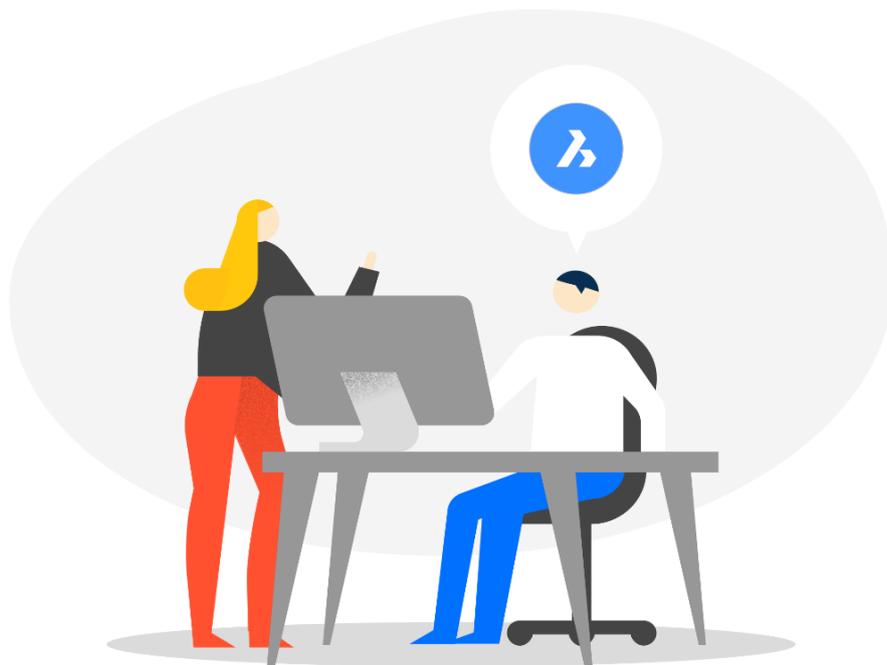


BricsCAD 3D Modeling Training



Contents*

Introduction	1
Interface, viewing and navigating	2
Exercise 1: Basic concepts	12
Exercise 2: Sculpting a model	15
Exercise 3: Mechanical Parts	23

Introduction

1. The step-by-step instructions also have figures included to provide additional context for select steps
2. Modules have “starter .dwg files” that should be used
3. The text in “**bold blue**” indicates BricsCAD commands
4. The text in “**bold black**” are inserted and/or selected values
5. The exercises are in metric units (mm)

Before beginning, make sure the following settings are enabled:

- In the Status Bar (bottom right of your screen): ESNAP, STRACK, DUCS, DYN, QUAD, RT
- In the Command Line: DMEXTRUDEMOMODE = 3, BIMOSMODE = 1, QUADDISPLAY = 5, (optional - for better on-screen rendering) ANTIALIASSCREEN = 2
- In the Ribbon, under Home tab (Can also be done in the Command Line: SELECTIONMODES = 6)
 - o Disable selection of Edges
 - o Enable selection of faces
 - o Enable selection of Boundaries
- In the Structure Browser Configuration Window: ‘Select entities when selected in tree’

* This document can be used by Bricsys Partners to create their own localized BIM training. Bricsys only requests to receive the localized content when finalized.

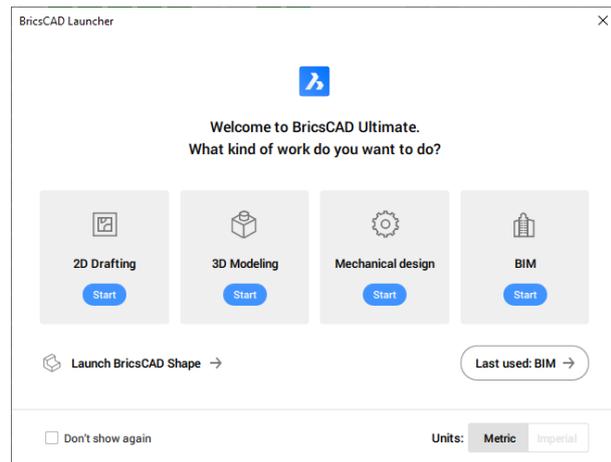
Interface, viewing and navigating

This module explains BricsCAD V21 interface, shows how to show and hide (selected) entities, make sections and how to navigate in 3D.

1 Interface

1.1 BricsCAD Launcher

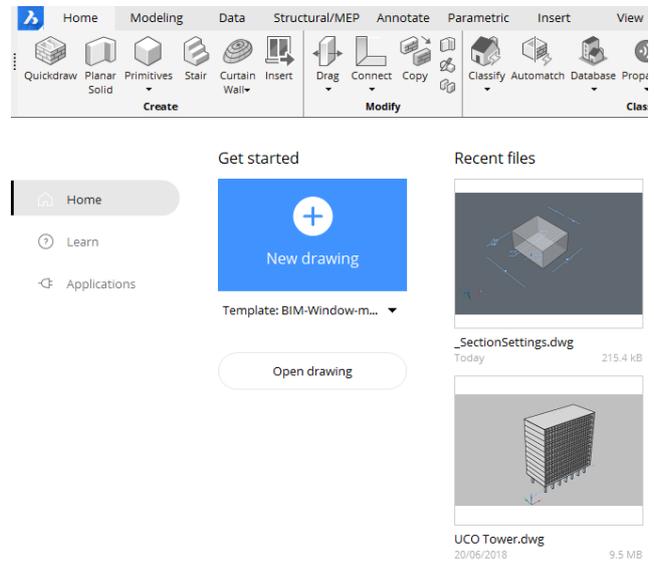
When starting BricsCAD, the Launcher dialog appears. Here you can select your workspace. Since our training is for BIM we will select the BIM workspace.



1.2 Getting Started

In V20 the welcome window, you have 3 main sections (1) HOME, (2) LEARN and (3) APPLICATIONS.

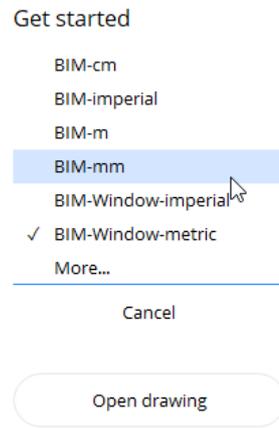
1. From the HOME tab you can create a new drawing, choose your units, open a drawing or access your most recent files.
2. From the LEARN section you can access tutorials
3. From the APPLICATIONS section you can explore third party applications



1.3 New Drawing

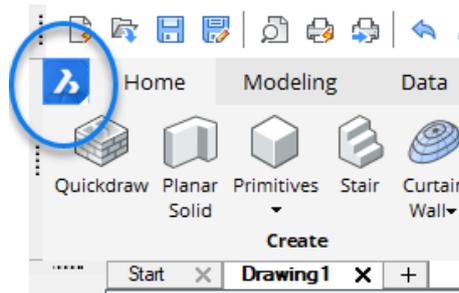
Before starting a New File, check that you use the BIM-mm template. You can change it by scrolling down through the Templates and selecting BIM-mm

NOTE: Once the model space appears, check that the settings are according to the one mentioned in the introduction.



