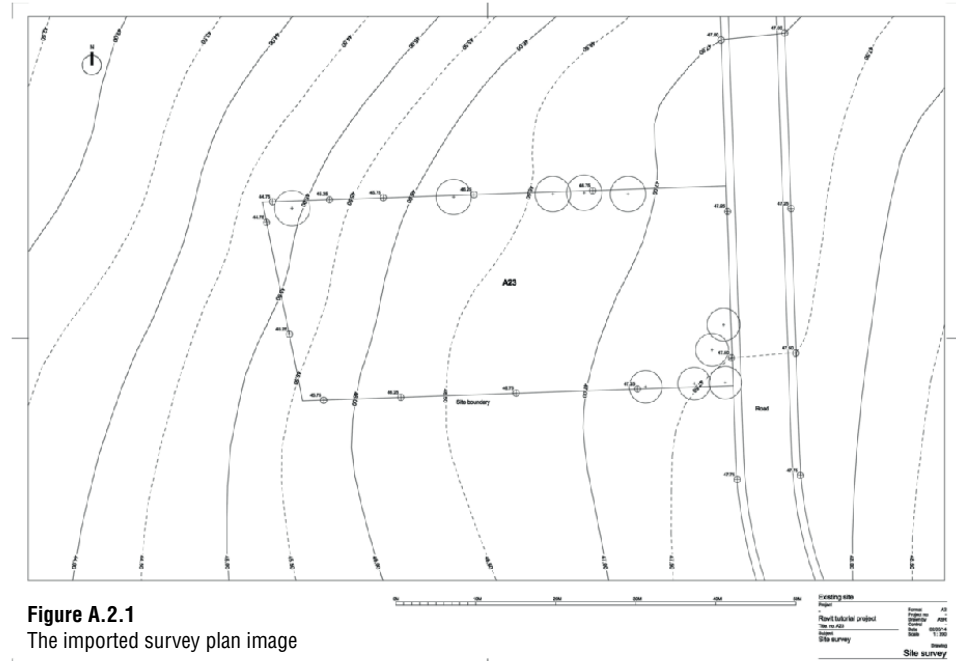
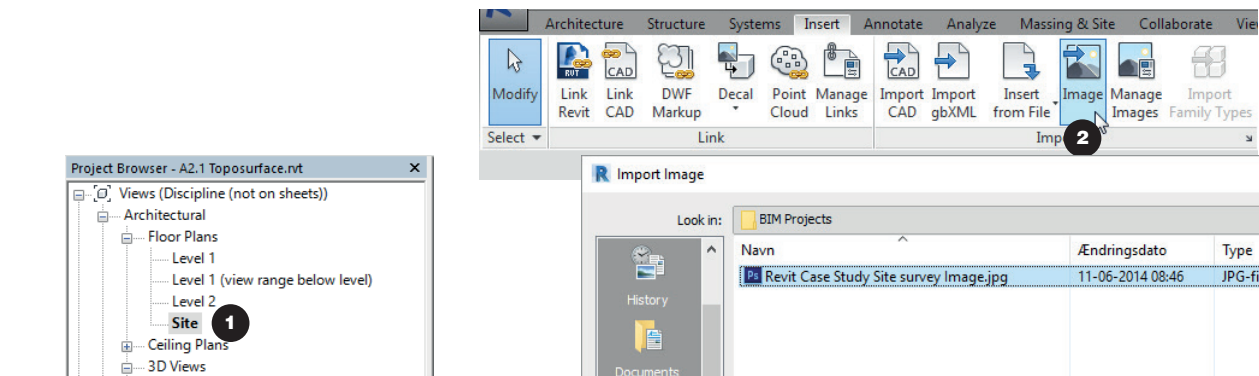


Figure A.2.1
The imported survey plan image



PROCEDURE/ Adding a 2D survey map

Insert Image

Preparation

Go to BIMbogen.dk in a web browser and download *Revit Case Study SITE_SURVEY_IMAGE*. Unzip to the *Revit Case Study* project folder on your computer (created in chapter 1.2).

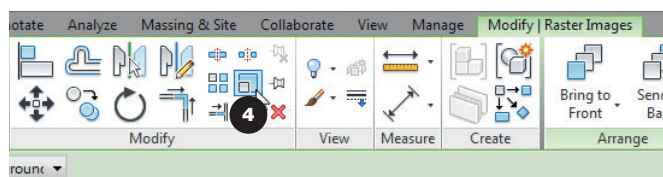
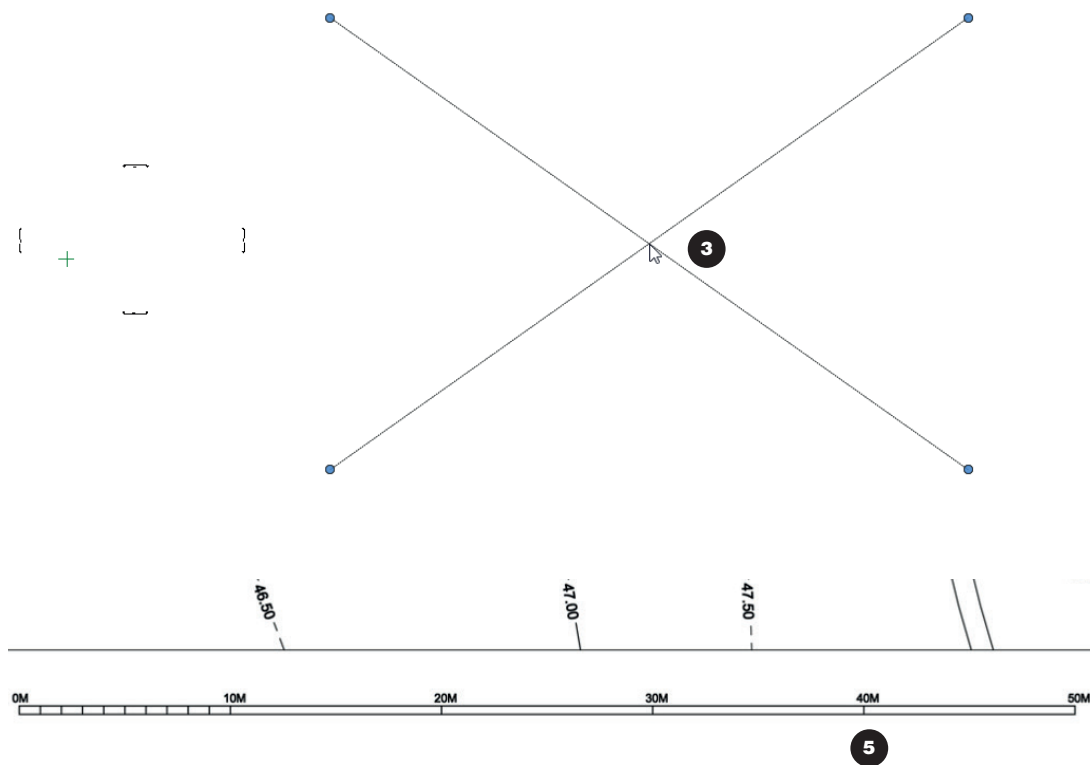
Next, start up a new project as described on page 117. Save the project.

1 In Revit, go to the Project Browser and activate the *Site* View by double-clicking it. Zoom out to get a good overview.

Insert Image

2 In the tab **Insert**, click on **Image** to start inserting an image.

Browse to the project folder and select the site survey image file. Click **Open**.



3 Place the image to the right of the Project Base Point. After the command is started, you can still navigate (Zoom or Pan) before placing the image.

Scale Image

The image must be scaled to the right size. We will do this manually by using the ruler displayed on the image. Click to Select the image.

4 In the Contextual Modify tab, start the **Scale** command.

5 Zoom in closer on the ruler.

Scale

Complex routines in Revit

Some commands in Revit involve many clicks from starting the command until finishing it (most often by pressing **Escape** twice). Often, one single mistake will cause the whole routine to fail or not come out the expected way.

A few good advice when carrying out complex routines:

Watch the **Status Bar** (see figure A.1.4 and Insert 1/ **Revit User Interface** in the back of Volume I). This is where Revit asks for step-by-step input at any given time - unless an object is selected. In order to see which next step Revit expects from you, it is sometimes necessary to move the cursor to a blank spot in the **Drawing Area**.

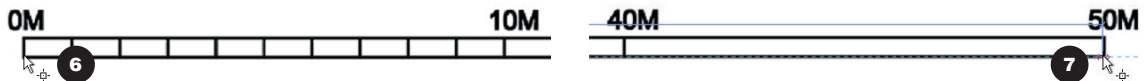
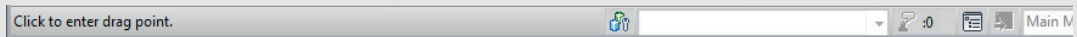
When clicking in the Drawing Area, pay attention! The moment you click, Revit often gives valuable information on snap locations or directions.

If a command seems to go wrong, press **Escape TWICE** to abort the command (Please note: This will NOT finish Editing Mode).

If an unsuccessful command causes faults in the model, **Undo** the command.

Search Revit Help on a specific command by pressing **F1** while hovering the cursor (not clicking) above the command button.

Figure A.1.4
The Status Bar asking for input



Scale Image (continued)

6 Click at first reference point (origin) on the scale bar.

Drag the cursor to the second reference point (the drag point) on the scale bar (navigate - **Zoom** or **Pan** - if necessary to get there).

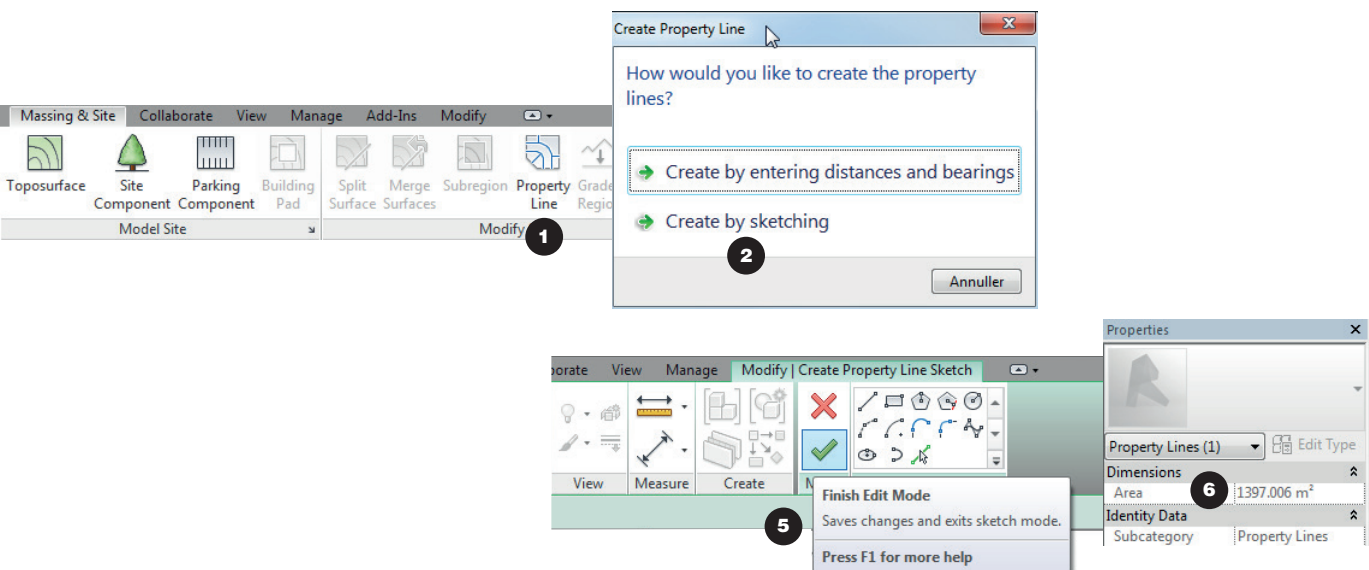
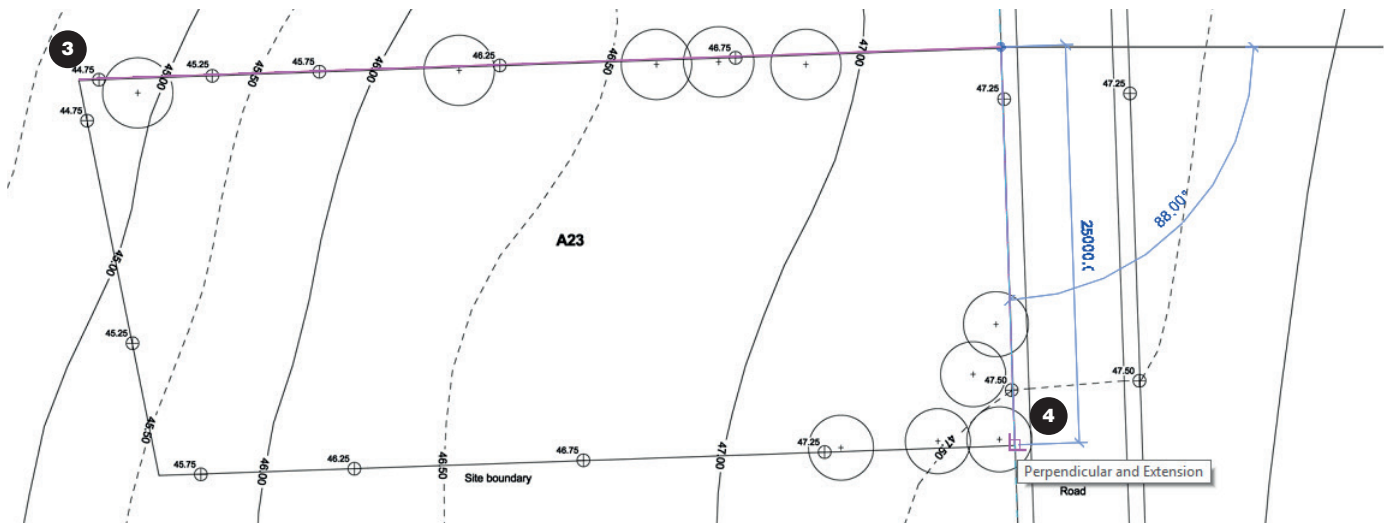
7 Click on the second point of reference. Zoom out again to see the ruler. Type the exact desired length between the two points of reference - in this case **50.000** (50 meter) - and press **ENTER**.

Through the whole routine, be very exact in order to scale the image as precise as possible.

For further advice on complex routines like this, see Tip above.

8 To check that the scale is correct, go to Quick Access Toolbar and start command **Measure**. Click on both ends of the scale and read the distance. Make sure that is very close to **50.000 mm**. If not, redo the scaling routine.

Property Boundary



PROCEDURE/ Drawing the Property Boundary

Sketch Property Line

1 To draw the boundary of the property, go to the tab **Massing and Site** and start the **Property Line** command.

2 Select **Create by sketching**. You are now in **Edit Sketch Mode** and can use the drawing tools normally available here.

3 Draw the **Property Line** using the **Line Tool**. Try to be very exact.

Start in the top left corner and draw clockwise.

4 Assuming that the two eastern corners are right-angled, look for the snap icon *Perpendicular and Extension* before clicking to finish the second and third line. Finish the last line by snapping to the first point of the first line.

5 Click **Finish Edit Mode** in tab **Modify...** the Property Line is now finished.

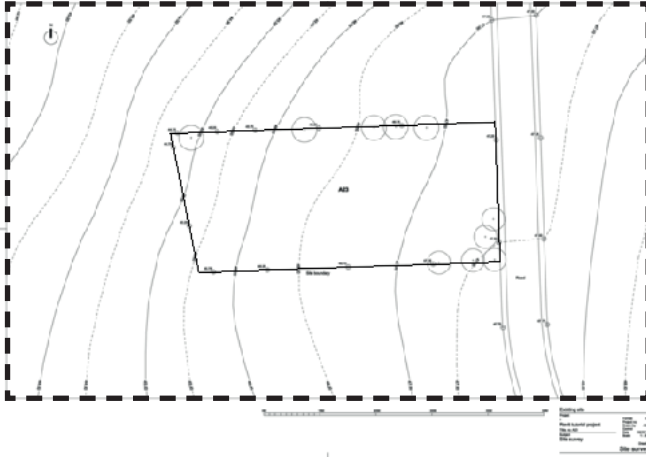
Area check

6 Select the **Property Line**. In **Properties**, observe the **Area**. The area should be very close to 1400 m². If it's not, try again to Scale the image and sketch the Property Line.

Property Line

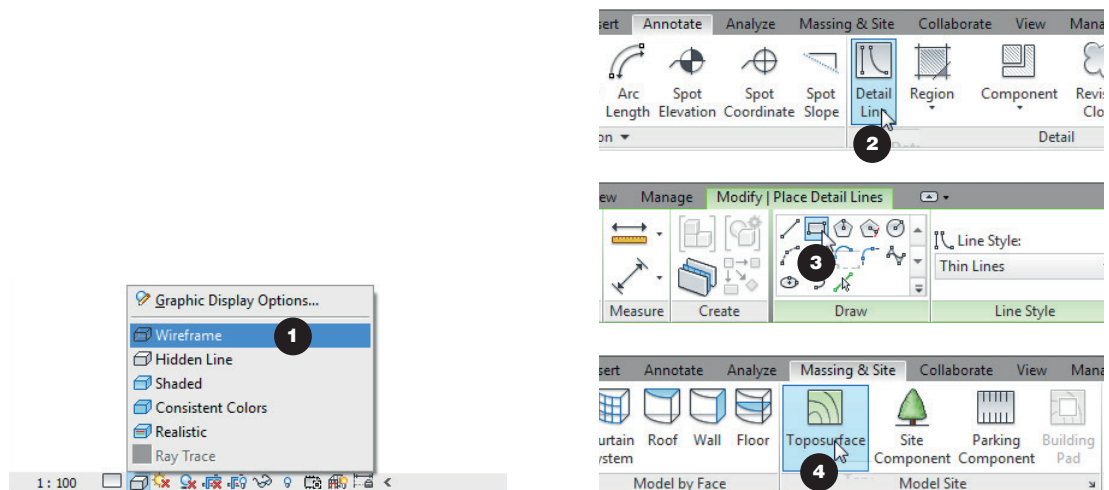
SITE 3D/ Model the topography

Figure A.2.2
Drawing a Detail Line to set the limits of terrain



Now that reliable 2D information is established, it is time to model a 3D site based on the 2D underlay.

We continue using tools from the tab **Massing and Site**.



PROCEDURE/ Modeling the terrain

Detail Line

Place Point

Toposurface

Preparations

Go to Plan View *Site*.

1 In the View Control Bar, set **Visual Style** to **Wireframe**.

2 In the **Annotate** tab, start the **Detail Line** command.

3 In the Draw tools, pick **Rectangle**.

By clicking twice, draw a rectangle following the edges of the survey plan (see *Figure A.2.2*). This rectangle is only a 2D serving as a frame for the terrain we will create.
End the command.

Create Toposurface

4 Go to tab **Massing & Site**. Start command **Toposurface**. Revit is now in **Edit Mode** and command **Place Point** is activated.

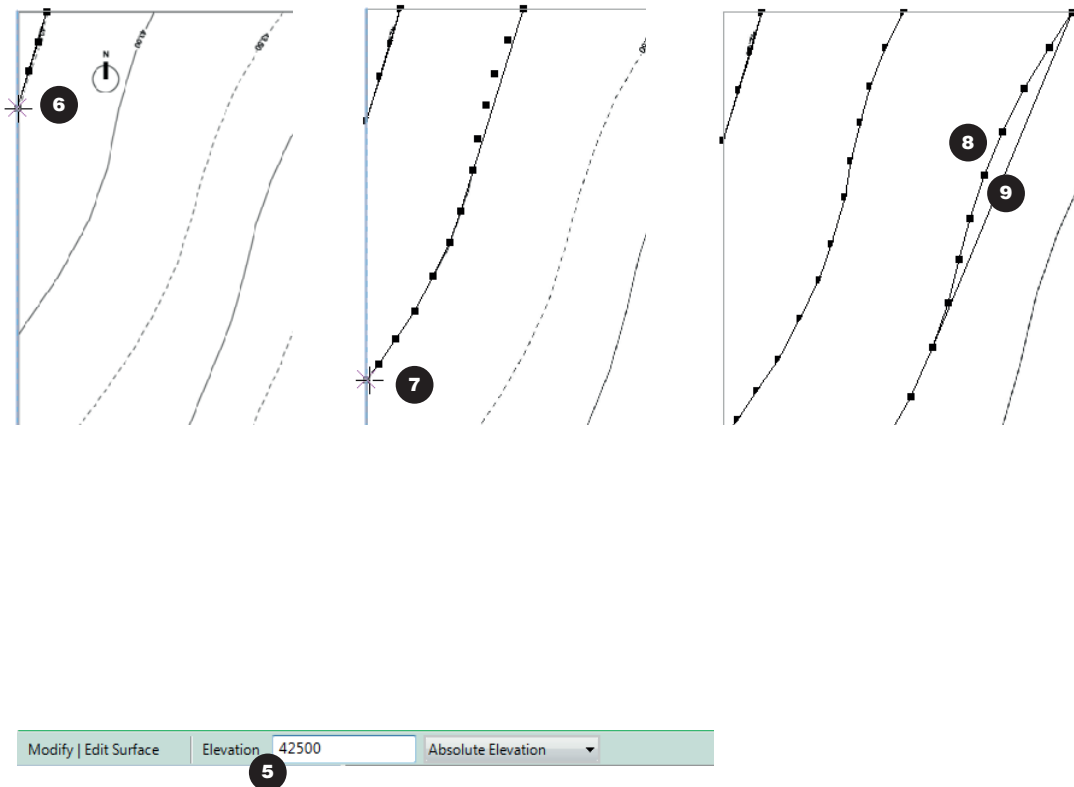
Toposurface

In Revit, terrain is modeled as a **Toposurface** - a surface defined by any number of points in three-dimensional space. Between the points, Revit interpolates to generate a relatively smooth surface.