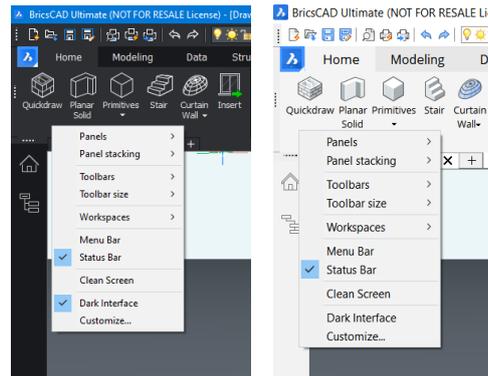
1.4 File Menu

The FILE menu can be accessed through the BricsCAD icon, in the top left corner of the ribbon



1.5 Dark Interface

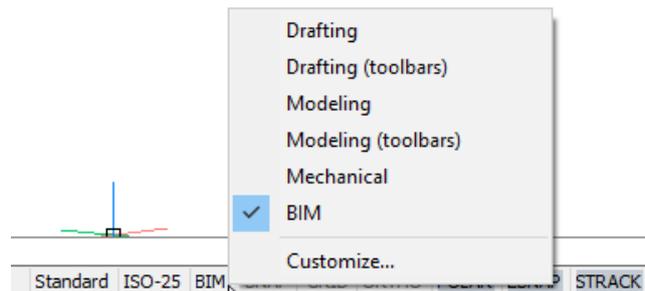
BricsCAD is set by default to have a Dark Interface, but this can be easily changed by right-clicking anywhere in the ribbon or toolbar, and de-selecting **Dark Interface**



1.6 Workspaces

Switching between workspaces can be done from the status bar. If you right-click on the tab displaying **BIM**, the list of different workspaces will be displayed.

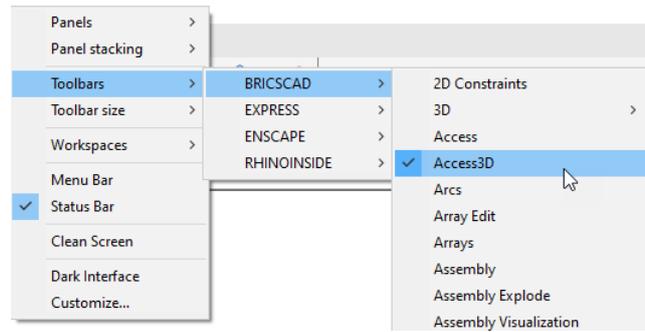
TIP: You can also access the **Workspaces** by right-clicking anywhere in the ribbon or toolbar



1.7 Access Toolbar

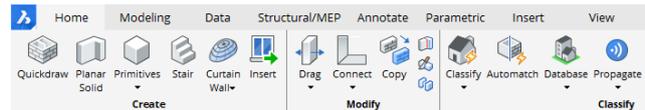
BricsCAD Access toolbar at the top of your screen acts as an Express Toolbar. Here you will find the most used tools when 3D modelling.

You can access this toolbar by right-clicking in the ribbon, selecting toolbars, then BRICSCAD and Access3D



1.8 Ribbon Tabs

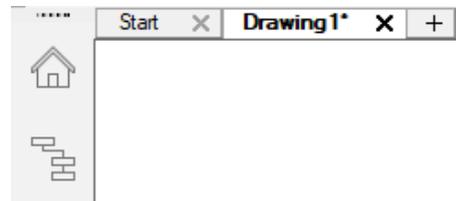
Common tools are organized in groups within tabs. Each tab corresponds to a group of functionality



1.9 Drawing Tabs

This allows you to easily switch between different open drawings.

TIP: You can also display all open drawings at once by right-clicking on any of the project tabs and selecting to view horizontal or vertical



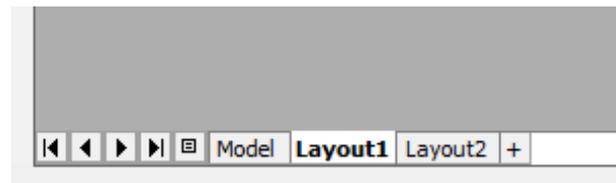
1.10 Model Tab

Model Space is an area in which you create two-dimensional and three-dimensional entities based on either the World Coordinate System (WCS) or User Coordinate System (UCS).



1.11 Layout Tab

Layout tab can also be referred as paper space. Here is a work environment that provides the model space view at a given scale, depending on the size of the paper



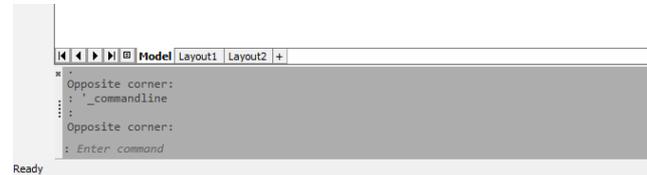
1.12 Collapsible panels

A set of collapsible panels is shown on either side of the screen. In the BIM workspace, by default the Structure browser, Project browser and BCF Panel are pinned to the **left-hand** side. On the **right-hand** side you will find the Tips, Properties, Components, Details, Compositions, Profiles, Layers, Mechanical browser and 24/7 Panel. Most of these will be covered later in this document.



1.14 Commandline

In the lower field, you can type the commands and BricsCAD shows prompt, options and other information regarding the execution of commands here. Press **F2** to show the full command prompt in a separate window, or **Shift + F2** to show/hide the commandline.



1.15 Status Bar

The Status Bar sits along the bottom edge of the BricsCAD application window. It contains a lot of information about the settings in the current drawing.



2 Viewing

If you work with many entities in a drawing, everything that you have in the drawing is visible in the view. When you want to temporarily make only a few entities or a particular entity visible and manage them in a view, you can use the Hide or Isolate tools.

2.1 File: Select **Template: BIM mm**. Then click on Open drawing. Select file **Building_M1.dwg**

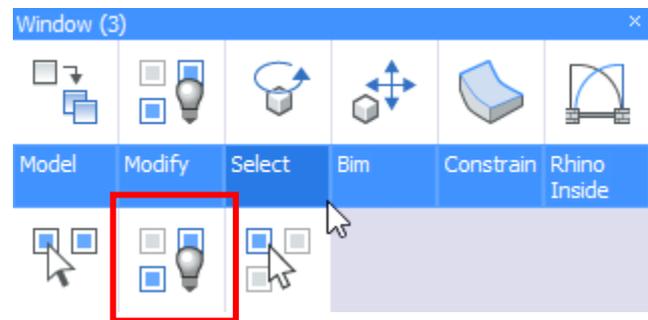
2.2 Hiding Entities

The Hide tool temporarily hides the selected entities in the view.

In this drawing we will hide the windows from the right building

1. Select windows
2. Quad appears, move cursor to Select tab and click on **HIDE ENTITIES** icon 

All entities that have been selected are hidden in the view.



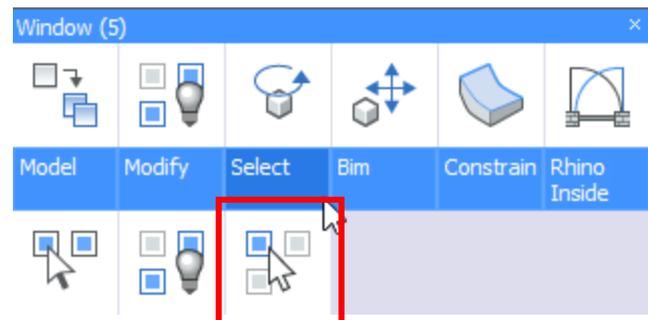
2.3 Isolating Entities

The Isolate tool temporarily hides all entities except those that have been selected.

In this model,

1. Select the front windows from the left building
2. Once the quad appears go to Select tab and click on **ISOLATE ENTITIES** 

All entities that have been selected are temporarily isolated.



2.4 Showing entities

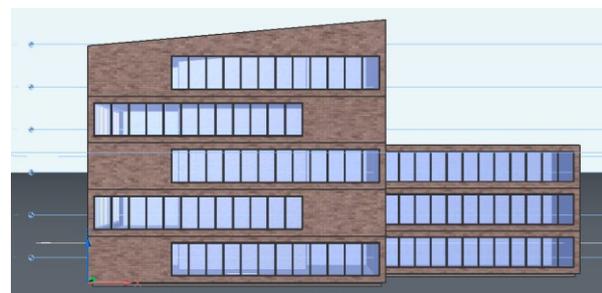
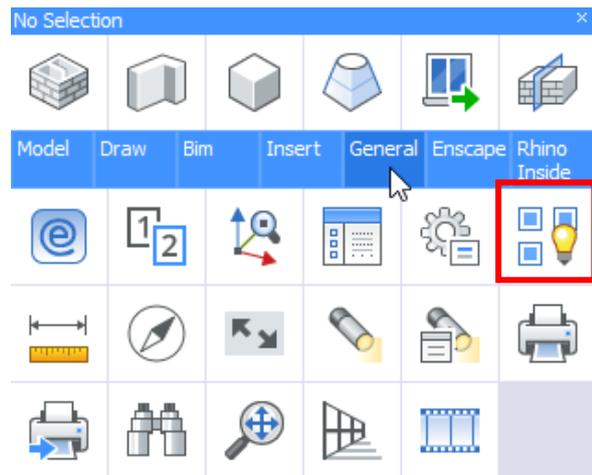
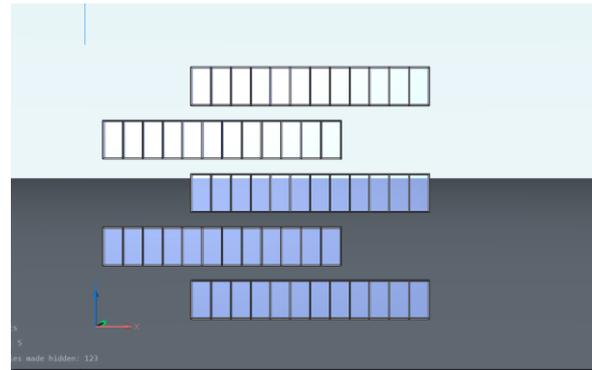
The Show Entities tool brings back all hidden entities in the view.

Let's bring all entities back to view

1. Right-click in the model space. The quad appears in no selection state
2. Move cursor over the General tab and click on

SHOW ENTITIES 

All entities that were temporarily hidden and isolated will be shown.

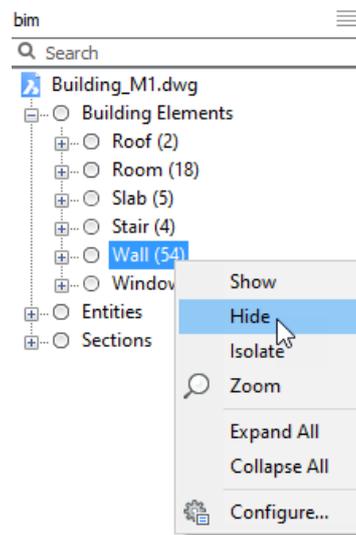


2.5 Structure Browser

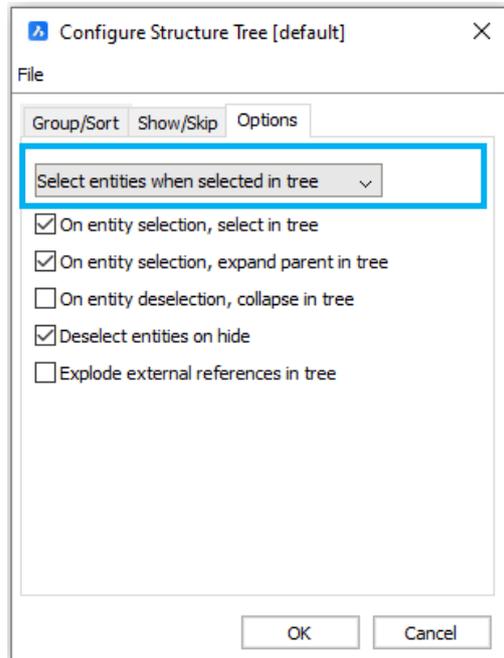
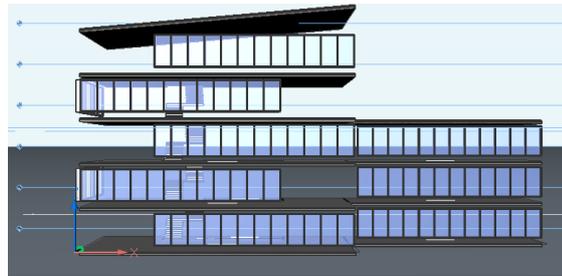
The Structure Browser can also be used to hide and isolate selected entities as well as revealing all hidden entities in the model space.

1. Open the **Structure Browser**
2. Make sure the current configuration is set to bim. If not, click the little hamburger menu on the top right corner of the structure browser.
3. Select **Wall** elements. All entities under this element will be selected
4. Right-click and select Hide

All the walls have been temporarily hidden.



NOTE: Make sure the settings for the structure browser are correct by clicking on the name **Bim** on top of the structure browser. You will enter a dialog where you need to go to the **Options** tab. There you need to choose the preset **Select entities when selected in tree** from the dropdown.



3 Navigate in 3D

As you navigate around and through your 3D model, the location of the model in space remains constant. It's your current view (viewpoint) of the model that is changing.

3.1 Mouse and Keyboard Navigation

Most used navigation tools are the zoom in/out, pan and orbit which can be easily accessed through the mouse and keyboard.

1. Zoom in/out – roll the mouse wheel
2. Pan – hold the mouse wheel or middle mouse button
3. Orbit – hold Shift key and mouse wheel

3.2 View Ribbon Tab

Extra zoom, panning and orbit tools can be found in the View Tab from the ribbon tool



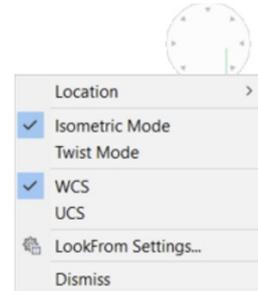
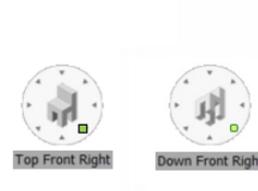
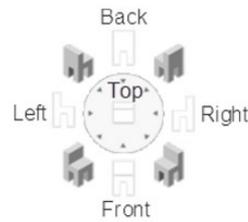
3.3 Look From Navigation Tool

The **LookFrom** tool is displayed in the upper right corner of the Drawing area.

Click on different places on the **LookFrom** tool to display the view from standard viewpoints.

TIP: To view Bottom viewpoints hold **Ctrl** key.

NOTE: A right-click menu offers access to additional controls and settings. To learn more, refer to BricsCAD Online Help.



3.4 Properties Panel

Extra view settings can also be found in the **Properties Panel** while nothing is selected.

1. PERSPECTIVE: Reports the current value of the PERSPECTIVE system variable; switches perspective view mode on and off.
2. VISUAL STYLE: Reports the current visual style, and allows you to select a different one.

No Selection

General	
Color	<input type="checkbox"/> ByLayer
Layer	0
Linetype	————— ByLayer
Linetype scale	1
Lineweight	————— ByLayer
Transparency	ByLayer
Elevation	0 mm
View	
Camera	10541.51, -116216.41, 39910.
Target	13836.31, -1913.26, 12793.43
1 Perspective	On
Lens length	50 mm
Field of view	38.58
Height	56.45851 m
Width	91.84104 m
Clipping	Off
Front plane	639.515 cm
Back plane	-30.14996 m
2 Visual style	Bim
Misc	
Annotation scale	1:1
Default lighting	Off

4 Selecting entities and Quad cursor

The following steps will demonstrate how to work with the Quad Cursor and highlight & select 3D model entities.