A Toposurface can be created by working in Site View, plotting points with different Z-coordinates on top of a 2D underlay.

The points defining the edges of the Toposurface are called **Boundary Points** by Revit - the rest are **Interior Points**.

Other means of acquiring 3D topographic exist. For example, digital information can be imported from digital surveying instruments, or linked into the site model from another CAD file with topographic 3D information. - see also section A.1.



5 Zoom to the top left corner of the survey plan. The elevation of the first contour line is shown to be 42,50 meters (above sea level).

With the **Place Point** command still active, go to the **Options Bar** and type 42500 in the **Elevation** field.

6 Plot points on top of the contour line by clicking along the line. Try to keep an even distance between the points. Start and end the contour line with

points placed *exactly* on the edge of the drawing by snapping to the rectangle framing the survey drawing.

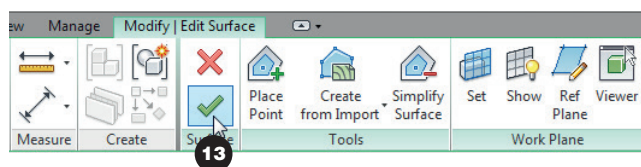
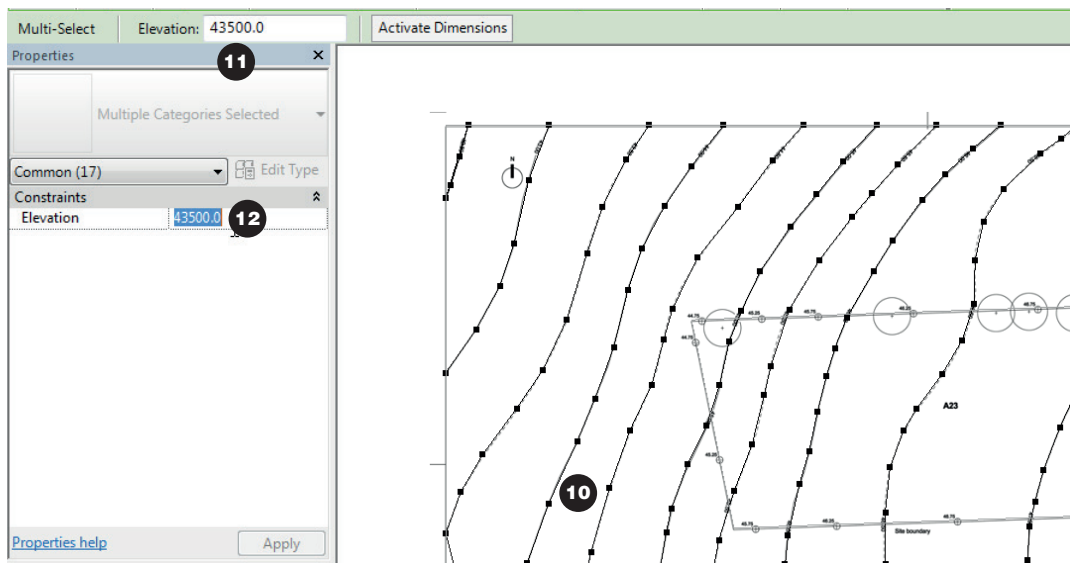
7 Before starting to plot points on top of the next contour line, remember to adjust the elevation in the **Options Bar**. This should be set to 43000 for the next contour line.

8 Draw a couple of contour lines more using the same

method. Notice that Revit automatically generates contour lines.

9 Also, notice the edge of the Toposurface being generated as you add points.

Place points along the rest of the contour lines. Press **ESC** to end the **Place Point** command.



Edit Points

10 A point in a Toposurface is an object like any other object in Revit. Like other objects, it can be edited at any stage.

If a number of points by accident is set to a wrong elevation, Select the points...

11 ... and change the elevation by typing the correct value in the field in either **Option Bar...**

12 ... or in **Properties**.

13 When all points are set in the correct position with the right elevation, go to tab **Modify...** and click the green tick to end **Edit Mode**.

Set **Visual Style** back to *Hidden Line*.

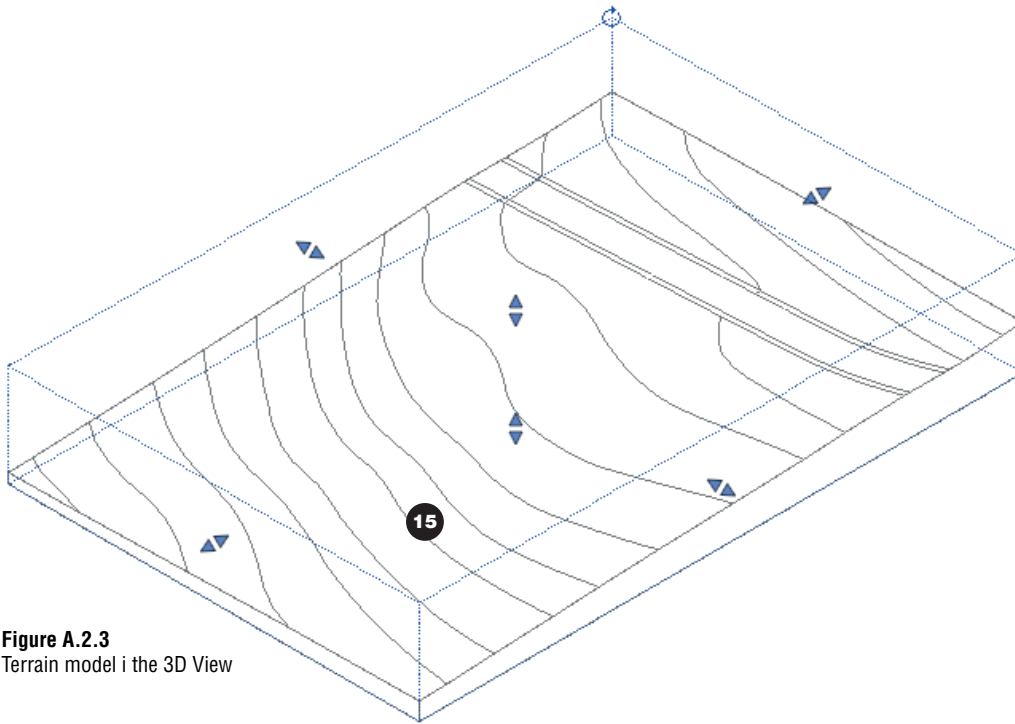
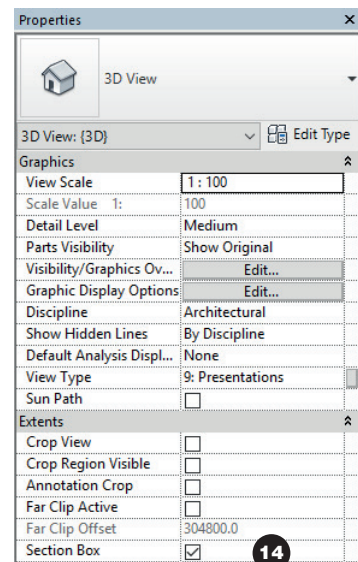


Figure A.2.3
Terrain model i the 3D View



Review Model

Go to the View (3D).

14 in Properties, check **Section Box**.

15 Select the Section Box and drag the **Controls** towards the center to cut off the edges of the terrain. Notice that the Toposurface becomes solid, making it easier to see the slopes of the terrain.

After checking the terrain, switch off the Section Box again.

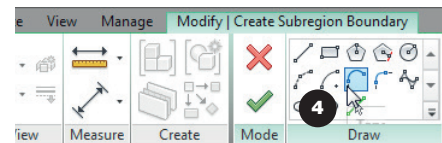
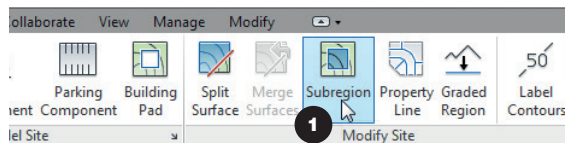
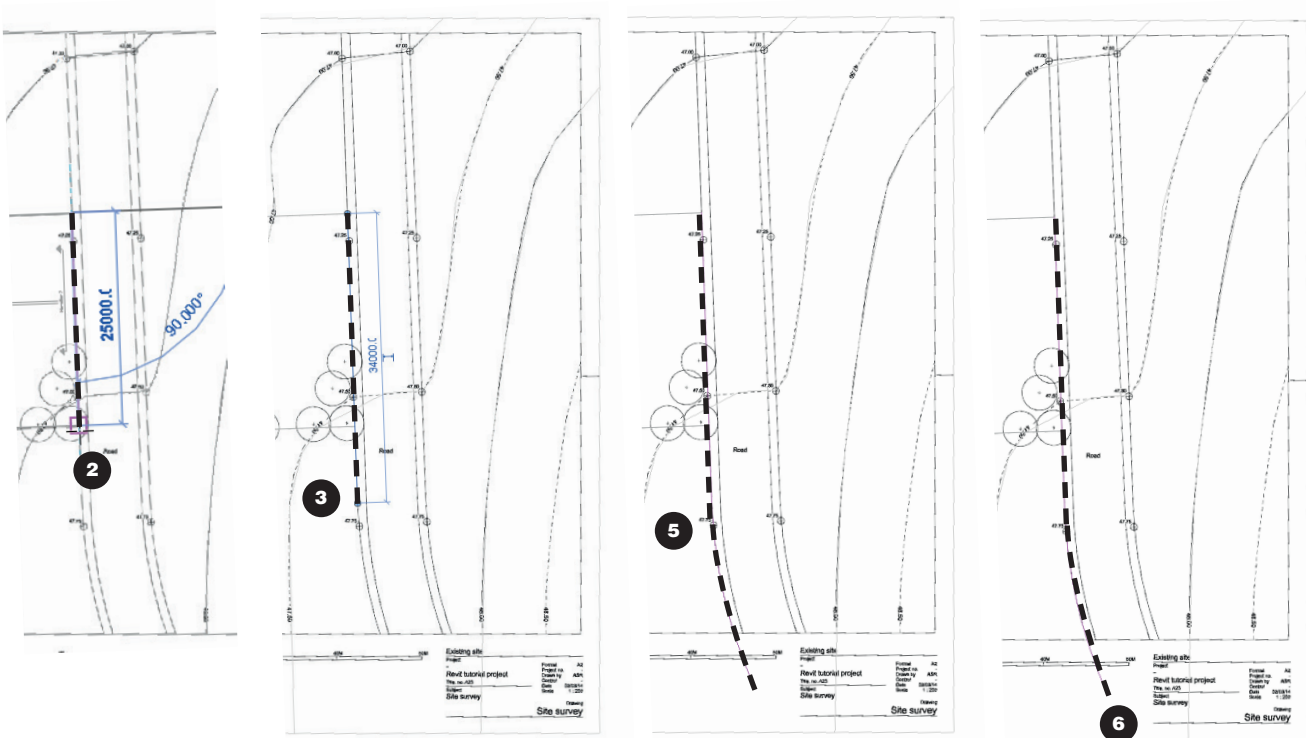
Subregions

To show roads, sidewalks, paved areas or other differences in surfaces within a Toposurface, we use the tool **Subregion** to subdivide the Toposurface.

A Subregion forms part of a Toposurface, but can be assigned its own properties, differing from the rest of the Toposurface.

The extents of a Subregion are defined in Edit Mode using the drawing tools normally available here.

In this case study, we will use the tool to create the road and the sidewalk.



PROCEDURE/ Subregions

Subregion

Line - Tangent End Arc

Create Subregion

Go to Plan View *Site*.

1 Go to the tab **Massing & Site** and start the **Subregion** command to start drawing one Subregion for the road and both sidewalks.

2 Using the **Line** tool, draw a line on top of the eastern *Site*

Boundary, snapping to its ends.

3 Select the line, grab its lower blue handle and drag downwards snapping to *Original* until it is approx. 34000 mm long.

4 Still in **Edit Mode**, go to tab **Modify...** and start command **Tangent End Arc**.

5 Click and snap to the lower end of the first line drawn to start arc here. Drag downwards, controlling the arc to follow the curve of the sidewalk.

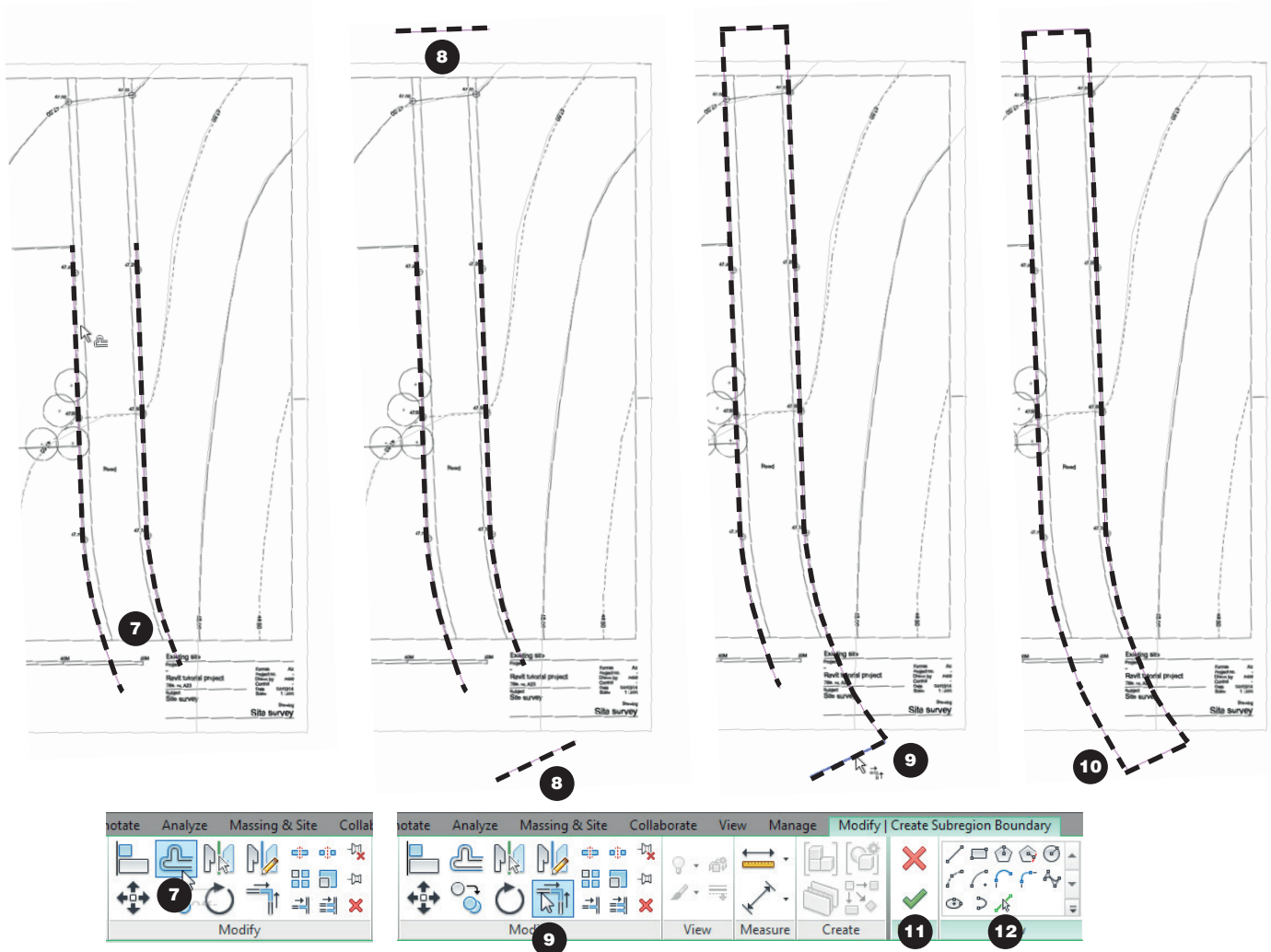
6 Click here to finish line. Press **ESCAPE** twice - first time ends drawing a continuous arc, second time ends the command.

Edit Mode

The geometry of certain Revit Family Types, e.g. **Roofs, Floors, Toposurfaces** and **Subregions**, can be modified in **Edit Mode**.

Edit Mode is entered through command 'Edit...' found in context-specific part of tab **Modify...** The only way to exit Edit Mode is clicking the red cross (abort) or green tick (save changes).

In Edit Mode, many command buttons turn gray, indicating that these cannot be used. Also, all other objects than the one being edited turn gray - these cannot be selected or modified while in Edit Mode. Most basic **Drawing Tools** and **Modify Tools** are always available in Edit Mode and are used in the same way, regardless of the Type of element being edited.



7 Go to tab **Modify...** and start command **Offset**. In **Options Bar**, set **Offset** to 8000. Offset the line and the arc towards right by clicking near the right side of the two lines. Press **ESC** to end the command.

8 Draw two lines above and below the road well beyond the edges of the Toposurface.

9 Start command **Trim/extend to corner**. Use it to form a closed figure. Remember to click on the parts of the lines to retain. End the command (**ESC**).

10 The group of lines must be a closed loop.

11 Click **Finish Edit Mode** to end road Subregion.

Offset

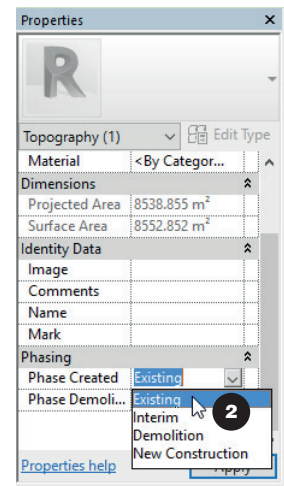
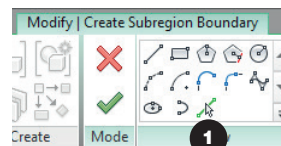
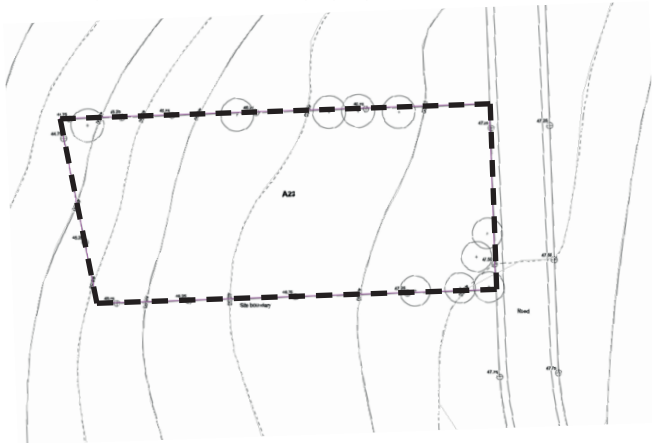
Trim/ Extend to Corner

A.3/ FINALIZE THE EXISTING SITE

After creating the topography, the boundaries and some subregions following the method of either section A.1 or A.2, the final parts are managed in the same way regardless of the previous.

Apart from topography, other 3D information may be relevant to add to a building model at a concept design stage - location of existing buildings, bodies of water etc.

Figure A.3.1
Boundary Lines of Subregion for property



PROCEDURE/ Finalizing the existing site

Pick Lines

Phase

Site Subregion

Create a new Subregion following the site boundary as shown in *Figure A.3.1*.

Start the **Subregion** command.

1 Use the **Pick Lines** tool and pick the four Property Lines. Finish Edit Mode.

Subregion Materials

Subregions can have different materials applied e.g. grass, asphalt etc.

See *Appendix B: Presentation* for detailed information on how to apply different materials to different subregions.

Topography Phase

2 By default, the **Phase** of all new elements is set to **New Construction**.

The Toposurface created in the previous is the existing terrain. Therefore, set the **Phase Created** to **Existing**.

Plantation

Studying the survey plan, we will find that in our case the only available information about the site which has still not been added to the model is **Plantation**.

The aim of showing existing plantation in the model at this stage is mainly to be able to estimate the visual impact of the building in the landscape. Therefore, we do not need to aim at a high level of realism, but just at getting the overall appearance roughly right.

We assume to have some knowledge of the plantation from a visit on site:

All trees are deciduous and the remains of windbreaks. The trees along the northern boundary are free-standing 8-12 meters tall, and the plantation in the south eastern corner is a thicket 5-7 meters tall.