4.1 File: New, select Default-cm template. Note that the drawing units of this file will be in centimeters.

4.2 Using the Quad

The quad is a floating toolbar that adjusts its content, depending on what you are or are not highlighting, and what you may have selected in the current workspace

We'll start with an empty drawing

1. Right-click in the model space. The quad appears in no selection state

2. Move the cursor over the **Model** tab

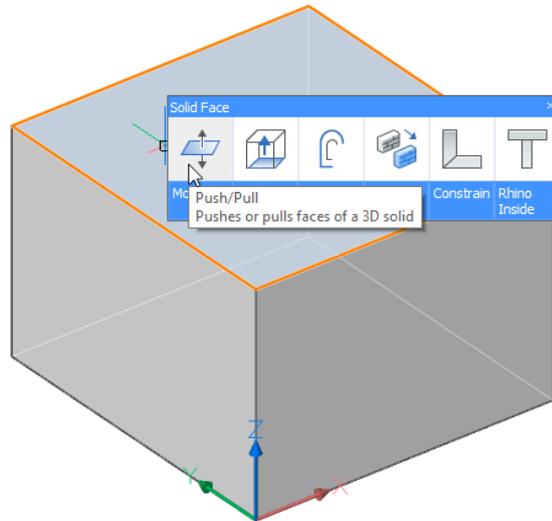
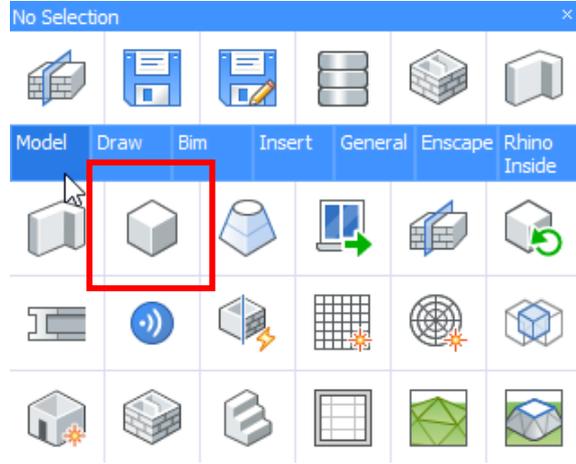
The tool group is expanded with more tool options

3. Click the **BOX** icon from the quad

4. Draw a simple 3D box

5. Hover the cursor over one of the faces of the box. The Quad displays a single icon, which is the most recently used tool with this entity type.

6. Right-click to launch the most recently used tool or move the cursor over the icon to further expand the Quad



4.3 Selection modes

Selection modes allow you to control which sub-entities (faces, edges, and boundaries) should highlight in selection preview, and can be selected.

1. Selection modes can be found in the **Access toolbar** or by typing **SELECTIONMODES** in the command line.
2. Click the face and boundaries options.

Select edges is inactive whereas select faces and select boundaries are active

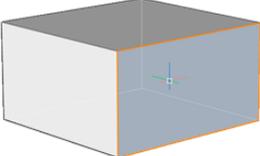
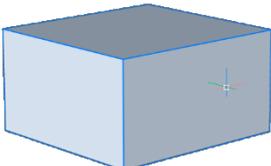
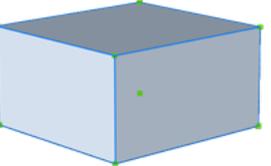
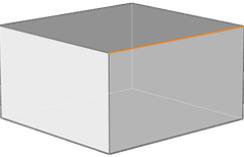


Enable detection of 3D solid edges 	Controls whether 3D solid edges are highlighted by selection preview, and can be selected.
Enable detection of 3D solid faces 	Controls whether 3D solid faces are highlighted by selection preview, and can be selected.
Enable boundary detection 	Controls whether closed boundaries in XY-plane of the current coordinate system or on the face of 3D solids are detected.

4.4 Highlighting vs Selecting entities

When select Edges is off, select Faces and Boundary Detection are on (default), do one of the following:

1. Hover over the face with your mouse cursor
The **solid face** is highlighted in orange. When the face is highlighted, click this face to select it
2. Hover over one of the faces of the solid while holding down the CTRL key
The solid displays in blue. When the solid is highlighted, click the solid to select it
3. Hover over the edge of the solid while holding down the CTRL key. The edge displays in blue. When the edge is highlighted, click the edge to select it

Highlighted/Selected Face	
Highlighted Solid	
Selected Solid	
Highlighted/Selected Edge	

4.5 Selecting multiple entities with selection windows

The selection windows allow you to select one or more than one entity at a time

There are two types of selection windows in BricsCAD;

Blue selection window: It appears when creating a window from left to right

Green selection box: It appears when creating a box from right to left

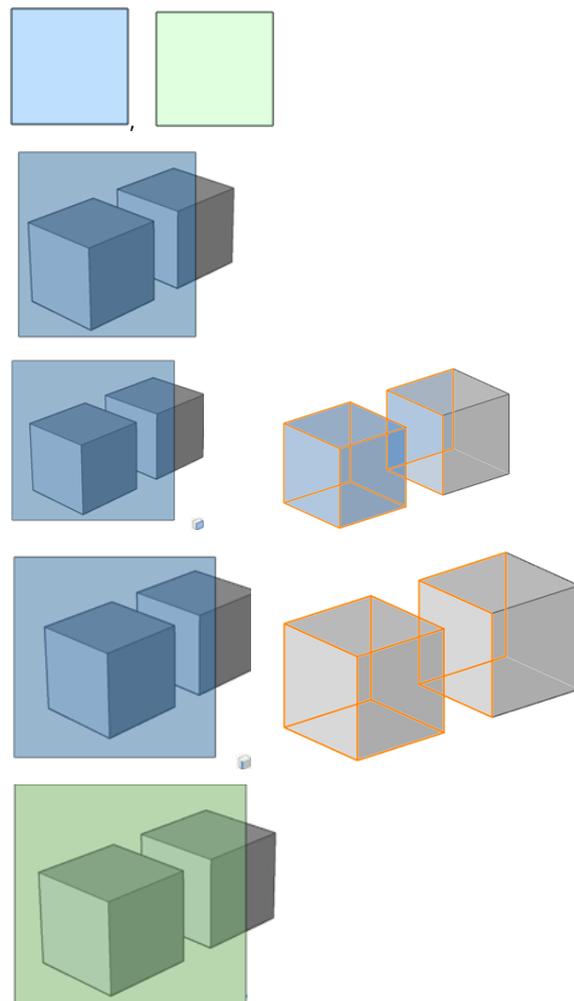
1. Click and move the mouse to the right to create a blue window around the box geometry you've created before. When the box is completely inside the window, it will be added to the selection set

NOTE: by default, selection window only selects entire entities (e.g. solids, lines, polylines, blocks...) but not sub-entities (e.g. solid faces, solid)

2. Press CTRL key once during window selection to select **faces** of the 3D box
3. Press CTRL key twice during window selection to select **edges** of the 3D box
4. Click and move the mouse to the left to create a green window around the box geometry

When the box overlaps the window or is completely inside the window, it will be added to the selection set

To select faces or edges of the 3D box with the green selection box, follow the same process as the blue selection box.



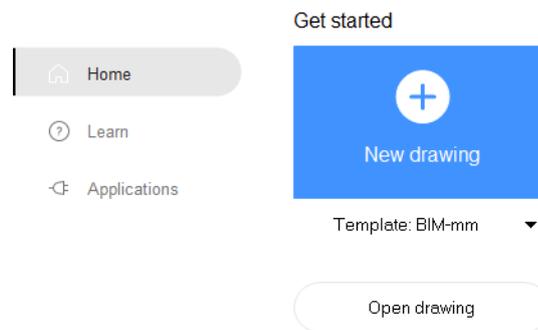
Exercise 1: Basic concepts

The following module is to get familiar with basic modeling tools.

1 The Basics

1.1 File: New, select **Default-cm template**. Note that the drawing units of this file will be in centimeters.

Make sure you are in the **Modeling** workspace. Switching between workspaces can be done from the status bar. If you right-click on the tab displaying BIM, the list of different workspaces will be displayed. Click on **Modeling** to switch.