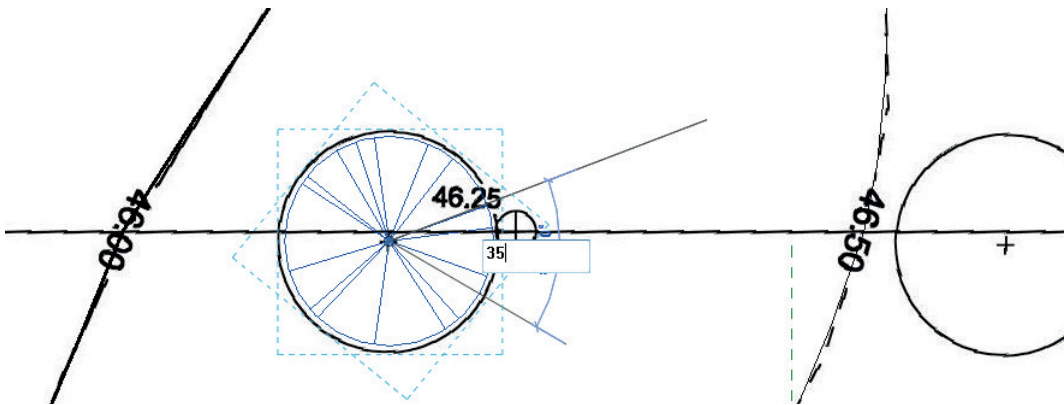
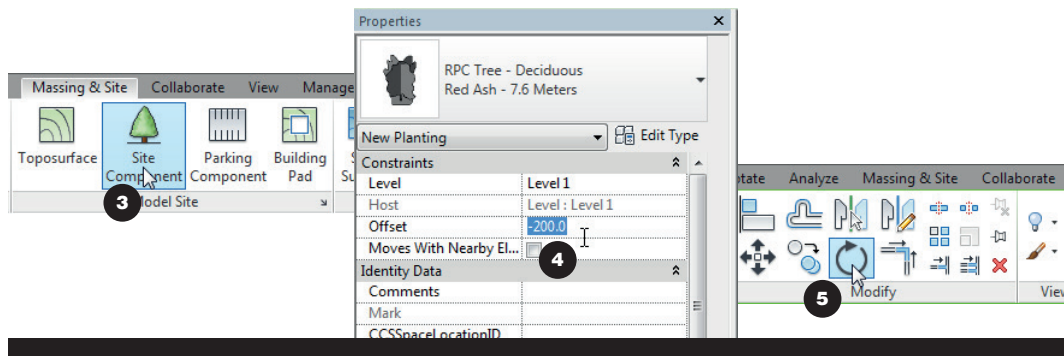


Figure A.3.2
Rotating a tree



Place Trees

3 In the tab **Massing & Site**, start the **Site Component** command.

4 In the Type Selector, pick a tree (e.g. *Red Ash - 7.6 Meters*). In Properties, set **Offset** to -200.

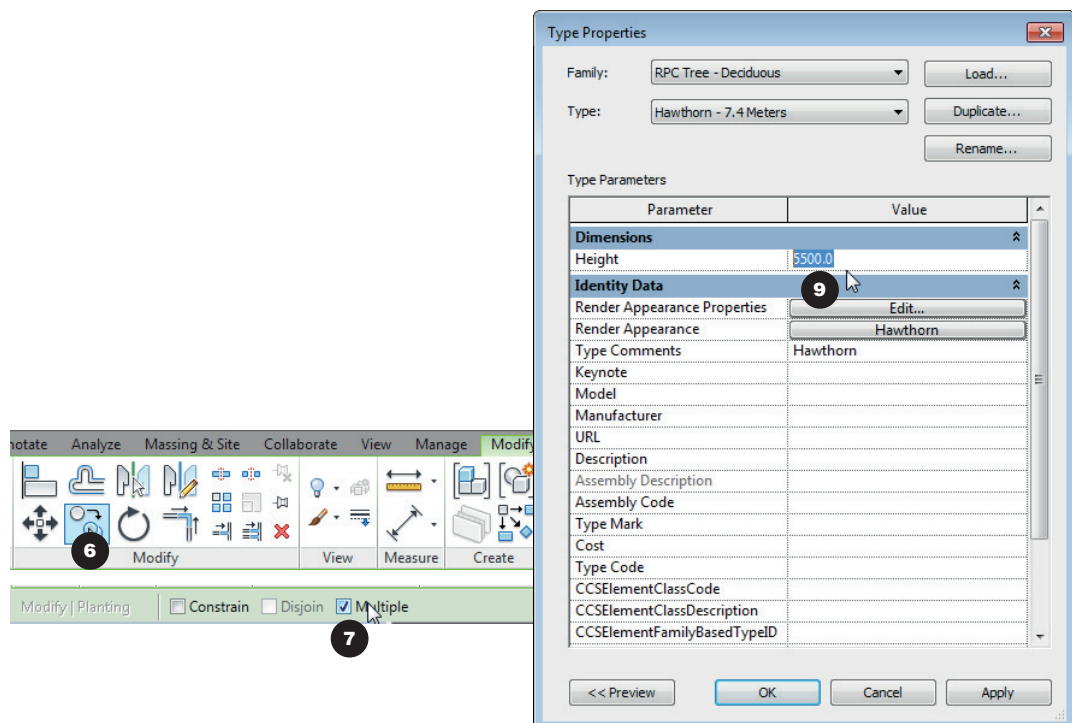
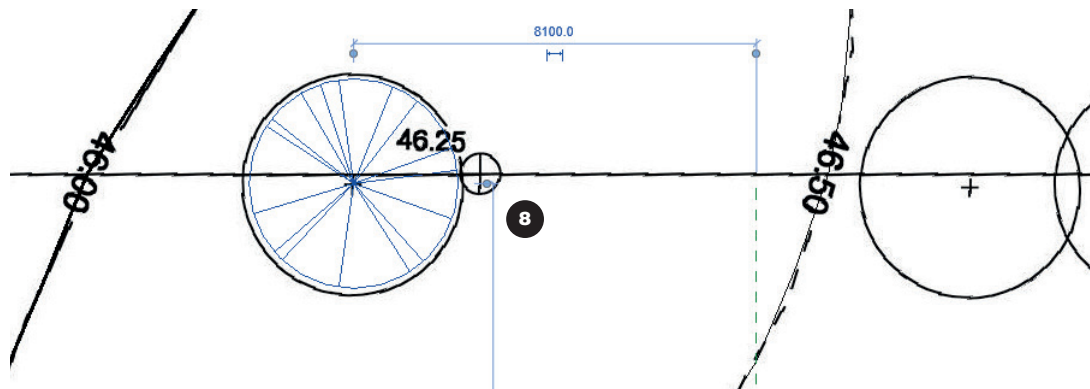
Place one tree in the model by clicking. Press *Escape* twice.

Rotate Trees

Select the tree.

5 In the tab **Modify...**, start the **Rotate** command. Rotate the tree to an uneven angle (e.g. 35 degrees - see Figure A.3.2). Being seen at an oblique angle, the tree will look more random and thus more 'natural' when generating facade output.

Planting



Add Trees

6 With the tree still Selected, start the **Copy** command.

7 In the **Options Bar**, tick **Multiple**.

8 Copy the tree to the other locations along the northern site boundary.

Insert trees in the south eastern corner in a similar manner. Use for example *Type Hawthorn - 7.4 Meters*.

To adjust the height of the trees: Select one of them. In Properties, select **Edit Type**.

9 Go to field **Height** and type **5500**, overwriting the previous value.

Hide Survey image

We do not need the survey image any more at this stage, but we want to keep it in the model, so we hide it.

Select the image. **Right-click**, go to **Hide in View** and pick **Elements**.

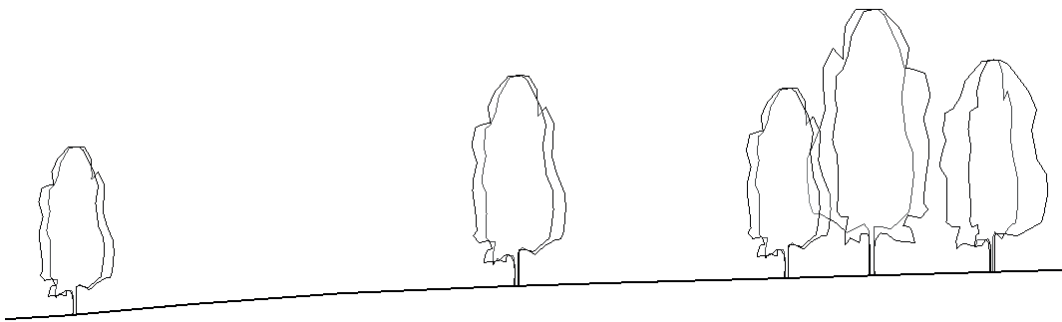
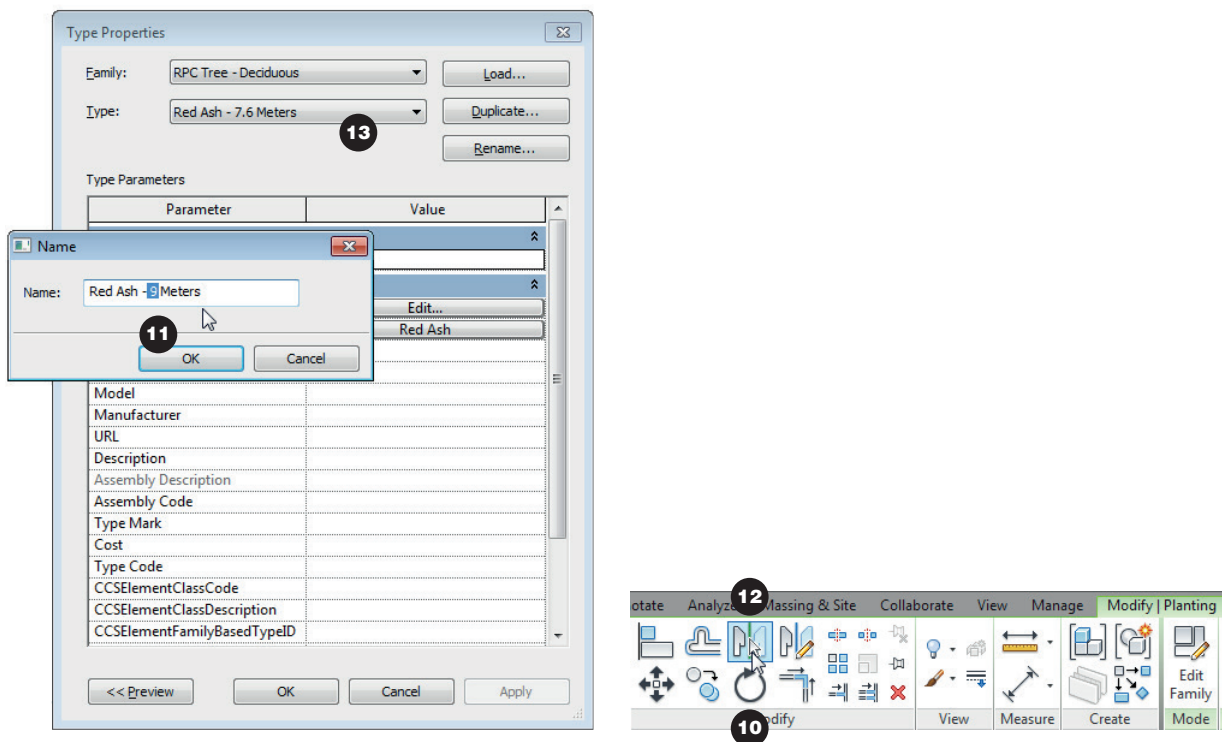


Figure A.3.3
Variation in how trees appear more natural



Adjust Trees

Go to the *View North Elevation*. We could now try to make the trees look less alike and more natural. Here is five ways to achieve this:

10 Rotating trees: In *Plan View Site*, **Rotate** some trees to a slightly different angle (see *figure A.3.3*).

11 Resizing trees: Select a tree. In *Properties*, click **Edit Type**. Click **Duplicate** and give the new type an appropriate name. Click **OK**. In *Type Properties*, change **Height** to a new value. Click **OK** > **OK**.

12 Mirroring trees: In *View North Elevation*, Select another tree. In tab **Modify...**, start the command **Mirror - Pick Axis**.

In **Options Bar**, uncheck *Copy*. Mirror a the tree by clicking the vertical axis. Press **Escape**.

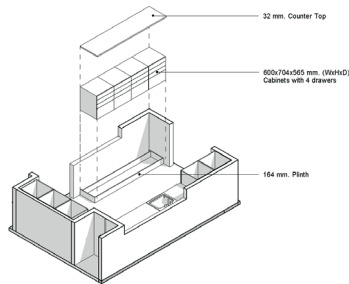
13 Changing tree **Type**: In **Type Selector**, select another Type. If necessary, **Edit Type** > **Duplicate** and change **Height**.

Making **Plantation** partially **Transparent** (see chapter 3.3).

B Appendix: documentation III

PRESENTATION

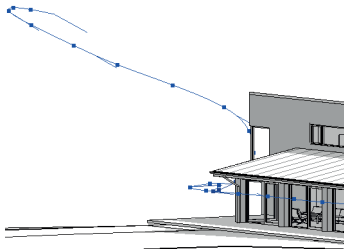
Figure 8.1.1
Presentation media introduced in Appendix B



1. Still Shadings



2. Still Renderings



3. Movie Walkthroughs



4. Interactive Panoramas

2D drawings, whether printed or digital (PDFs), is not the only media format offered by Revit for presenting a building project.

Before deciding which media to use for the presentation of your project, it is relevant to consider the recipient of the presentation and in which context the presentation will be seen.

If the building is presented in a newspaper or in a brochure, a still picture is an obvious choice. If the choice of materials is not yet in place, a black/white picture may be the best option. For non-professional recipients and for selling or otherwise convincing, photo-realistic rendered perspectives may be considered.

If the building is presented on a web page or at a live event, opportunities are much wider.

Video walkthroughs and *interactive panoramas* as known from real estate websites can be generated in Revit.

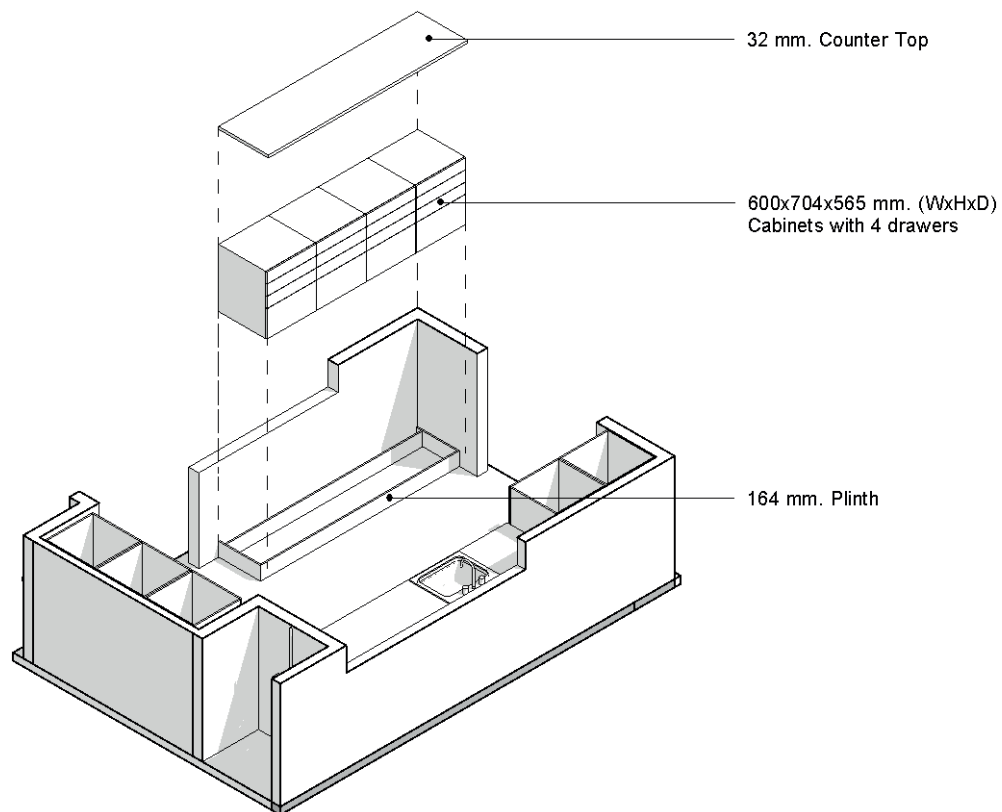
Working with the presentation formats presented in this appendix, you can decide to continue working on your current Revit Model, or you can download a sample file from www.bimbogen.dk.

B.1/ STILL - EXPLODED VIEW

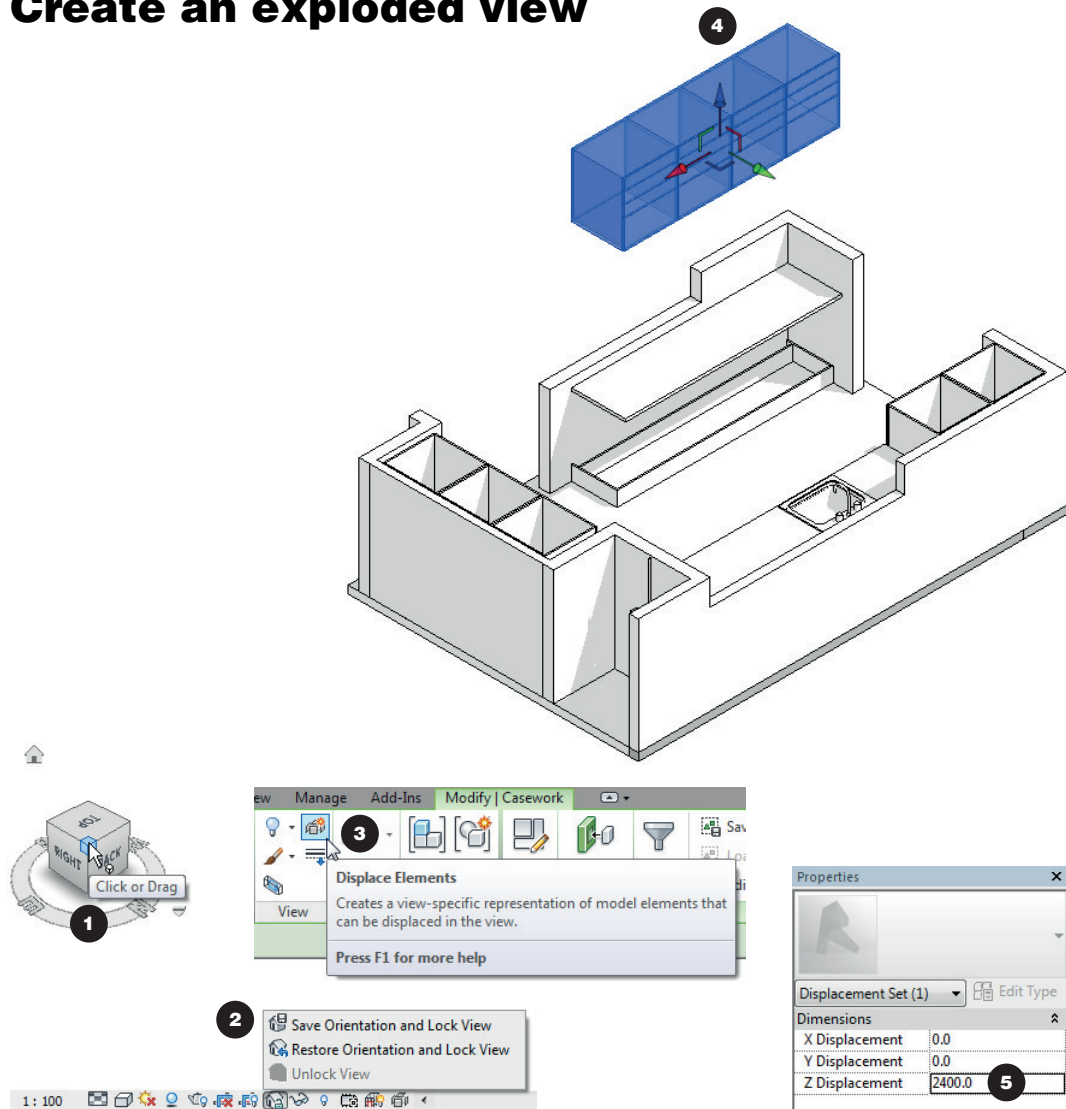
OVERVIEW/ Still - Exploded View

- Create new 3D View...
- ... or use existing 3D View
- Adjust Graphic Display
- Move objects; Display Elements
- Lock 3D View
- Add Text
- Print or export

This example of an exploded View shows the kitchen with the different elements dragged apart for better overview: plinth, casework and counter-top. The presentation will be without colors (Visual Style: Hidden)



Create an exploded view



PROCEDURE/ Creating an exploded view

Download

In a web browser, go to www.bimbogen.dk and download the file *Revit_Case_Study_MATERIALS.zip*. Save it to the *Revit Case Study* folder and unpack the file here. In the folder you'll find a Sample file; *Revit_Case_Study_Building_Final.rvt*. You can choose to continue working on your own Revit file or use the Sample.

Review model

In the **Project Browser**, go to the View *3D Section Kitchen*.