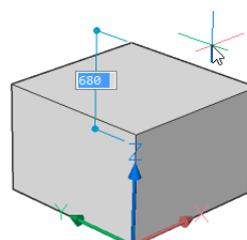
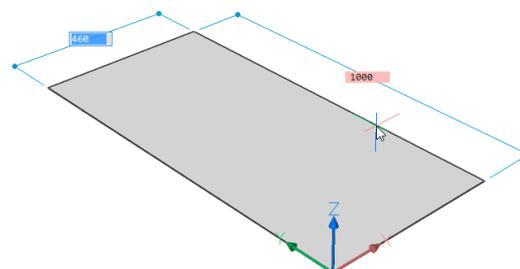
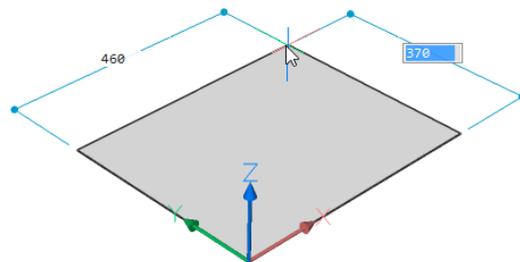


1.2 Creating a project folder

Before beginning, save the file in a new folder. This will be your project folder where additional documents will be saved.

1.3 Drawing a box

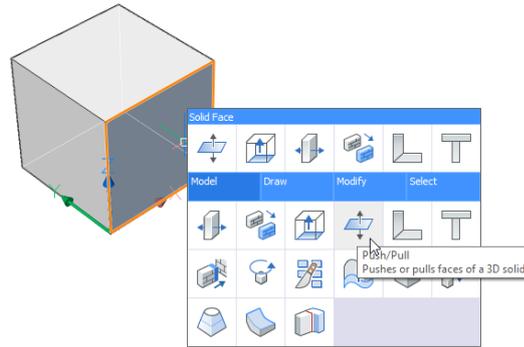
1. Open the No-Selection Quad by right-clicking on an empty place in the canvas and moving the cursor over the icon
2. Under the Model tab, click the **BOX** icon 
3. You are prompted: Set corner of box or [Center]:
4. Type in **0,0,0** and press **Enter**
5. Two dynamic dimensions are displayed that control the length and width of the box (see image). The dynamic dimension that is highlighted in blue is the active one.
6. Type in a value of **1000** and press the **Tab** key to switch to the other dynamic dimension
7. Note that the first dimension is now highlighted in pink. This is to indicate that a value was entered here, and this value is now locked on this dynamic dimension.
8. Type in a value of **1000** and press **Enter**. Alternatively, you can press **Tab** again to switch back to the first dynamic dimension



- Finally a dynamic dimension appears that controls the height of the box. Type in a value of **1000** and press **Enter**.

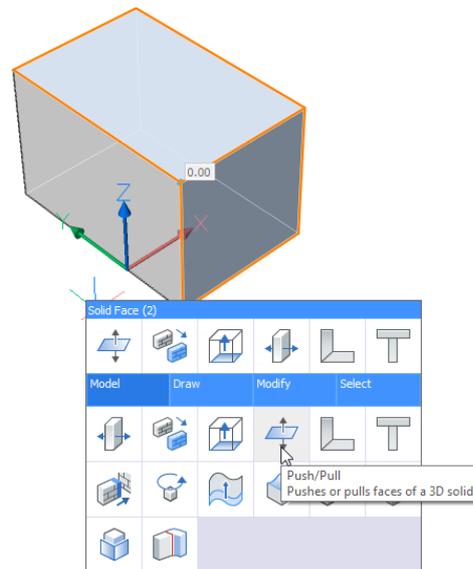
1.4 Manipulating a face

- Move your cursor over a side face of the box until it is highlighted
- Open the Quad by moving your cursor over the icon
- Under the Model tab of the Quad, click the **PUSHPULL** icon 
- Type in a value in the dynamic dimension box and press **Enter**, or left-click on the location where you want to pull this face to.



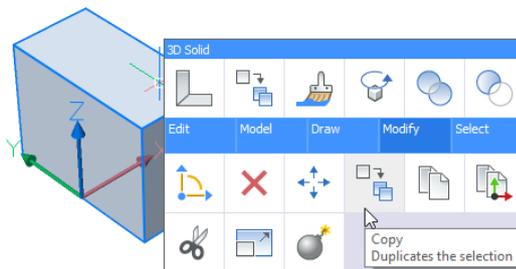
1.5 Manipulating multiple faces

- Select a side face of the box by left-clicking it
- Select the top face of the box
- When you have both faces selected, right-click anywhere on an empty space in the canvas to open the Quad
- Under the Model tab, click the **PUSHPULL** icon 
- Both faces will now be pushed in or pulled out over equal distances.
- Type in a value and press **Enter** or left-click.



1.6 Copying a solid

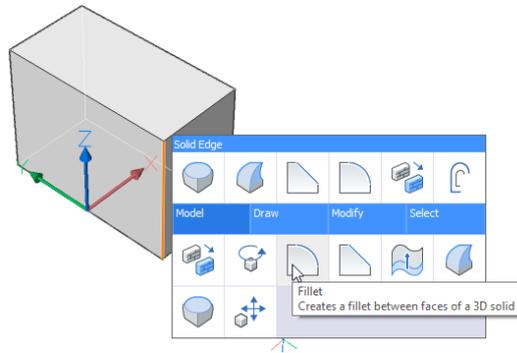
- Highlight the box by holding the **Ctrl** key and hovering over one of the faces of the box. Instead of the face, the entire solid should be highlighted now.
- Open the Quad by moving your cursor over the icon, and under the Modify tab, click the **COPY** icon 
- You are prompted for a *Base Point*. Left-click one of the corners of the box.
- You are prompted for the *Second point*. Left-click where you want the copy of the box to be.
- You can continue placing copies, or press **Enter** or **Esc** to exit the command.



Note that the above steps can also be done using BIMCOPY after highlighting a face of a 3D solid.

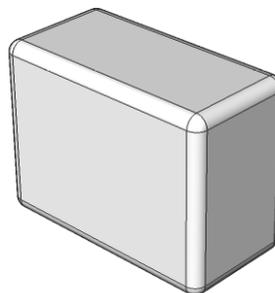
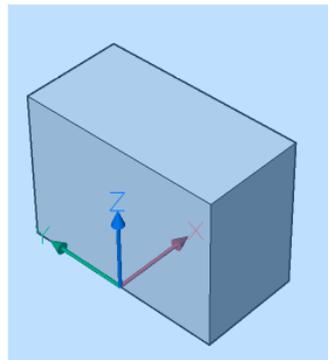
1.7 Manipulating an edge

1. Highlight an edge of the box by holding the **Ctrl** key and hovering over one of the edges of the box. Instead of the face, the edge should now be highlighted.
2. In the Quad under the Model tab, click the **FILLET** icon 
3. Type in a fillet radius and press **Enter**.



1.8 Manipulating multiple edges

1. Instead of giving one edge a fillet, we will fillet all the edges of the box at once
2. Press **Ctrl + Z** to undo your previous action, so the fillet of the previous step is removed.
3. Create a selection window around the entire box, and while drawing this window, press the **Ctrl** key twice until a small icon indicating 'edge selection' appears (see image)
4. You should now have selected all 12 edges of the box. In the Quad under the Model tab, click the **FILLET** icon 
5. Type in a fillet radius and press **Enter**.



Exercise 2: Sculpting a model

The following steps will give an example of how to turn a simple volume study into actual building geometry. You will learn some basic modeling tools along the way

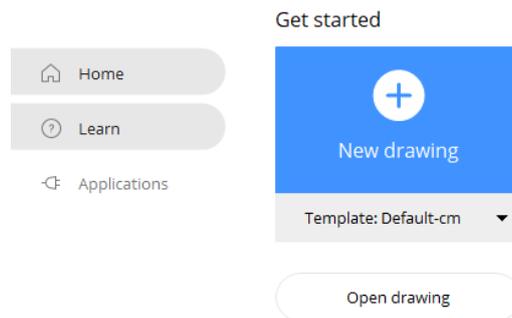
2 Sculpting a model

- 2.1 File: New, select Default-cm template.**
Note that the drawing units of this file will be in centimeters.

Make sure you are in the **Modeling** workspace.