1 On the **ViewCube** click the *Right/Back/Top* corner.

2 To avoid rotating the view later on, click **Save Orientation and Lock View**.

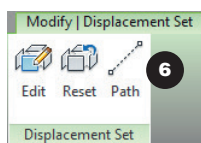
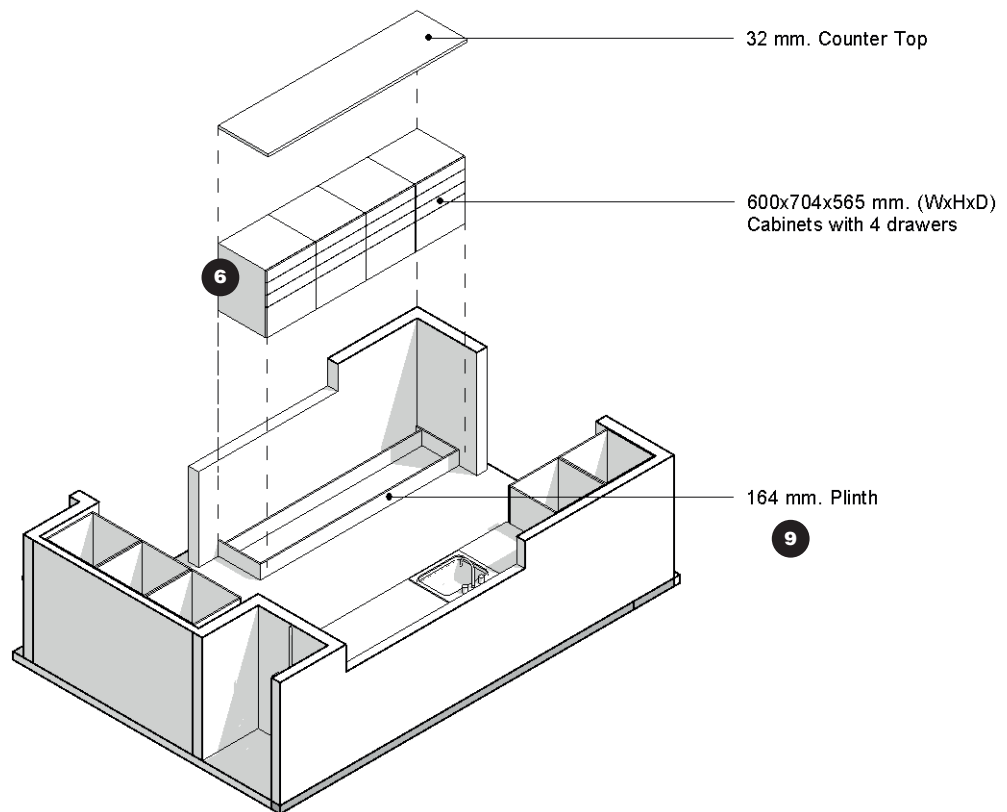
Displace Elements

3 Select the four Cabinets. Click **Displace Elements**.

4 Move the four Cabinets up by dragging the blue arrow in the *Z-direction*.

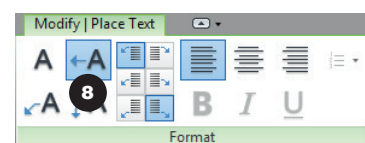
5 In **Properties** you can enter a specific height by changing the **Z Displacement**. Set the value to 2400. Move the Counter Top using the same method; **Z Displacement**; 3600.

Displace Elements



1 : 50

7



Displacement Set

Path

Create Paths

6 To show the objects original position, you can create *Projection Lines*. Select the four Cabinets and click **Path**. Click on the edges to make the *Projection Lines*.

Make the same procedure on the *Counter Top*.

Adjust View

7 Set the **View Scale** to 1:50.

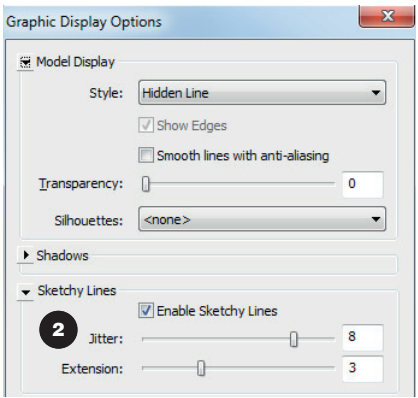
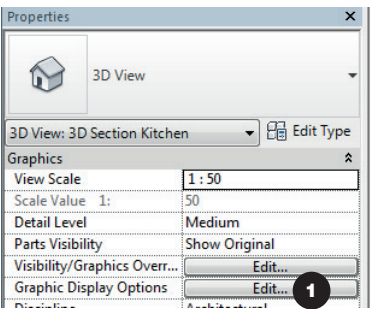
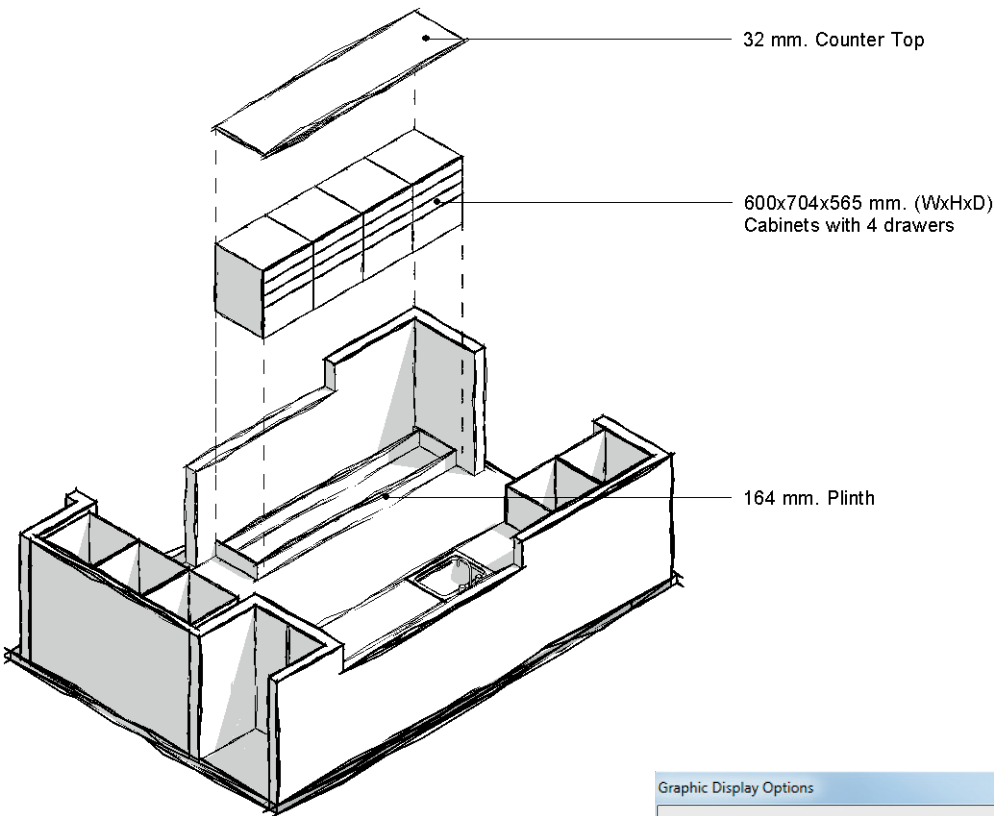
8 Go to Tab **Annotate**, click **Text** and Pick **One Segment**.

9 Add text to the view. Turn on **Crop**, adjust it, and hide it again.

Sketchy Lines (Optional)

the Graphic Display Option *Sketchy Lines* emulate a hand drawing, which can serve to lend an less ‘literal’ air to a drawing than

a more exact presentation style. Sketchy Lines can be applied for any View (except Ray trace).



PROCEDURE/ Creating Sketchy Lines

Enable Sketchy Lines

1 Select **Edit Graphic Display Options**.

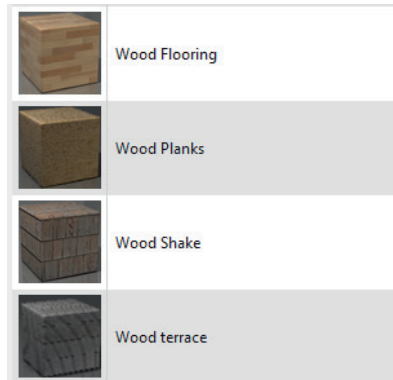
2 Enable Sketchy Lines and move the **Jitter** slider to indicate the degree of variability in the lines.

Extension indicates how far a model line’s endpoints extend beyond intersections.

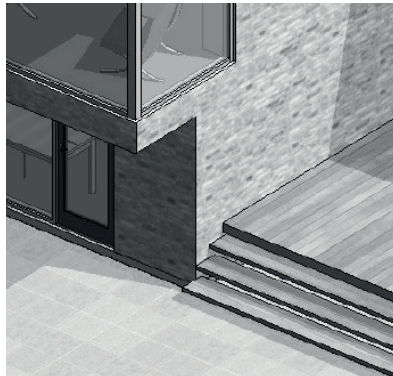
Sketchy Lines

B.2/ STILL - RENDERING

Figure B.2.1
Stages of the development creating Renderings in
Chapter B.2



1. Creating Material Database



2. Adding Materials to surfaces



3. Rendering the Scene

A still rendering is an image generated from the model, where shadows, reflections etc. are calculated by the software with a high degree of detail in order to achieve an output with photorealistic qualities.

Rendering an image may take a lot of time for the computer, depending on the level of detail of the image and the computer hardware properties.

Therefore, it is often a good idea to generate initial low-quality renderings with a low degree of precision - or showing only a part of the image - in order to test the settings before starting the final render command.

OVERVIEW/ **Still - Rendering**

- Set up Materials
- Apply Materials to Surfaces
- Create new 3D Camera View or Duplicate existing Camera
- Adjust Render Quality
- Render on local computer or Render in Cloud

The Material Browser

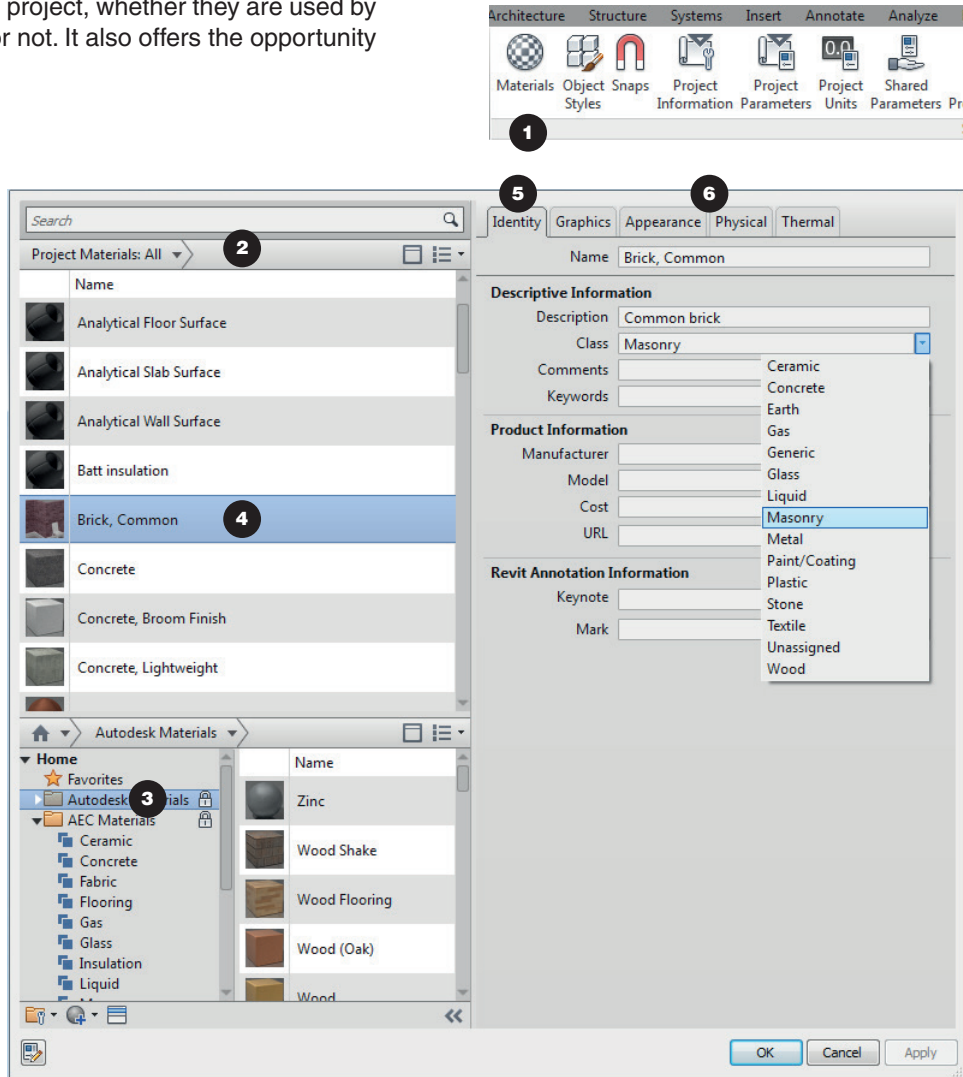
Some basics of setting up Materials has already been introduced in chapter 5.

In this section, the Material Browser will be explained in greater detail.

The Material Browser displays all Materials in the project, whether they are used by objects or not. It also offers the opportunity

to load Materials from other Libraries into the project.

Material Libraries are files which the extension .ADSKLIB.



PROCEDURE/ Material Browser

Material Browser

1 Go to the Tab **Manage** and click **Materials** to open the Material Browser.

2 You see a list of the Materials already in the scene.

3 You also see the list of *Autodesk Standard Material*, (click black triangle at **Home** to

unfold) which is premade Materials that can be applied to the Materials in the scene.

4 Select *Brick, Common*.

5 **Identity** Tab is general information about selected material; class of selected material (Masonry) Name etc.

Assets

6 **Assets** of the selected material; **Graphics, Appearance, Physical** and **Thermal**.

Graphic and **Appearance** Assets will be explained on the next pages.

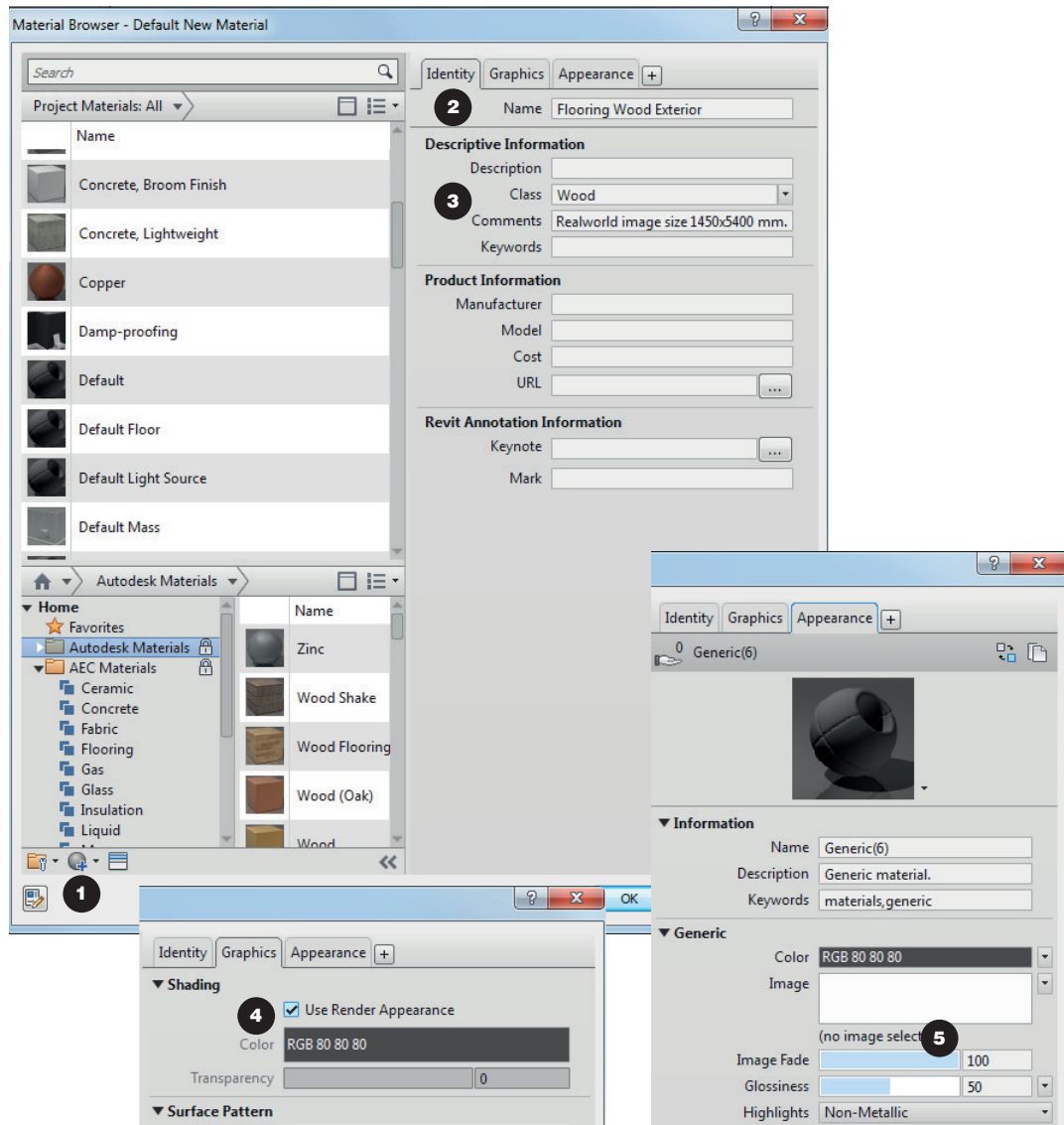
Physical and **Thermal** Assets will not be introduced in this book.

Material Browser

Create a new Material

A Material can be created from sketch as shown in this procedure. This method is used, if no Material with

similar properties is available in the Material Browser, or if full control of many Material Parameters in detail is needed.



PROCEDURE/ Creating a new floor material

Material Setup

1 Click **Create New Material**.

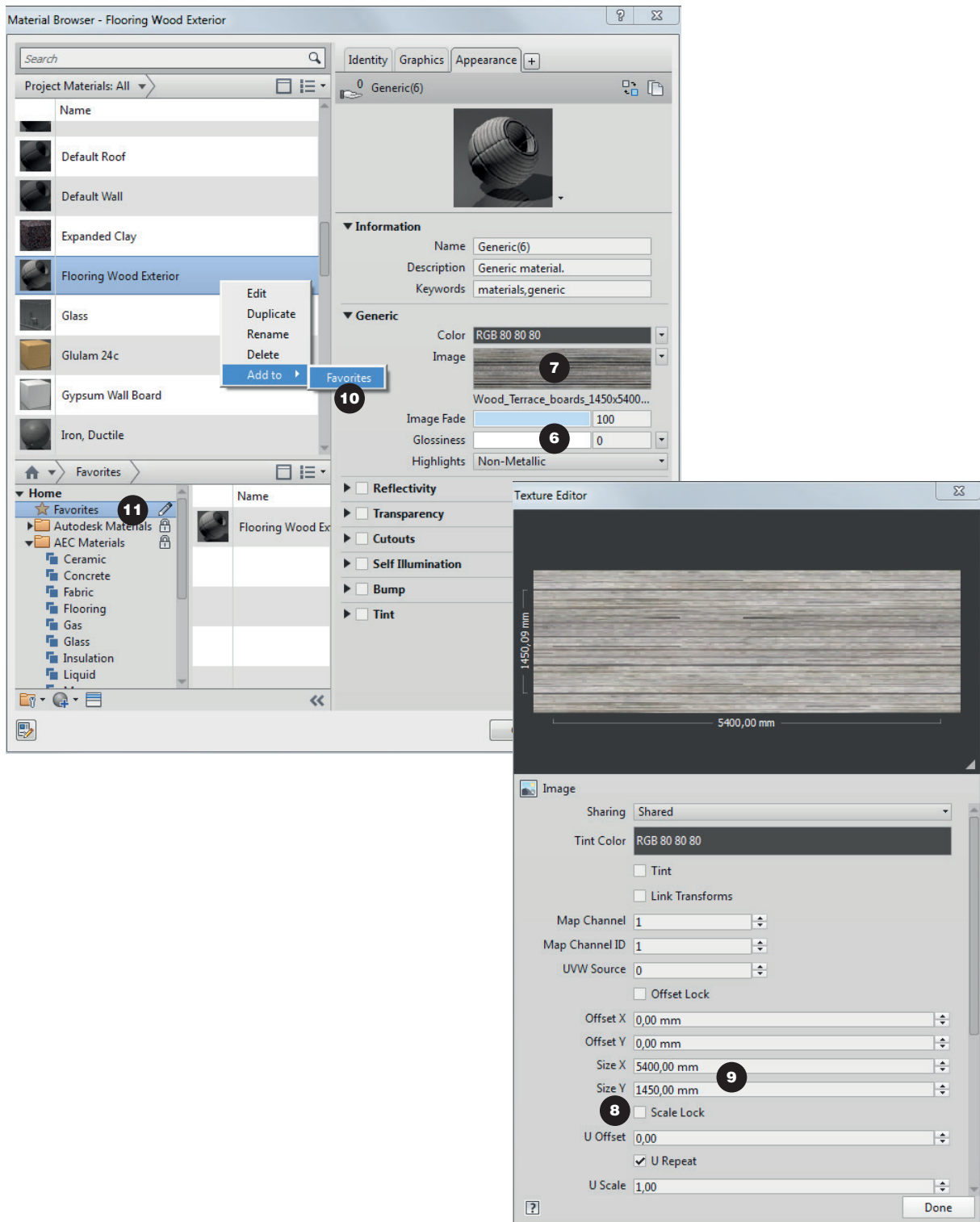
2 On the **Identity** Tab name the new floor material; *Flooring Wood Exterior*.

3 Set the **Class** to *Wood*.

4 On the **Graphics** Tab, enable **Use Render Appearance**. Revit calculates an average color of the image applied in the **Appearance** tab used for the Visual Styles *Shaded* and *Shaded With Edges*.

Add photo for rendering

5 On the **Appearance** Tab, click the white area to add an image. Browse the MATERIALS folder and select *Wood_Terrace_boards_1450x5400.jpg*



Texture Editor

- 6** Set the **Glossiness** value to 0 (no glossiness)
- 7** Click on the image to start the **Texture Editor**.
- 8** *Uncheck* the **Scale Lock** of the image.

- 9** Set the **Sample Size** 5400 and 1450 (WxH). Click **Done** to finish Texture Editor and return to the Material Browser.

Texture Editor

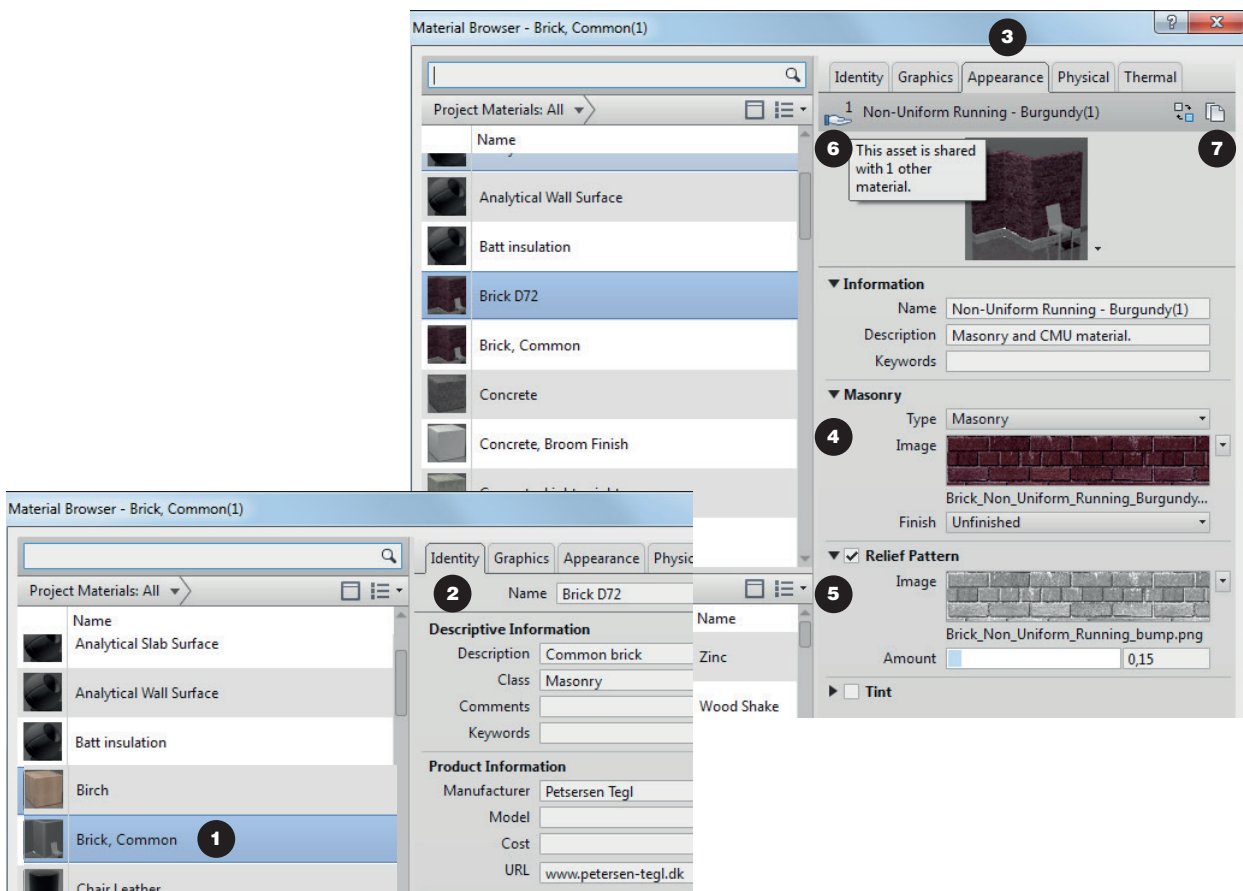
- 10** Right-click on the new material and make it into a *Favorite*.
- 11** The material is now also stored in the **Favorites Library**.

Texture Editor

Duplicate an existing Material

Another method to generate a new Material is to duplicate a similar Material and change its Parameters as needed. This method is often quicker than the previ-

ous method and is especially useful, when it is not of great importance to get all Material Parameters exactly right.



PROCEDURE/ Duplicating existing Material

Duplicate Material

Material overview

1 Right-click on the material *Brick, Common* and **Duplicate** the material and its *Assets*.

2 Go to the Tab **Identity** and name the new brick material **Brick D72**. You can add information about *Manufacturer* and *URL* if you like.

3 Go to the **Appearance** Tab. Take a look at the most important settings:

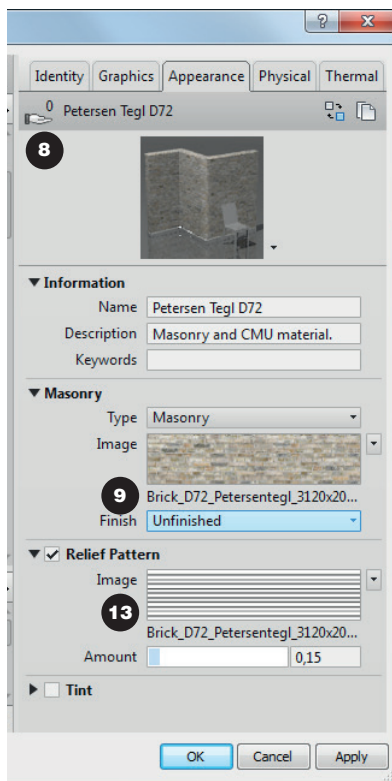
4 **Masonry** is a real picture of a tileable brick wall.

5 **Relief Pattern** create a simulation of a recessed joint. Relief Pattern is a black & white copy of the Masonry image.

Shared Material

6 Note that this asset is shared with another material (*Brick, Common*). If the material is modified, the other material will also be modified.

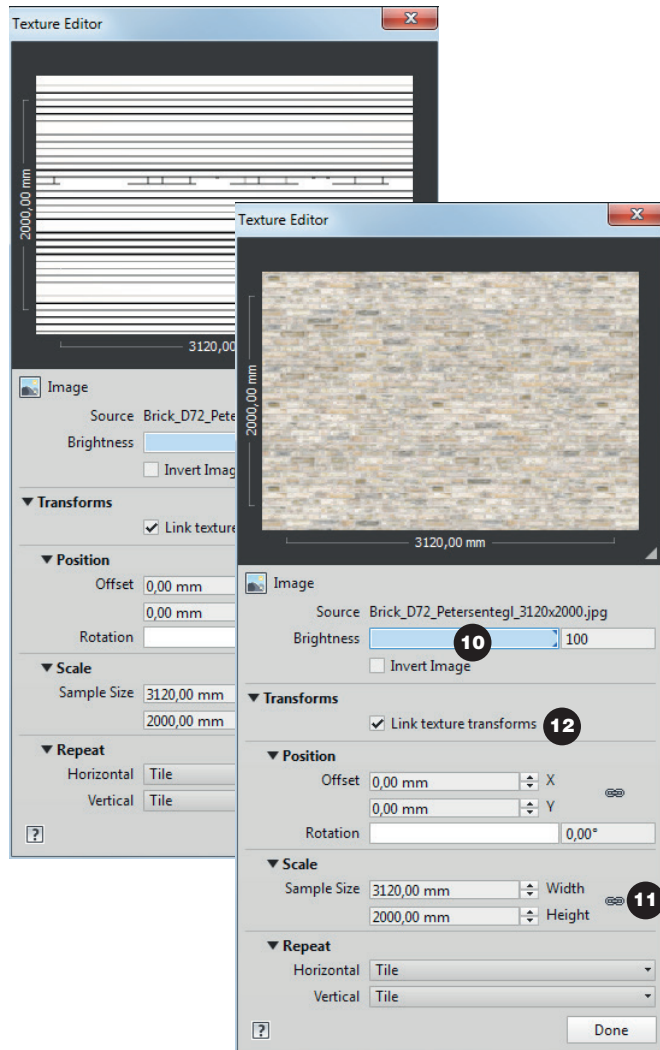
7 To make material *Brick D72* unique, click **Duplicate This Asset**.



8 The asset is now only used by this material.

Change Texture Image

9 Choose a new image for **Masonry**: Click below the image preview and choose a new texture. Browse the **MATERIALS** folder and select *Brick_D72_Petersentegl_3120x2000.jpg*.



Texture Editor

10 In the Texture Editor, set **Brightness** to 100.

11 Unlock the aspect ratio and set the **Scale** to 3120 and 2000 (WxH).

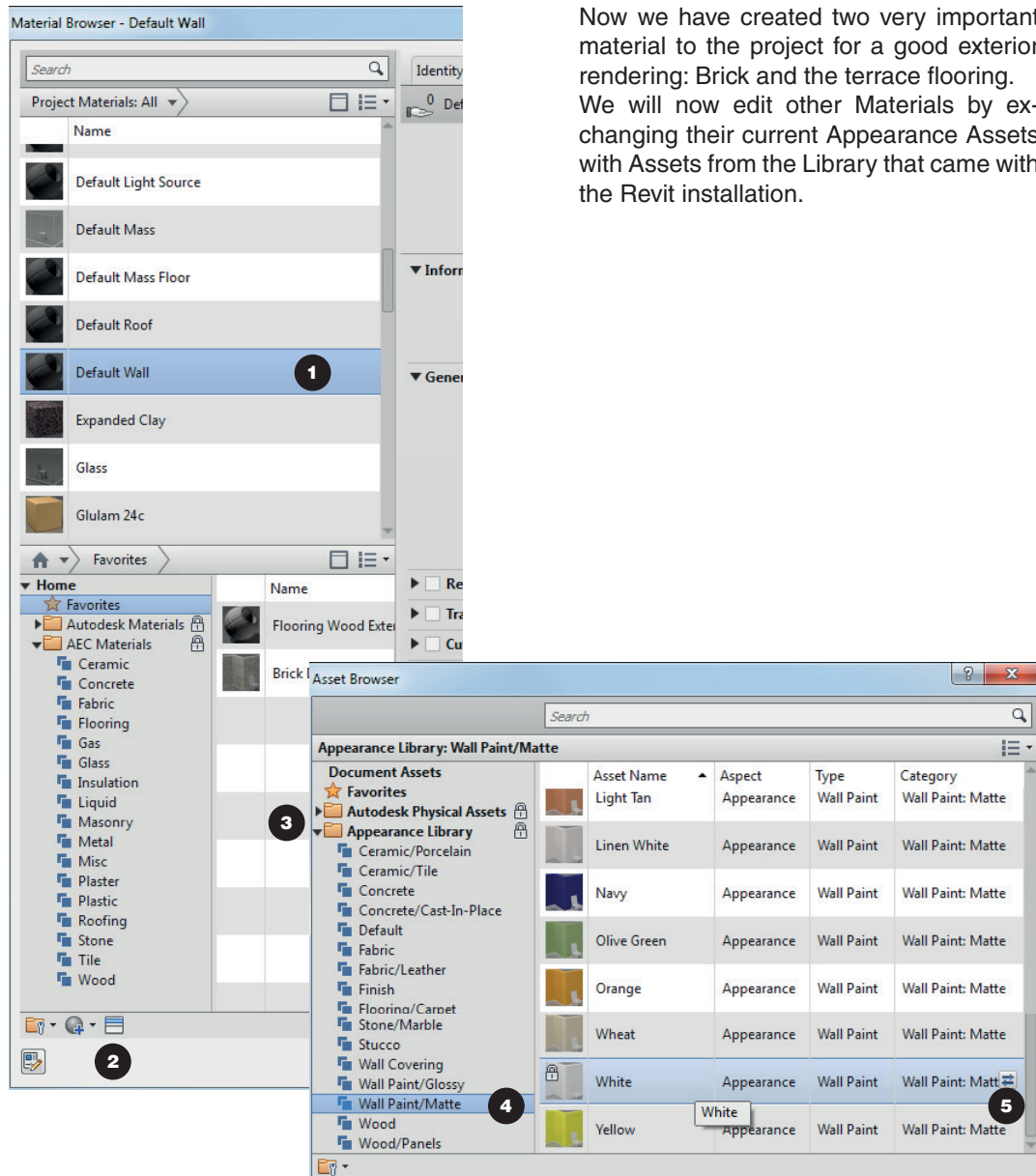
12 Enable **Link texture Transform**. This will bind the **Transform** settings together

for both *Masonry* & *Relief Pattern*. Click Done to finish.

13 Select a new image for **Relief Pattern**; *Brick_D72_Petersentegl_3120x2000_BUMP.jpg*. Set the scale and enable **Link texture Transform**.

Click Done to return to the Material Browser and make also this material to a Favorit.

Add Predefined Assets to Materials



Now we have created two very important material to the project for a good exterior rendering: Brick and the terrace flooring. We will now edit other Materials by exchanging their current Appearance Assets with Assets from the Library that came with the Revit installation.

PROCEDURE/ Adding predefined Assets to Materials

Material Library

Create new Material II

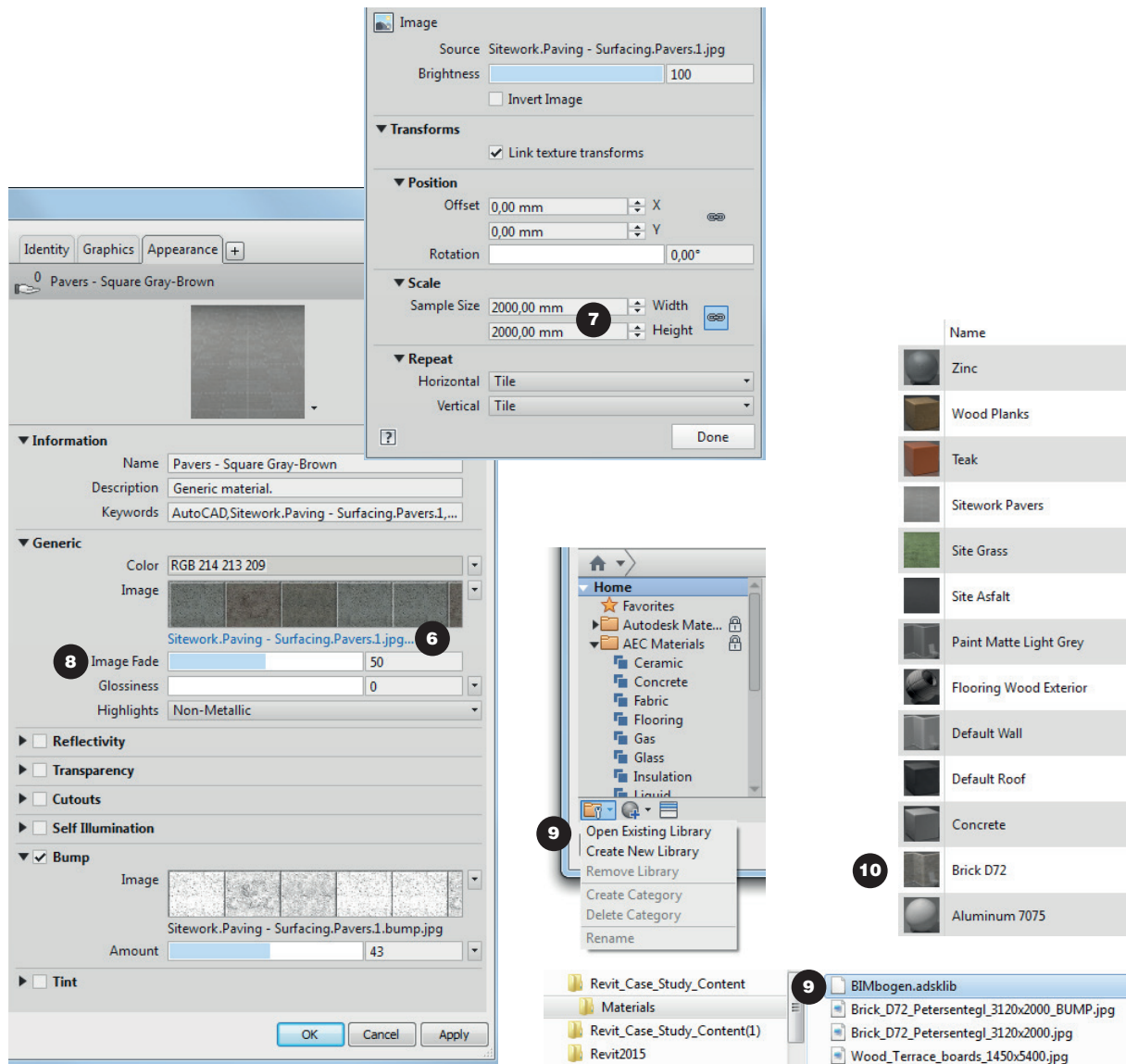
1 Select *Default Wall* material in the **Material Browser**.

2 Open the **Asset Browser**.

3 Expand **Appearance Library** to view list of Appearance Assets.

4 Select *Wall Paint/Matte Library*.

5 Select *White* and click **Replace the current asset**. The Default Wall material now have a white Painted Matte Color. Close the **Asset Browser** to return to the Material Browser.



Create new Material III

6 Create a new material called *Sitework Pavers*. Replace the Appearance asset with *Pavers - Square Gray-Brown* from the Sitework category.

7 Scale both images (also **Bump**) to 2000x2000.

8 Set Image Fade to 50 and set color to a light gray color. This will tone the pavers to a lighter material.

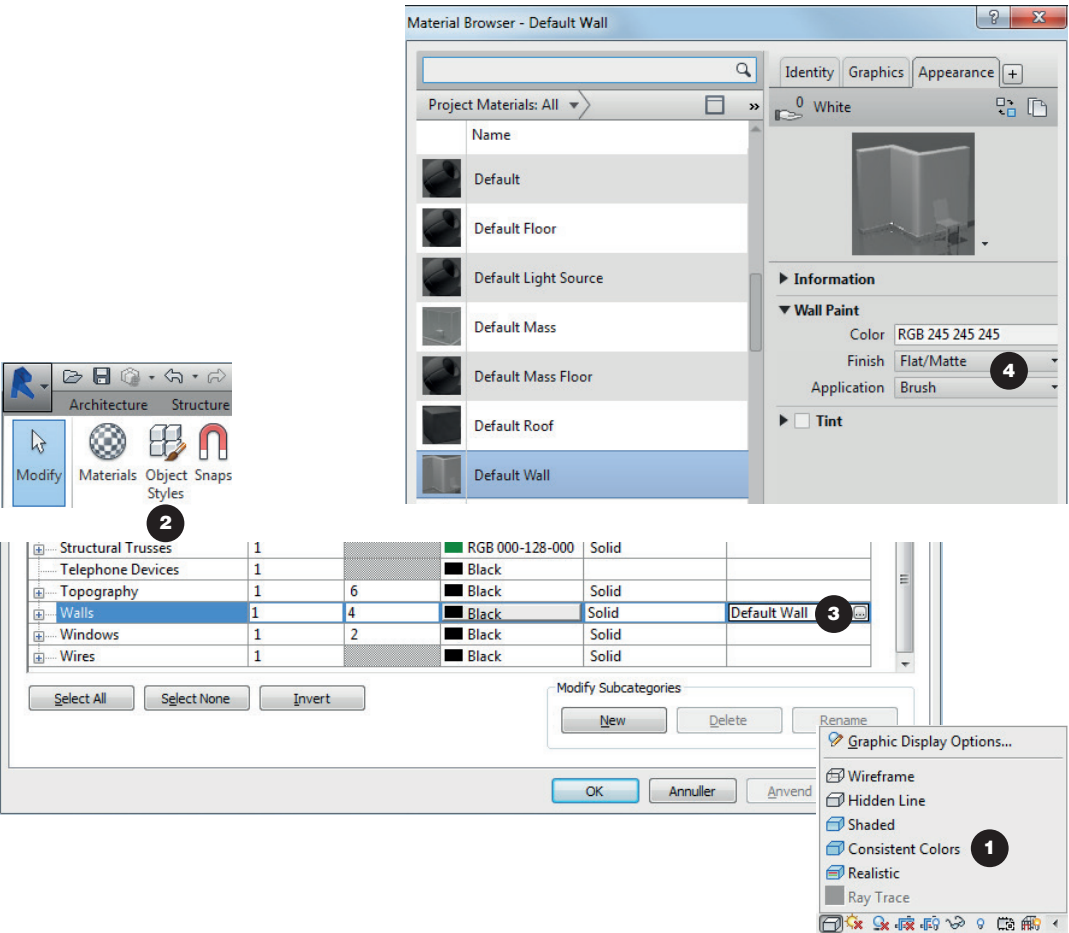
9 Complete the material list with materials on your own choice or open Material Library *BIMbogen.adsklib* which is a library file containing premade Materials.

10 You can return and add more materials later on in the process. For inspiration check out BIMbogen's list of materials. Click OK to close down the **Material Browser**.

Add Materials to surfaces

We have now created the Materials needed for generating visually detailed output. Now these materials need to be added to surfaces in the model. This can be done in several ways:

- 1. *By Category.* Add the same material to a whole Category (all walls, roofs etc)
- 2. *By Layer.* Add the material to a surface layer of the element in the Type Properties.
- 3. *By Face.* Add the material by Painting a face of an object if none of the above procedures are possible.