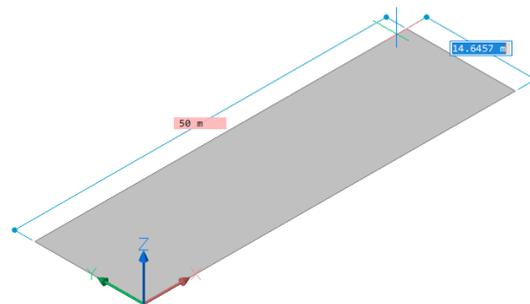
Switching between workspaces can be done from the status bar. If you right-click on the tab displaying BIM, the list of different workspaces will be displayed. Click on **Modeling** to switch.

Note: After creating a new drawing from the template make sure you do **Save As**. Look for a location easy to find and give it a name (ex. *Exercise 2*)



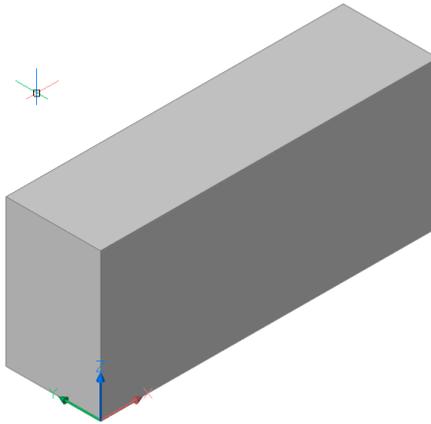
2.2 Drawing a box

1. Open the No-Selection Quad by right-clicking on an empty place in the canvas and moving the cursor over the icon
2. Under the Model tab, click the **BOX** icon 
3. You are prompted: Set corner of box or [Center]:
4. Type in **0,0,0** and press **Enter**
5. Two dynamic dimensions are displayed that control the length and width of the box (see image). The dynamic dimension that is highlighted in blue is the active one.
6. Type **5000** for the x-axis and press the **Tab** key to switch to the y-axis dimension.
7. Note that the first dimension is now highlighted in pink. This is to indicate that a value was entered



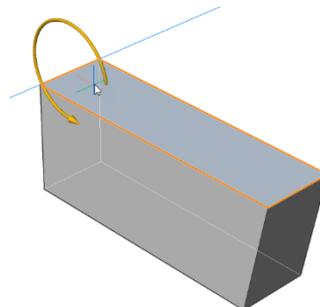
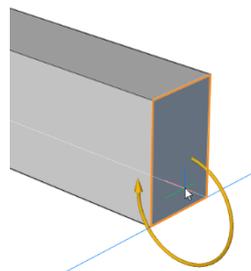
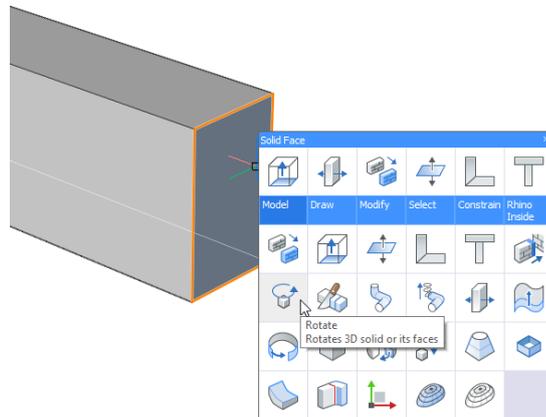
here, and this value is now locked on this dynamic dimension.

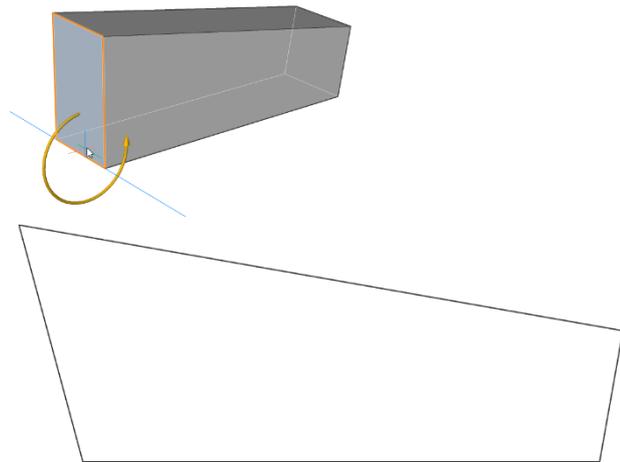
8. Type in a value of **1400** and press **Enter**. Alternatively, you can press **Tab** again to switch back to the first dynamic dimension
9. Finally, a dynamic dimension appears that controls the height of the box. Type in a value of **2200** and press **Enter**.



2.3 Manipulating the basic shape of an object

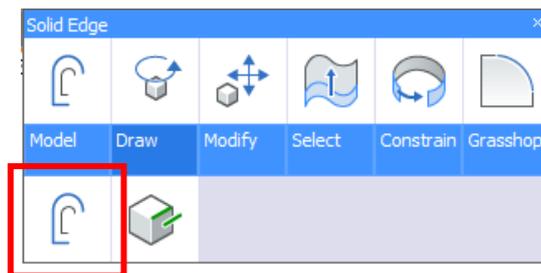
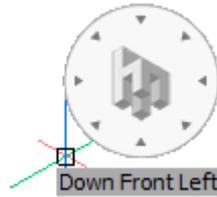
1. We want to rotate some faces of the box to create a more interesting shape. To do this, make sure **Face Detection**  is enabled.
2. Hover over the end face of the box so that it is highlighted in orange, and in the Quad under the **Model** tab click **ROTATE** .
3. A yellow widget appears that indicates the rotation direction and axis. Move your cursor close to the bottom edge of the face, until the widget 'rotates' around that edge.
4. Move your cursor to the right so that the face rotates 'outwards', type in **10** and hit **Enter**.
5. Do the same for the top face: rotate it **10** degrees downward around its **left** edge (see image).
6. Do the same for the opposite end face of the box: rotate it **15** degrees outward around its **bottom** edge (see image).
7. In the end, you should end up with a shape similar to the one shown in the final image (side view).

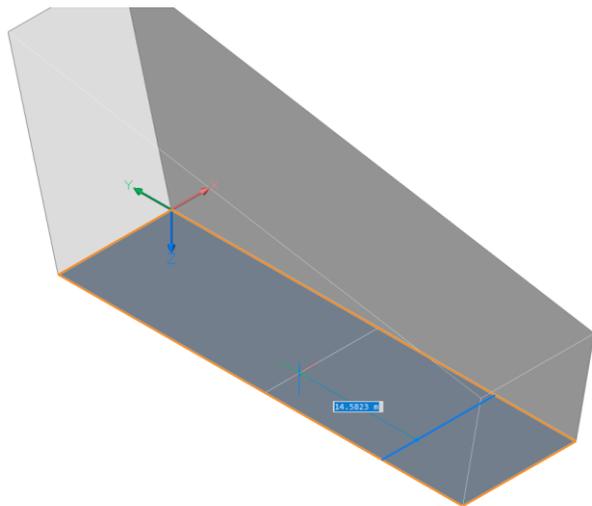
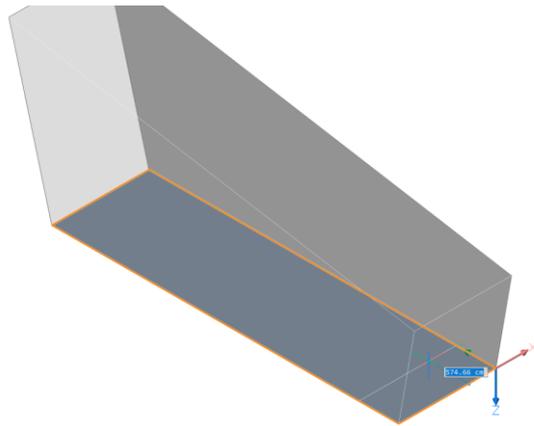




2.4 Offset of edges

1. On view control icon (LookFrom), hold the CTRL key to select **Down Front Left**.
2. Change selection mode to Edge selection .
3. Select bottom right edge, and from the QUAD, under Draw tab click on **OFFSET** . Type the value **1000**.
4. **OFFSET**  the new line, with a distance of **2000**.
5. Repeat step 4, with a distance of **1000**.