PROCEDURE/ Adding material to elements

Object Styles
Visual Style:
Consistent Colors

Apply By Category

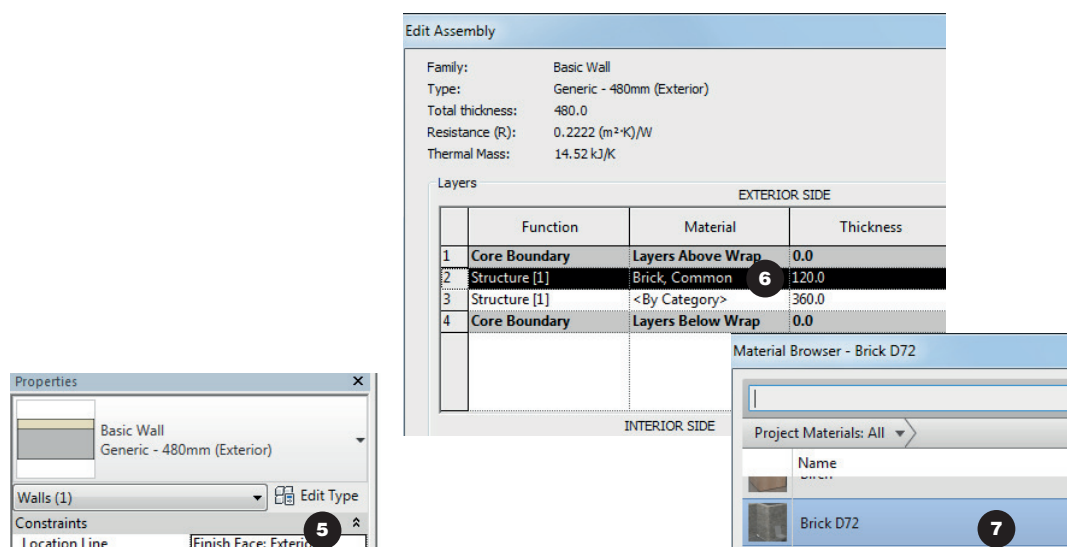
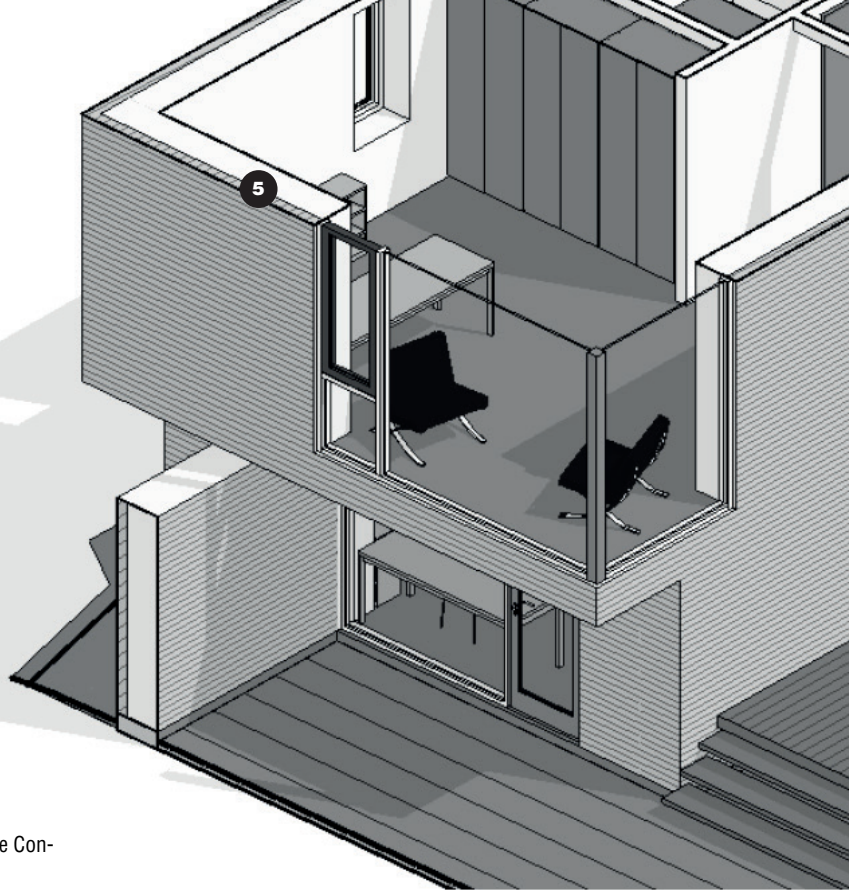
- 1 Open the View 3D Section and set the Visual Style to Consistent Colors.
- 2 In Tab Manage, click on Object Style. Without having noticed it, you have already changed the material for Walls.

- 3 Select Walls. You see that the material applied for Walls is the material Default Wall. Click in ... to open the Material Browser.
- 4 Select the Appearance Tab and see that Default Wall is the white paint matte material you made earlier. Click OK

and close down both Material Browser and Object Styles.

Review model
Take a look at the building. A question might pop up: Why is the Exterior wall not completely white?

Figure B.2.2
3D View of the Building Model in Visual Style Consistent Color with material applied to Walls



Apply By Layer

5 Select a random exterior Wall and click **Edit Type**.

6 Click **Edit Structure**. The Interior side is set to material *By Category* (Default Wall) and the Exterior side is set to material *Brick Common*. Click on *Brick Common* to open **Material Browser**.

7 Select *Brick D72* as the new material. Click **OK** to finish.

Review model

Check the Model and see how Materials is applied to most objects. Material *Brick Common* is still visible on some faces.

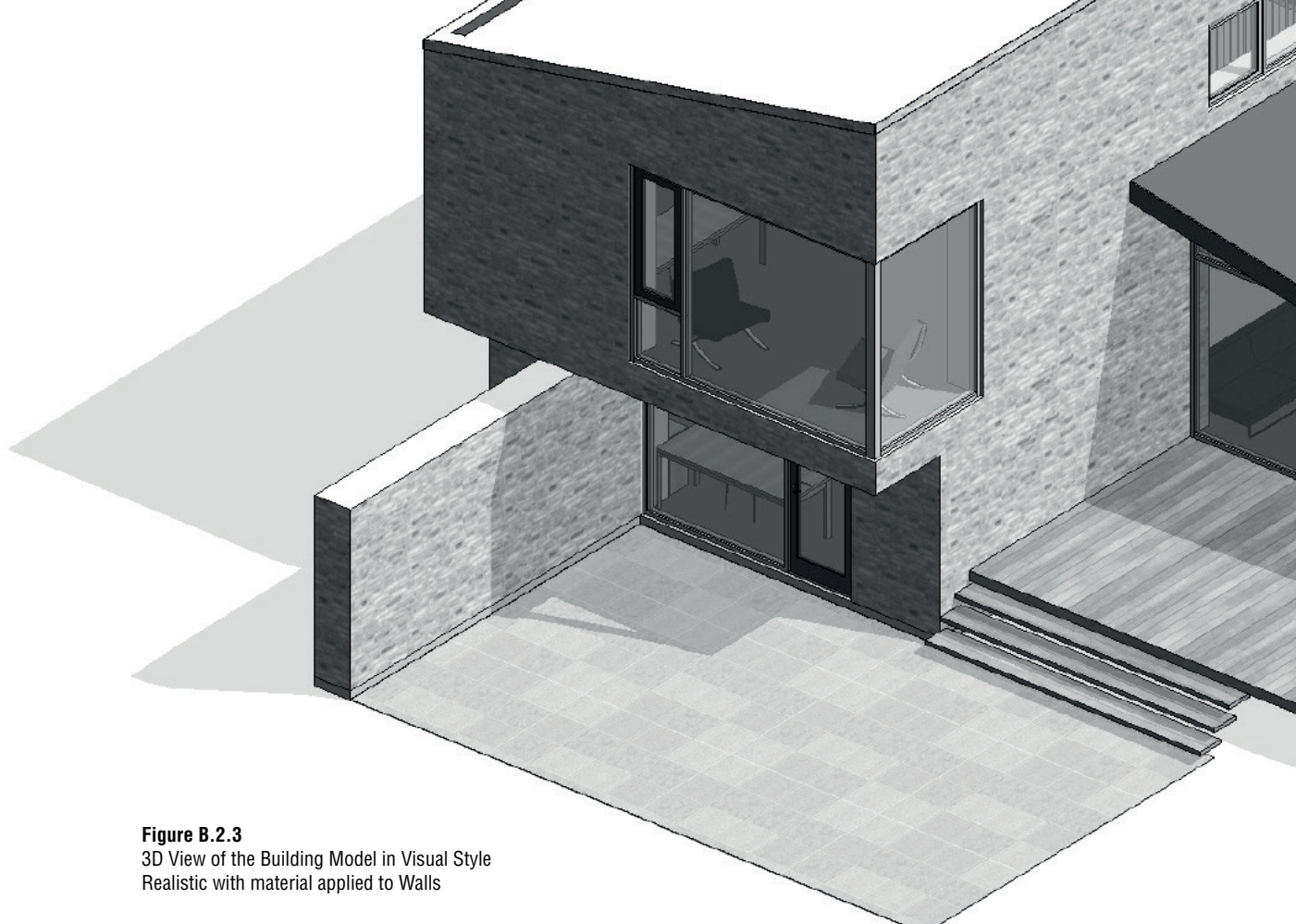
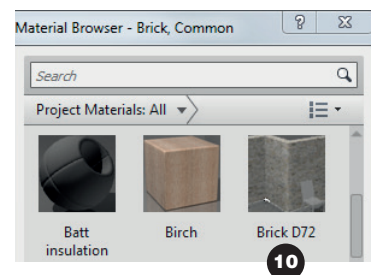
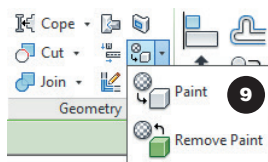
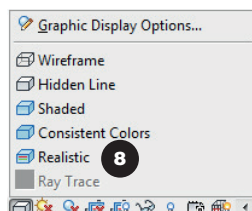


Figure B.2.3
3D View of the Building Model in Visual Style
Realistic with material applied to Walls



Visual Style; Realistic

Paint

Review model

8 Set the **Visual Style** to *Realistic*. Changes made before in the Material Browser's Appearance Tab, are visible in the view.

Apply By Face

Select the garden Wall.

9 In the Modify Tab, click on **Paint** tool.

10 Select *Brick D72* and Paint all remaining faces e.g. the top of the garden wall. See Figure B.2.3.

Complete Materials

Now work through all Categories, Object's and faces to apply materials correctly to all objects:

Step 1

Start applying material using Object Styles to as many categories as possible. Note that if you open the hierarchy of for

example Roofs, you can apply different materials to subcategories.

Set the Visual Style to Realistic and see how the materials appear realistic in the model.

Step 2

Apply materials by Type or Instance.

Step 3

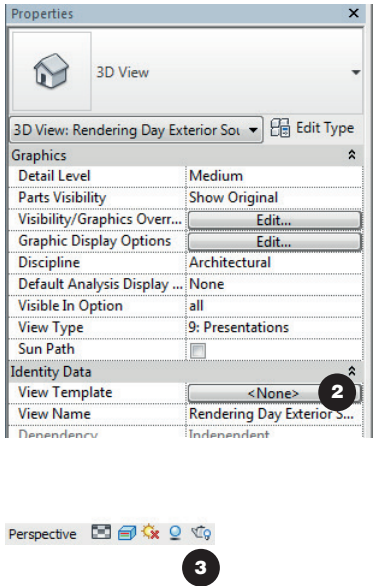
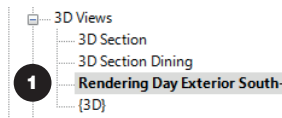
If necessary, use paint to apply final materials to object faces.



Figure B.2.4
 Rendering of a day scene

Day scene render

To render is to simulate reality based on physically accurate lights, materials, and light reflection.
 This first rendering will be a day time rendering. The scene will be lit by the sun only.



PROCEDURE/ **Rendering a day scene**

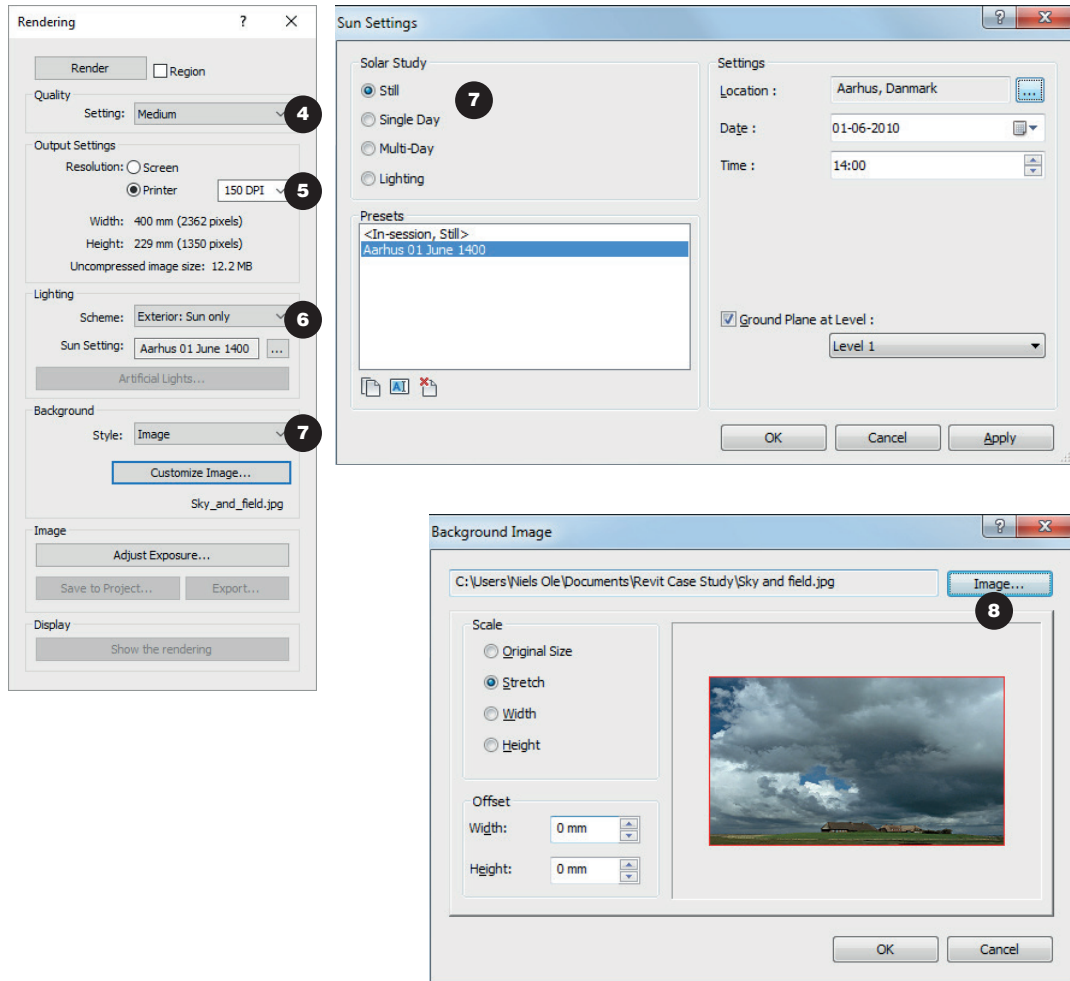
View Setup

1 Duplicate an existing 3D Camera View or create a new camera Name it; *Rendering Day Exterior South-West*.

2 Disable the View Template (*None*).

3 Open the **Rendering Dialog**.

Rendering



Background Image

Sun Settings

Render Settings

4 Set the **Quality Setting** to **Medium**.

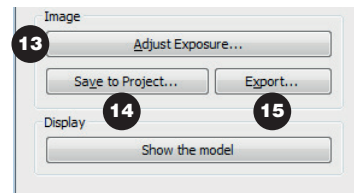
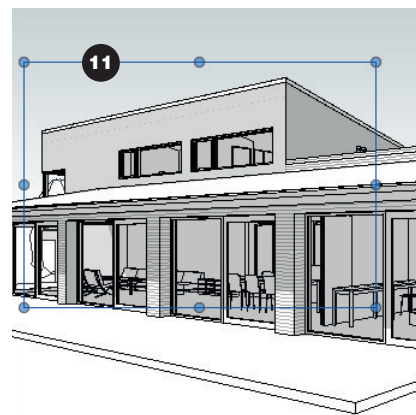
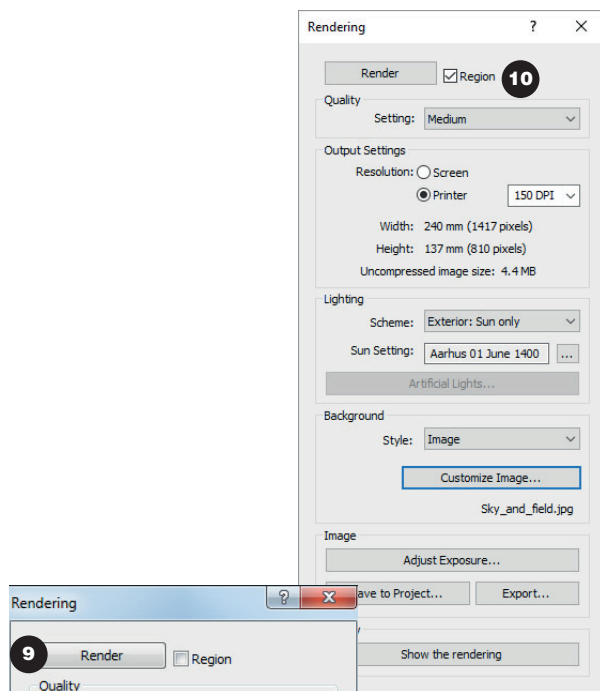
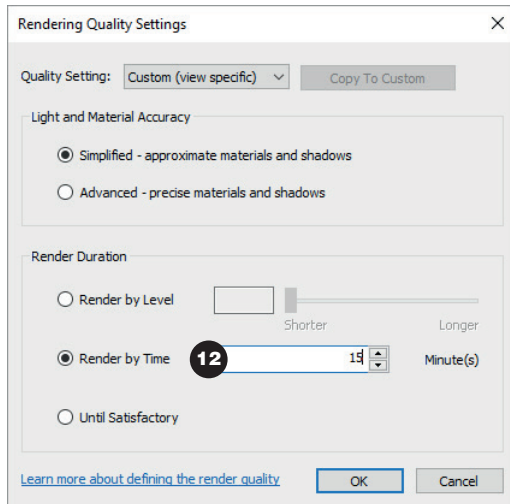
5 Set the Resolution to **Printer** & **150 DPI**. The output will become a **400x229 mm**. picture printed in a **150 DPI** quality or a **2362x1350** pixel picture.

6 Leave the **Lighting Scheme** to **Exterior: Sun Only**. The scene will only be lit by the sun (not artificial light).

Click to edit **Sun Settings**. Set the location to **Aarhus**, **01 June 1400**.

7 Select **Style > Image** and click **Customize Image** to enter **Background Image**.

8 Click **Image** to browse a picture on your computer. In your **MATERIALS** folder you can find an example called **Sky_and_Field.jpg**. Click **OK** to finish.



Render

9 Click **Render**. Quality setting, computer power, and material settings will have influence on how long it will take to render the photorealistic picture.

Work flow

10 A good rendering work flow is to render a smaller **Region** before rendering the final

picture. The Region should include both areas lit by the sun and shaded areas.

11 The Region can be resized and moved around the scene.

12 If you have a limited amount of time for your rendering, in the **Quality** settings, you can choose **Edit** and set the **Render Duration** to **Render by Time**.

Post production

13 After the rendering is finished, you can adjust the **Exposure** of the picture.

14 You can **Save Picture to Project**. The picture will be stored as a view in the **Project Browser**. Note that the rendering will NOT be saved if you go to another view.

15 **Export** will save the file to the computer as an image.

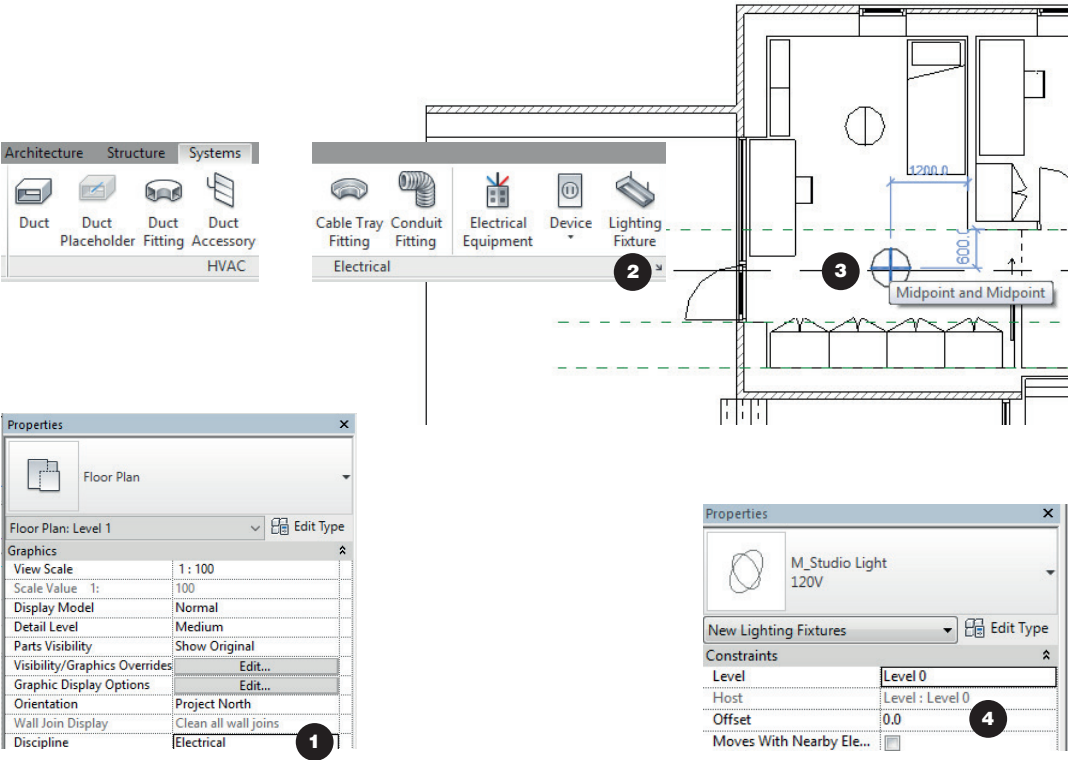
Render

Render by Time



Night scene render

Second rendering will be at night time. The scene will be illuminated by artificial lights only.



PROCEDURE/ Rendering a night scene

Rendering
Discipline
Lighting Fixtures

View Setup
Duplicate *Rendering Day Exterior South-West* and rename to; *Rendering Night Ext...*
1 Go to *Level 0*. Set the **Discipline** to *Electrical*. This will make the Lighting Fixtures visible. Check that the **Top View Range** is set to minimum 2500.

Artificial Lighting Setup
2 Go to the Tab **Systems** and select **Lighting Fixtures**.
3 Place two *M_Studio Lights* in the room. The placement height of the Light above Level 0, is by default 2400 mm.

4 If you want to adjust this height, enter an *Offset* value. Place 10 - 12 Lighting Fixtures on *Level 0* and 1 and 4 - 6 Lighting Fixtures in the rooms on *Level 2*. See *Figure B.2.5*.

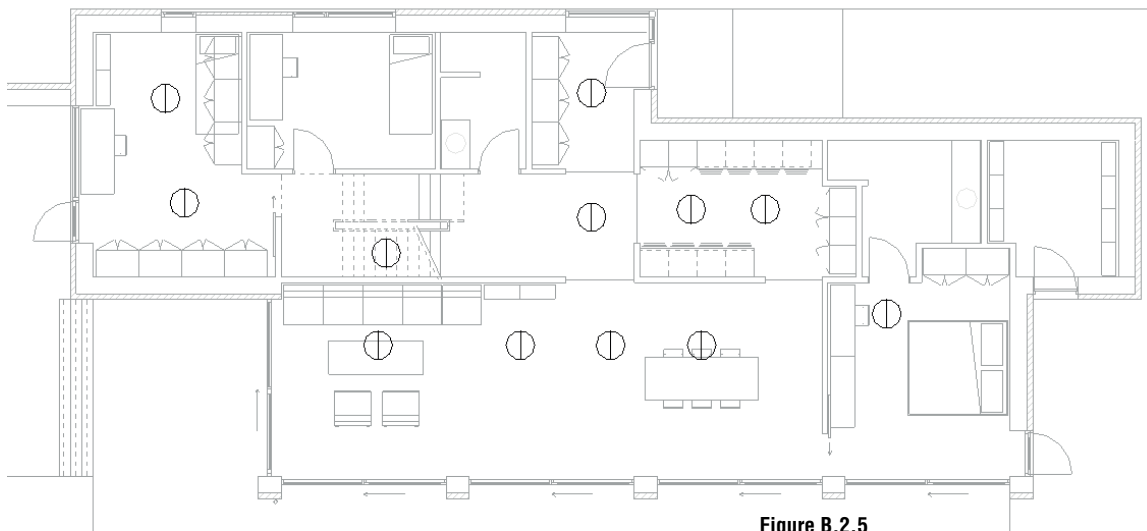
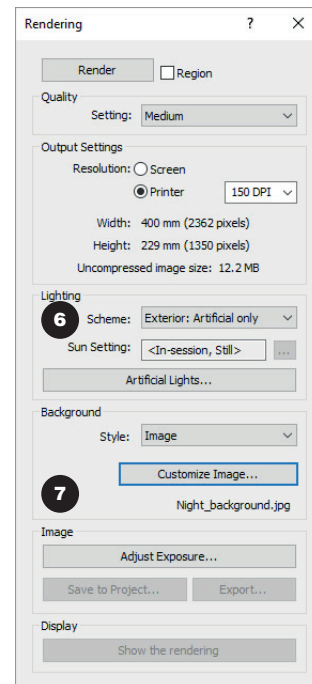
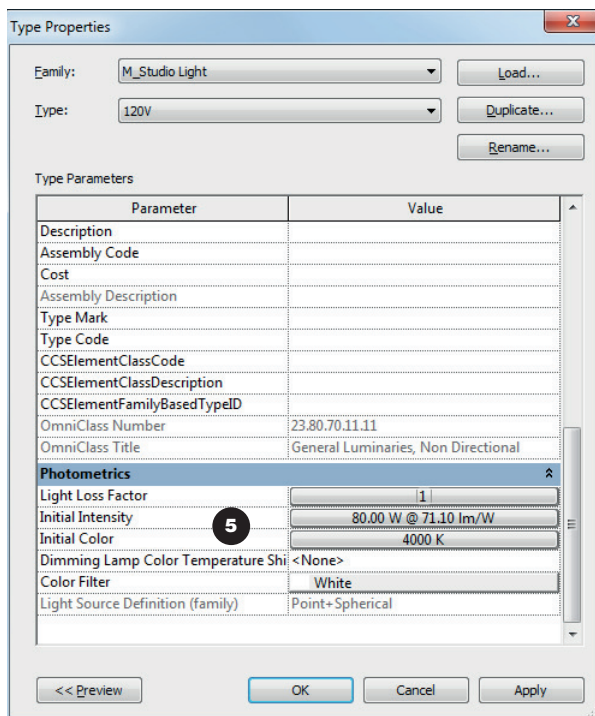


Figure B.2.5
Lighting Fixtures placed in the Scene



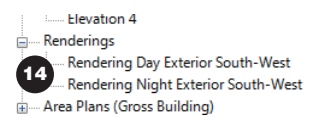
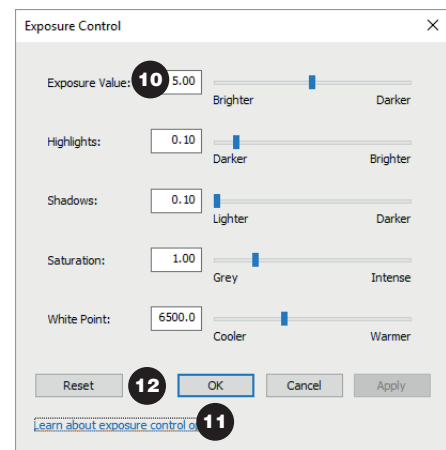
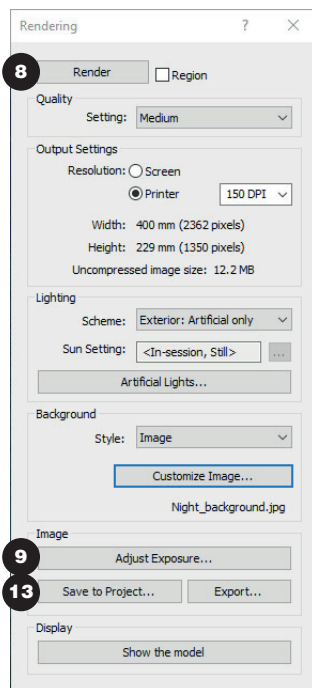
5 Select a Lighting Fixture and click **Edit Type** to adjust the height of all *M_Studio Lights*. Among other settings, you can adjust the **Initial Intensity** & the **Color** of the light. Make a change if you like.

Render Settings

6 Open the **Rendering Dialog** and set **Lighting Scheme** to *Exterior Artificial Only* (Lighting Fixtures)

7 Change the **Background Image** to *Night_background.jpg*.

Artificial Lights



Exposure Control

Render Picture

8 Open the Rendering Dialog and adjust settings. Hit **Render**.

Adjust Rendering

9 If the rendering turns out to be very dark, don't be disap-

pointed. Click **Adjust Exposure**.

10 Try adjusting the **Exposure** value to brightened up the scene.

11 Click **OK** to see the changes on the picture.

12 You can always press **Reset** to Default to start over again.

Save Rendering

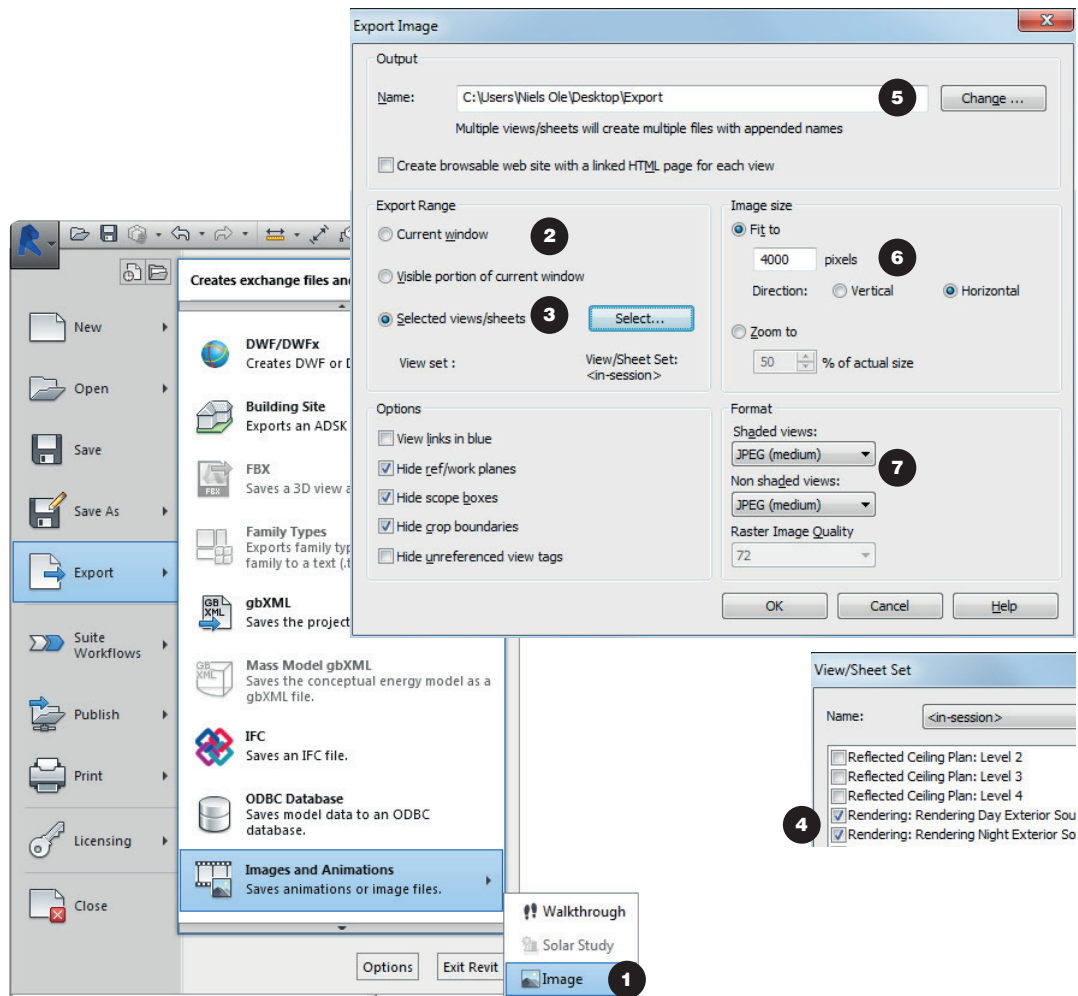
13 Click **Save to Project**.

14 The rendering will be visible in the **Project Browser**.

Export images

To use a rendering or a View (floor plan, section, elevation etc.) outside the Project File - as an image in a document, digital presentation or on a website, it must be Ex-ported from the project.

The Export dialogue box is very similar to the Print dialogue box in Chapter 3.



PROCEDURE/ **Output: Export images**

Export Setup

1 Go to **Application Menu** (Blue Revit icon) - **Export** - **Images and Animations** and choose **Image**.

2 Click **Current Window** if you only want to export this view.

3 Or choose **Selected view/sheets** if multiple views should be exported.

4 Select the views or sheets to be exported.

5 Choose a **Destination**.

6 Set the **Pixel Size**.

Export

7 Choose a format and click **OK**.

Export Image

B.3/ MOVIE - WALKTHROUGH

A **Walkthrough** is an animation of the Model - a movie filmed through a virtual camera in motion through the Model.

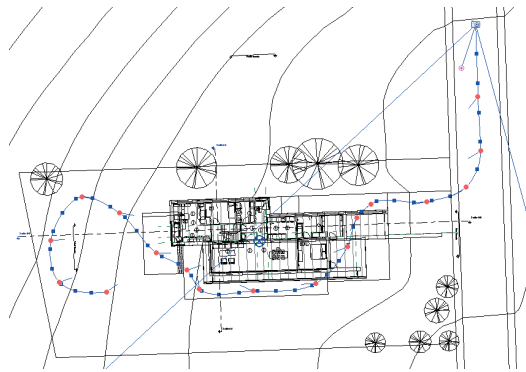
The Walkthrough consists of a series of camera positions on a **Path**. When generating the walkthrough, the camera is moved from one position to the next in one smoothly flowing movement.

OVERVIEW/ **Movie - Walkthrough**

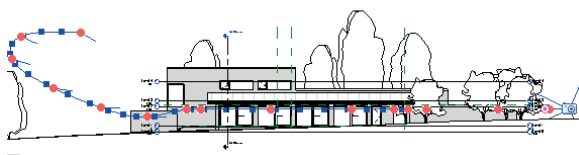
- Create Walkthrough Camera
- Draw path for camera
- Adjust path and camera
- Export

Figure B.3.1

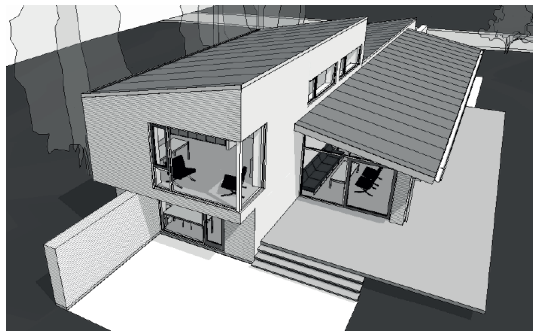
Stages of the development creating a Walkthrough in Chapter 8.2.



1. Create Path



2. Adjust Path

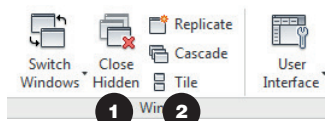
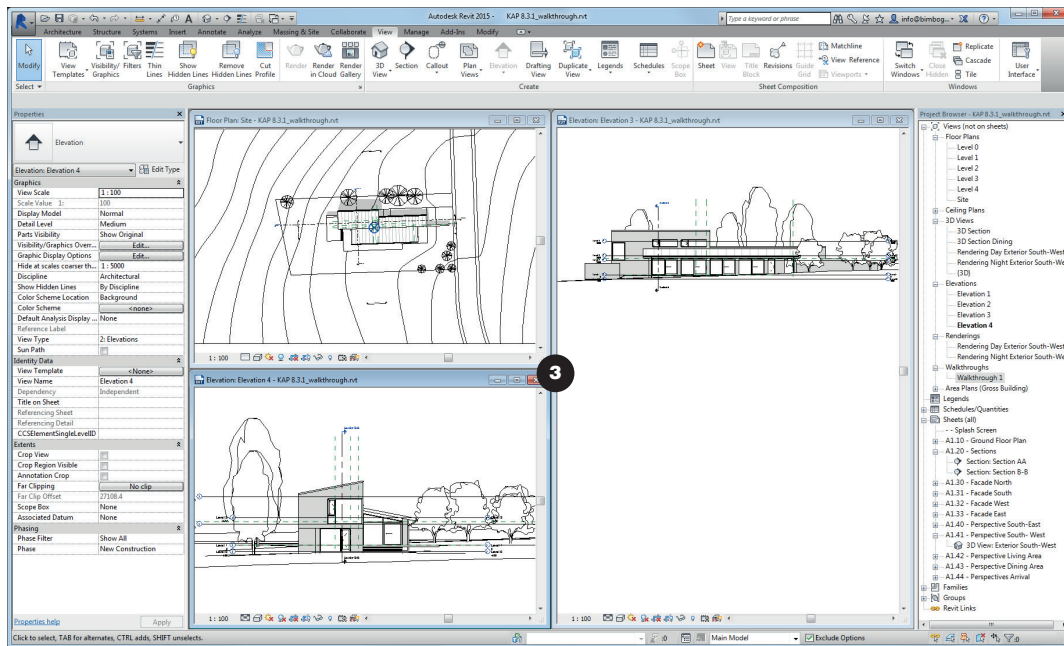


3. Export

Arrange Views for overview

As you may have experienced throughout the book, setting up Views for an optimal overview is the key to a good work flow.

This also applies when the path and cameras are adjusted in this walkthrough.



PROCEDURE/ Arranging Views for overview

Arrange Views

1 Go to the Floor Plan *Site*. On the **View** Tab click **Close Hidden**. This will leave you with only *Site View* open.

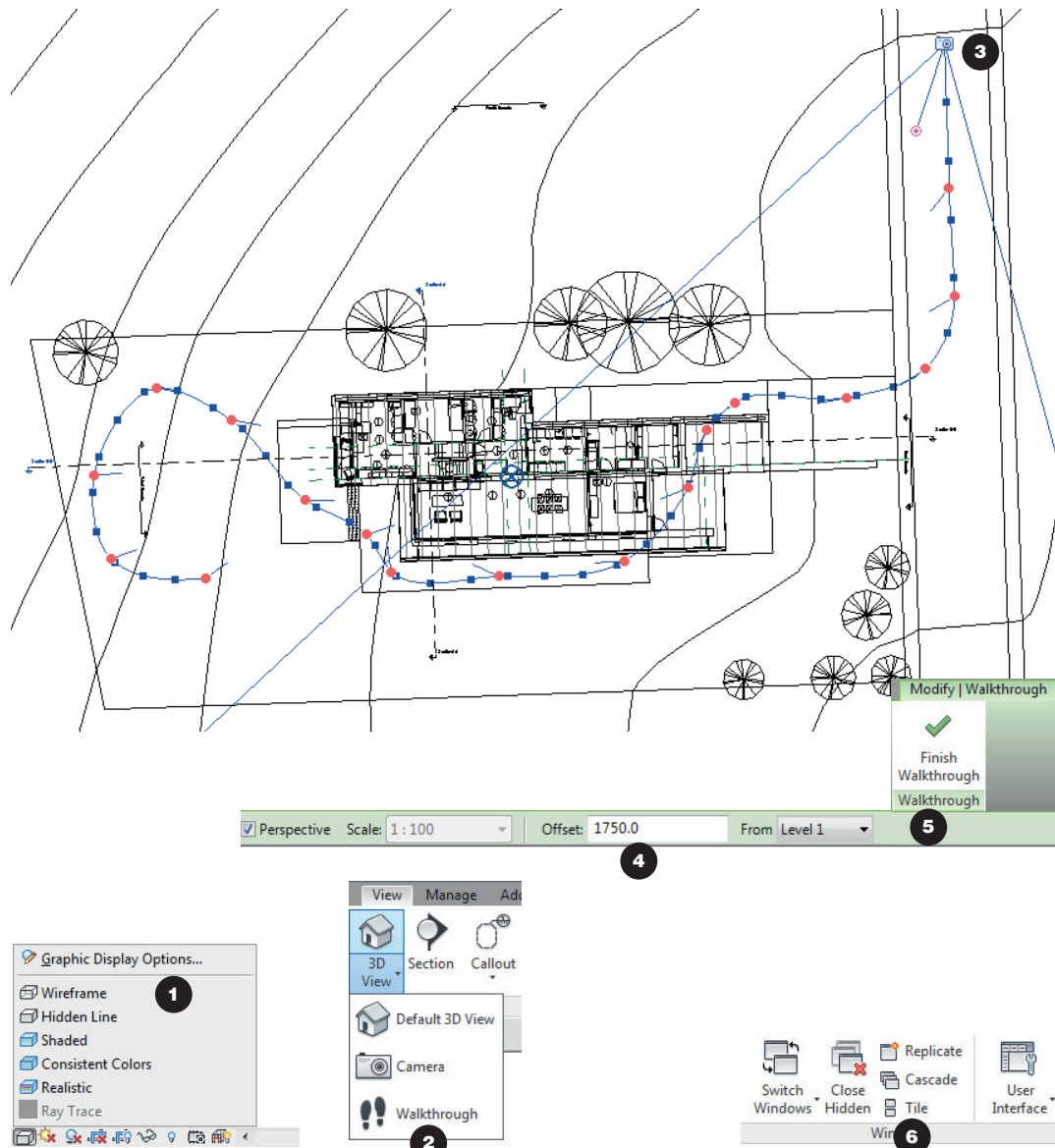
2 Open the two Elevations; **Elevation 1 & 2** and click **Tile** on the **View** Tab. All three open Windows will be placed besides each other and not on top.