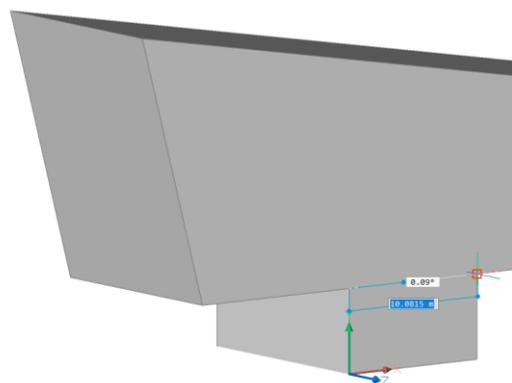
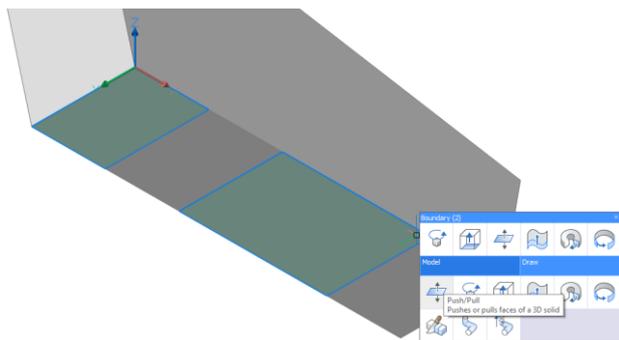


2.5

Using Push/Pull

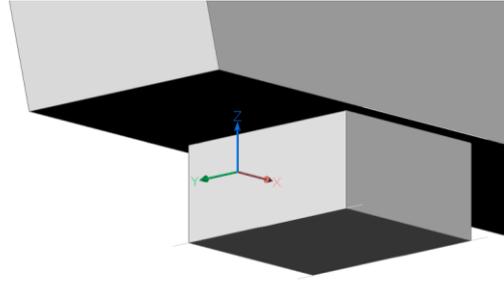
We want to use some Push/Pull to create a more interesting shape

1. Make sure **Boundary Detection**  is enabled
2. Move your cursor on the bottom face of the solid so that the boundary is highlighted as shown in the image on the right.
3. Once you have this boundary selected or highlighted, use **PUSH/PULL**  and push these faces inward over a distance of **550**. Thus, you should end up with something similar as shown in the final image.
4. Let's create boundaries on the front face by drawing a **LINE** from end point to endpoint to divide the top



from the bottom. See image for reference.

5. Select boundary and use **PUSH/PULL**  and push these faces inward over a distance of **120**
6. Repeat step 4 on the back of the building.
7. Repeat step 5 on the back boundary

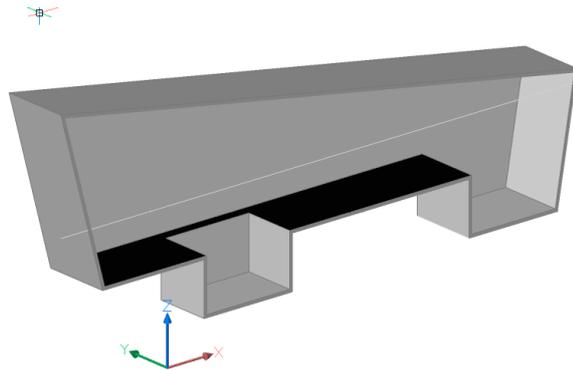
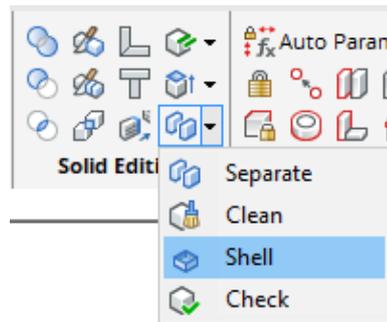


2.6

Using Shell

Currently, our building is still just a box: if we section through our building, we see that it is not hollow so no spaces can be made inside.

8. In the **Home > Sections** tab of the Ribbon, click **SECTIONPLANE** . You will be prompted to some options, select **Orthographic > Front**
9. In the **Home > Solid Editing** tab of the Ribbon, click **SOLIDEDIT > BODY > SHELL** .
10. Select the solid and press **Enter**.
11. When prompted the enter the shell offset distance, type in **30** and press **Enter**.
12. Hit **Enter** twice more to exit the solid editing command.

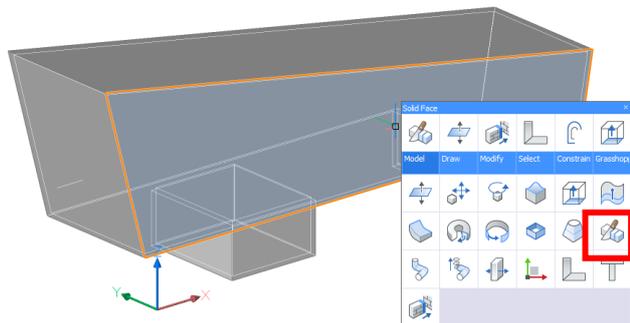


2.7

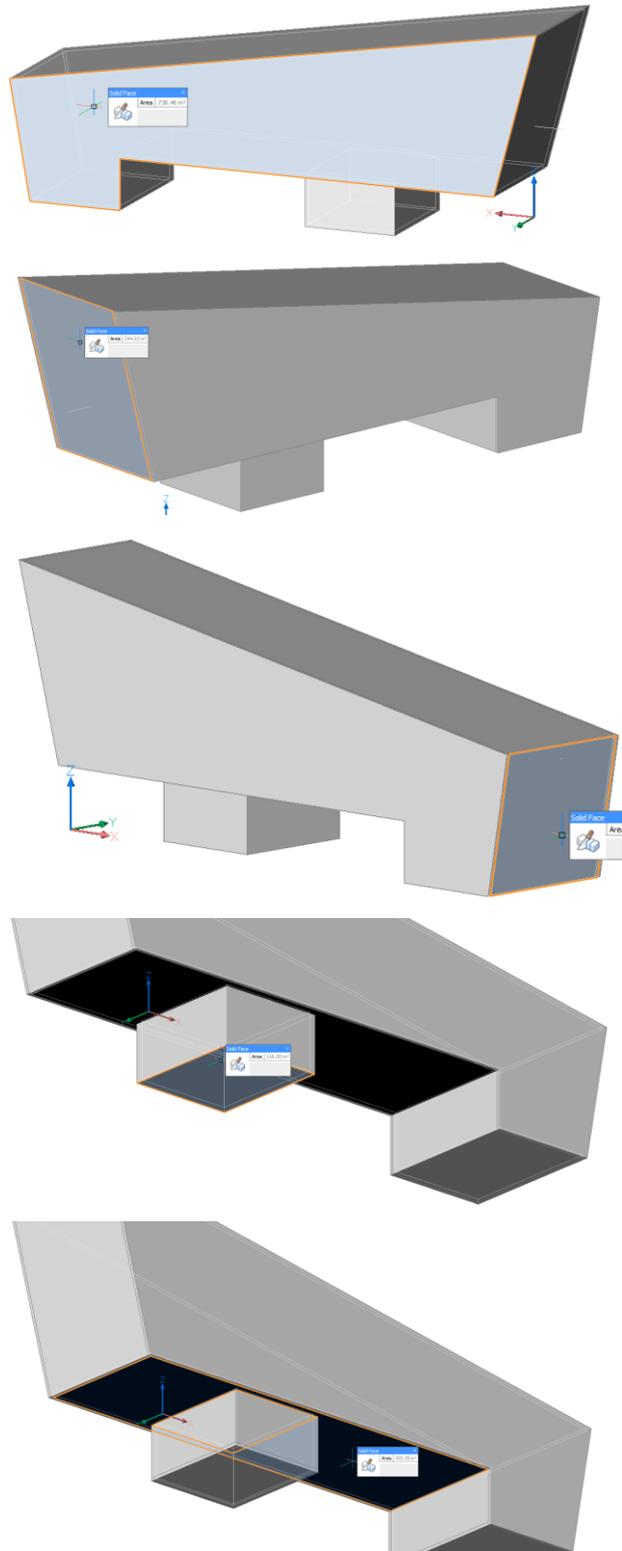
Splitting the model into separate pieces