3 That will give a good overview of the creation of a Walkthrough.

Close Hidden

Tile Windows

Animated walkthrough



PROCEDURE/ Creating an animated walkthrough

Walkthrough

Model overview

1 Go to Site and Maximize the view. Select the Visual Style; **Wireframe** so that you can see through the model.

Create Walkthrough Path

2 Go to the Tab **View** and start the **Walkthrough** command on the 3D View menu.

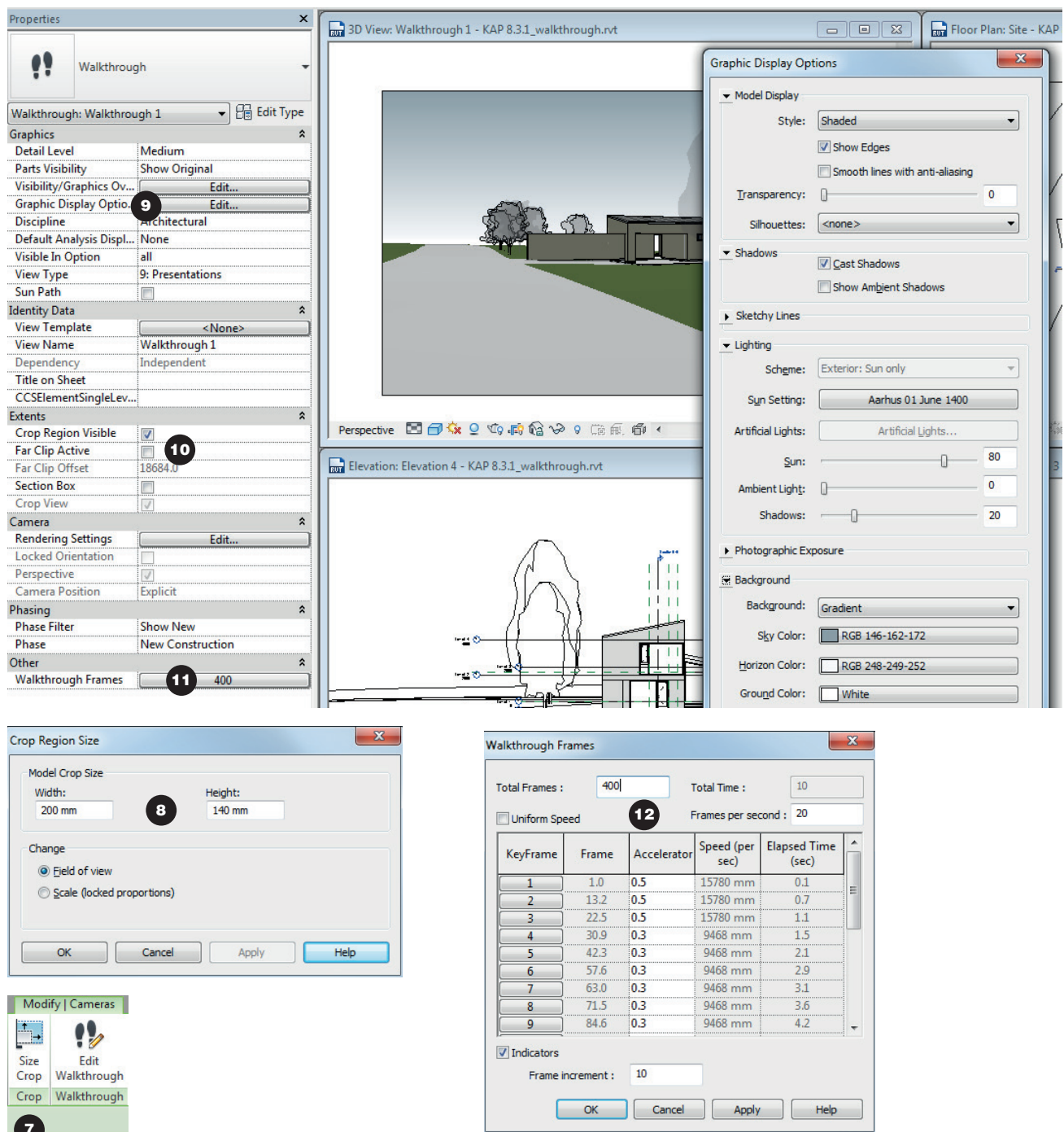
3 Create a path where your camera will fly along. Click to place the first key frame for your path.

4 You can set the height of the camera by adjusting the offset value before you place a new key frame.

5 When you have placed the last key frame click **Finish Walkthrough**.

Arrange Views

6 Open the Walkthrough Camera and click **Tile** on the View Tab to have *Site*, *Elevation 1 & 2* and *Walkthrough Camera* open and visible at the same time.



Adjust Walkthrough

7 Select the *Walkthrough 1* View. Click Size Crop.

8 Set the **Model Crop Size** to **200 mm.** & **140 mm.** and click **OK.**

9 Click to setup **Graphic Display Options** manually.

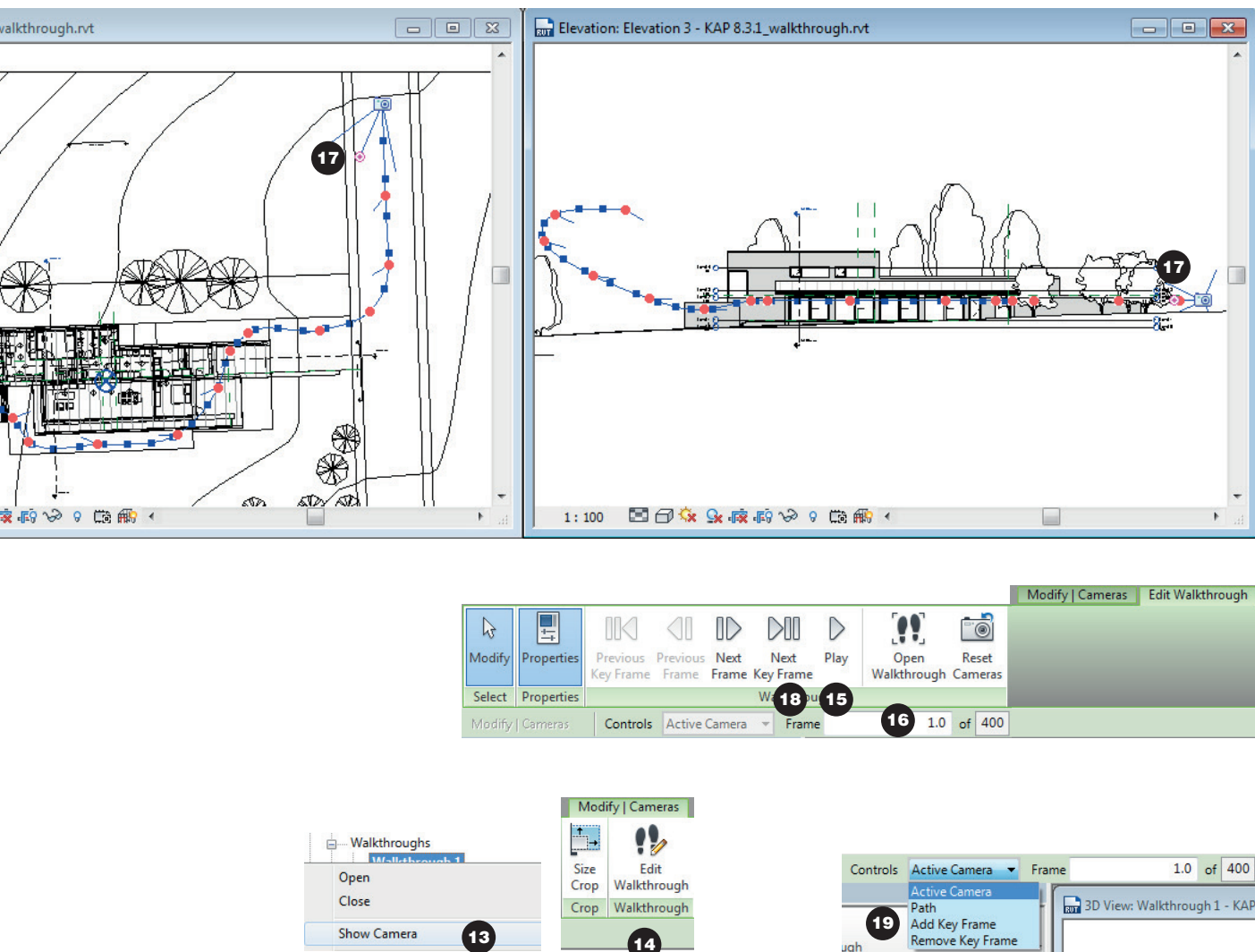
10 Disable **Far Clip Active** (Infinite visibility)

11 Select **Walkthrough Frames.**

12 Adjust the Total Frames to **400** and the **Frames Per Second** to **20.** The Camera will move slower. Enable **Uniform Speed** to individually adjust Accelerators between Key Frames. Click **OK** to finish.

Frames

Uniform Speed



Edit Walkthrough

Edit Walkthrough

13 When you deselect the Walkthrough Camera, it will be invisible. Right-click on *Walkthrough 1* in the **Project Browser** and click on **Show Camera**.

14 Click **Edit Walkthrough** in the menu.

15 Click **Play** to see the walkthrough before we adjust the path & camera.

16 Reset camera back to Key Frame 1; type *1* and **ENTER**.

Adjust Camera

17 Move the Cameras Target Point on the *Site* plan or on a *Elevation*.

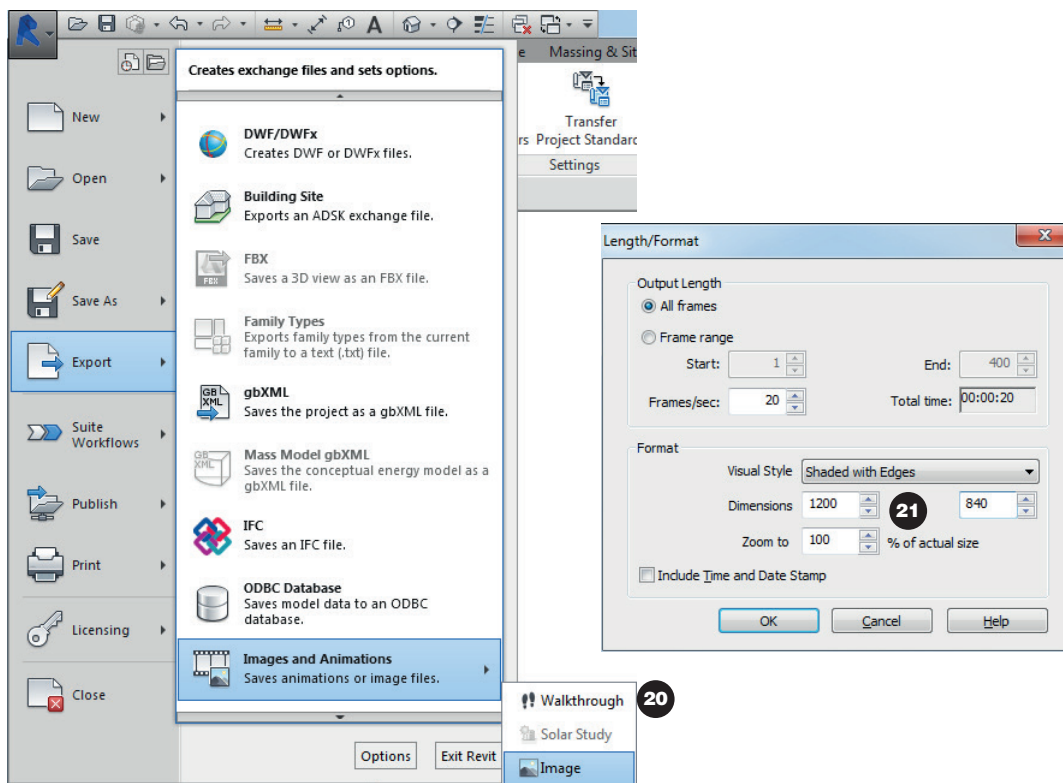
18 Click **Next Key Frame**. Adjust Camera Target etc. etc.

Adjust Path

19 At every **Key Frame** you can also choose to control the **Path** instead. Move the **Path** on a *Site View* or on an *Elevation View*.

Final Adjustment

Try playing the movie and edit the path and adjust the camera until you think it's perfect.



Export Setup

20 Go to **Application Menu** (Blue Revit icon) - **Export** - **Images and Animations** and choose **Walkthrough**.

21 Be realistic when you set the **Visual Style** and **Dimension**. Rendering this movie can take weeks instead of hours if you choose **Realistic**!. Try using the **Visual Style Shaded With Edges** and a **Dimension** of **1200 x 840**. Save the movie (.avi) to the computer.

Export Walkthrough

B.4/ INTERACTIVE PANORAMA

An Interactive Panorama is the output of a 360 degree camera in a fixed position for digital presentation only. When viewing an Interactive Panorama on a computer or other device, the view direction can be controlled by the viewer, while the position of the camera remains fixed.

Interactive panorama is a service only available on the Autodesk 360 Cloud service.

Use the Cloud Render for rendering fast Still images and Illuminance studies without using your own computer.

OVERVIEW/ Interactive Panorama

- Create new Camera View....
- ... or Duplicate existing Camera
- Render In Cloud
- Show i Web Browser

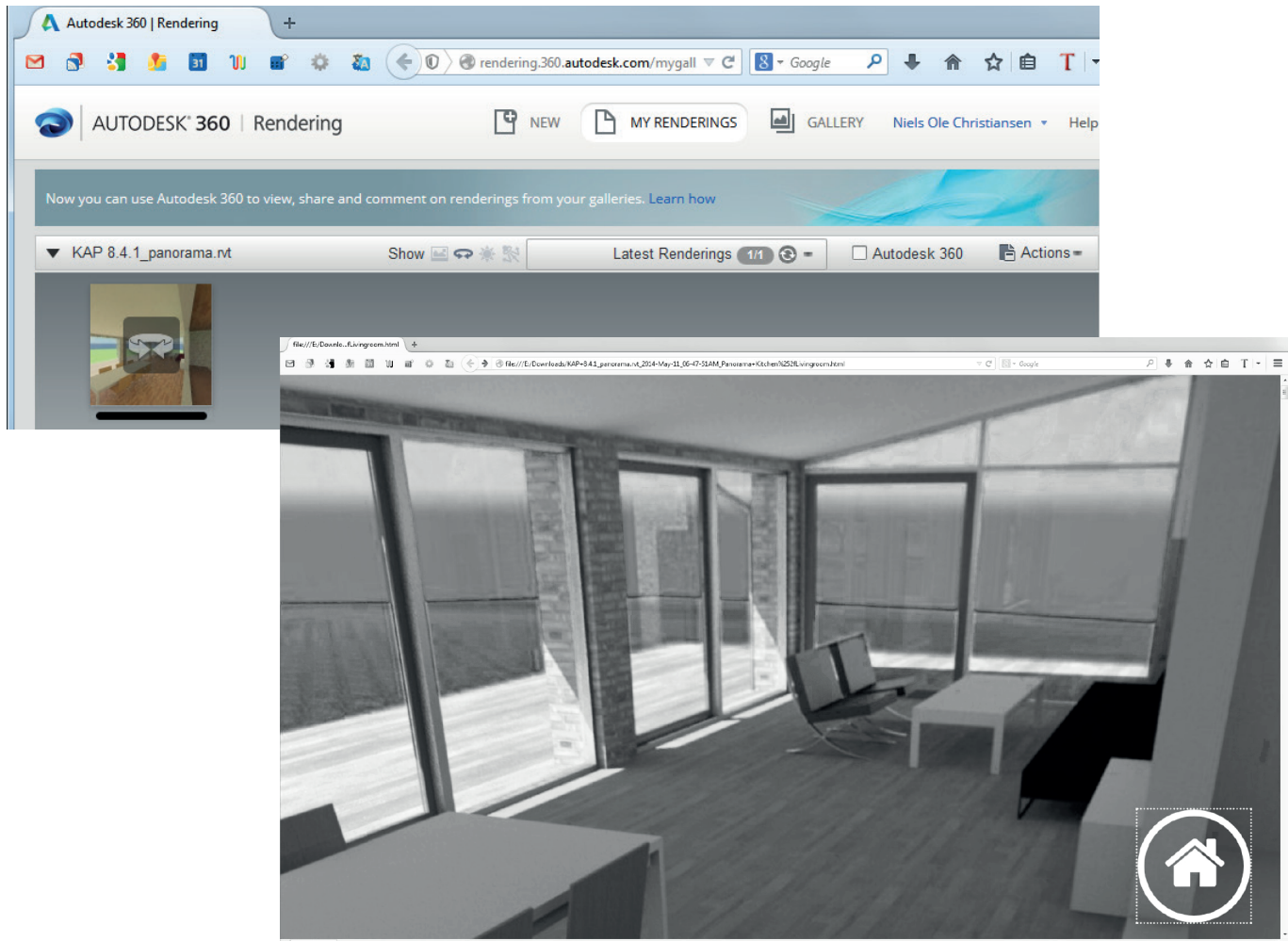
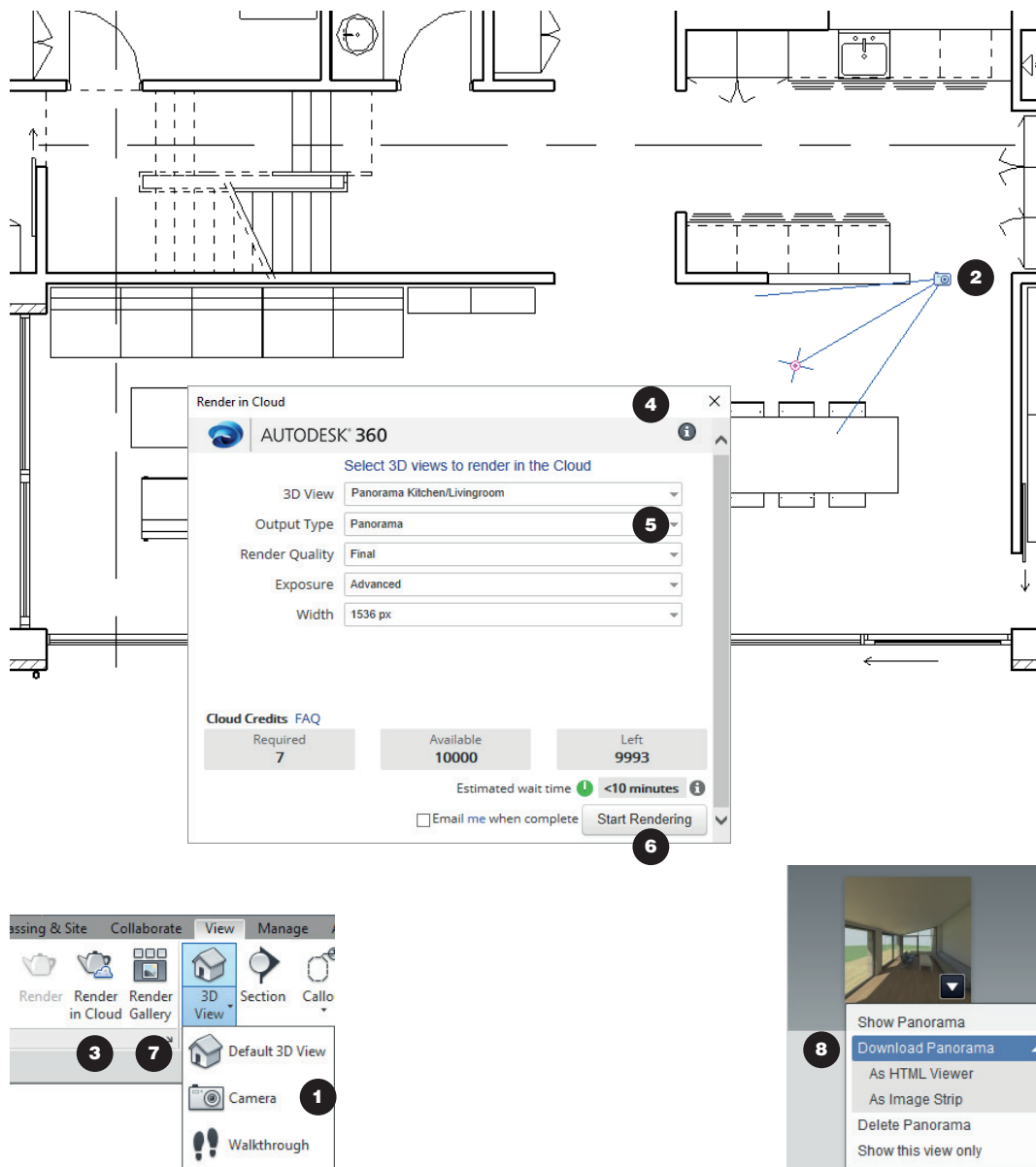


Figure 8.4.1
Screen-shots of the Render in Cloud service

Interactive Panorama



PROCEDURE/ **Creating An Interactive Panorama**

Camera Setup

1 Create a new camera view; **View > 3D View > Camera** or open *Interior Dining*.

2 Place the camera so you get a nice view into both kitchen and living room. Name/rename it *Panorama Kitchen/Living room*.

Cloud Setup

3 Select **Render in Cloud**.

4 Sign in to your Autodesk 360 Account if you haven't already done so.

5 Set the **Output Type** to *Interactive Panorama* and complete other settings; **3D View**, **Render Quality**, **Image Size & Exposure**.

6 Click **Start Rendering**.

7 If the Render In Cloud dialog disappears, click **Render Gallery**.

8 After the Rendering is finished, you can download the file and view it in a web browser.

Render in Cloud

Interactive Panorama

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WEBSITE

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While working your way through the concept design stage of a detached single family house in a realistic design process, you will be led through all the tools in Revit necessary to master modeling a small building.

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