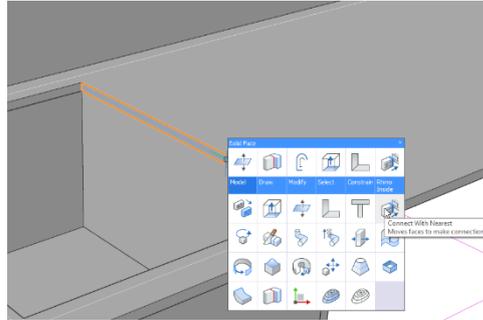
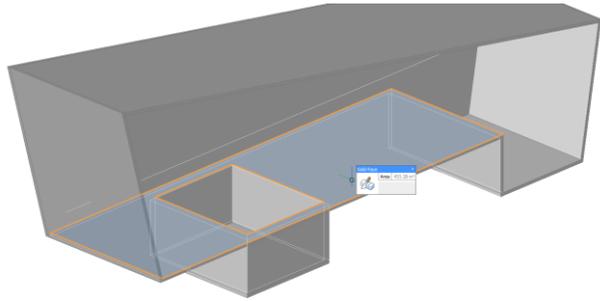
The solid is now hollow, but it still consists of 1 single object. In general, we want to split up the model so every object is a separate entity.

1. Make sure **Face Selection**  is enabled
2. Select front Face and from the **QUAD** select **MULTISLICE** . You will be prompted to give a distance value, type **30** and press **ENTER**. Then exit command.
3. Repeat **STEP 2** to split the back wall.



4. Then split the left wall, by repeating **STEP 2**.
5. Split the right wall, by repeating **STEP 2**.
6. Split the slab from the ground level, by repeating **STEP 2**.
7. Split the slab from the first level, by repeating **STEP 2**.
8. To separate the slab from the first level from the ground level walls, **HIDE** front wall, select top face of the slab and use the **MULTISLICE** , type **30** and press **ENTER**.
9. Make sure that the ground walls are also split into individual walls. **Type 30** for every **SLICE** that you do.
10. To remove the opening in the slab, highlight any of the inner faces of the hole (make sure **Face Detection**  is enabled), and in the Quad under **Model**, click **CONNECT WITH**  **NEAREST**





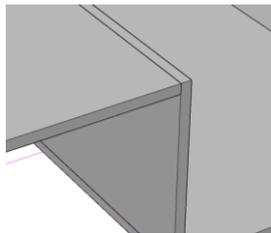
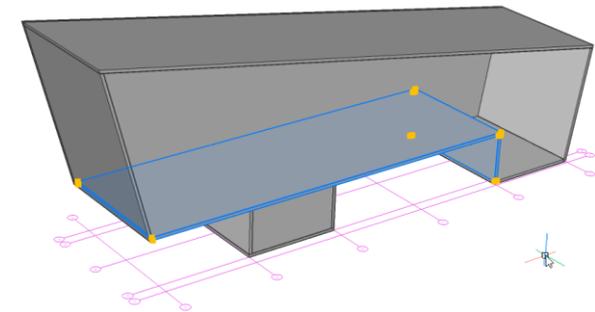
2.8 Creating some more interior walls and slabs

Let's change the connection between the upper floor slab and the wall highlighted in the image. Rotate model to show the opposite short wall of the narrow room.

1. Select both solids as highlighted in the image, and in the Quad under **Model** tab, click **L-TYPE SOLIDS**



2. Hit the **Ctrl**-key a few times until the connection is shown as in the image, i.e. with the slab butted against the wall instead of resting on top of it. Press **Enter** to accept.

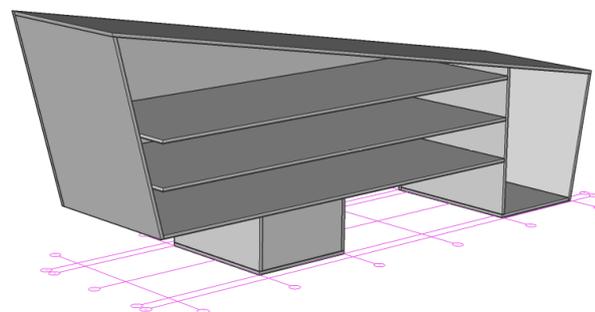


3. Highlight the top face of the wall (make sure **Face Detection** is enabled), and in the Quad under **Model**, click **CONNECT WITH**



. This should connect this wall with the roof slab, so we now have to separate rooms inside our building.

4. We can create some more interior floor slabs. We can do this by simply copying the existing upper floor slab in the Z-direction
5. Select the entire solid of the floor slab and use the COPY tool to add 2 more floors.



6. Move the cursor upward, type in **4000** and hit **Enter**
7. Notice that the two upper floor slabs are not connected to the slanted end wall. We can again use **CONNECT**

WITH NEAREST  on the end faces to solve this problem.

2.9 Making changes to the model

Often you will have to make small changes after your first draft goes to the revision phase. Here we will discuss some tools that will help with the changes and avoid deleting solids to then re-model them.

1. Let's move some walls from the ground floor.

NOTE: First make sure selection mode is set to 0. Type **SELECTIONMODE**, type **0** and press **Enter**

2. Select a wall from the ground floor (see image) and use the

MANIPULATOR  tool. You can select the **MANIPULATOR** from the **QUAD** under the **Modify** tab.

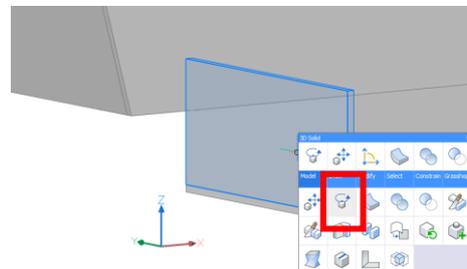
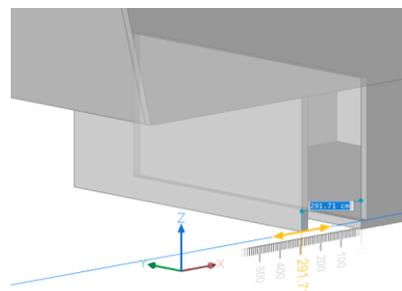
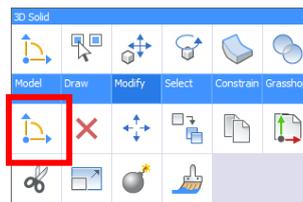
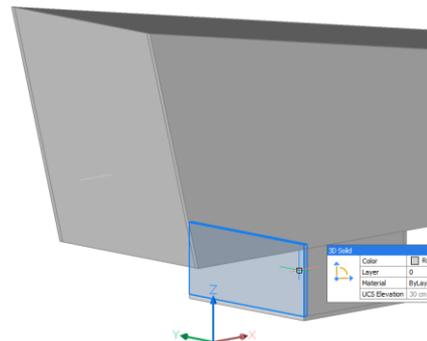
3. Once the **MANIPULATOR** appears you can move entities by selecting either axis (x,y,z) from the widget. By selecting the x-axis and dragging it to the left, you can either move the wall visually or give an exact distance. Before giving a distance press **CTRL** key to **Enable**

Connectivity Mode , type **300** and press **Enter**.

NOTE: When moving connecting entities with the **MANIPULATOR**, you have the option to move single entity or move entity while keeping connections. You can toggle options using the **CTRL** key.

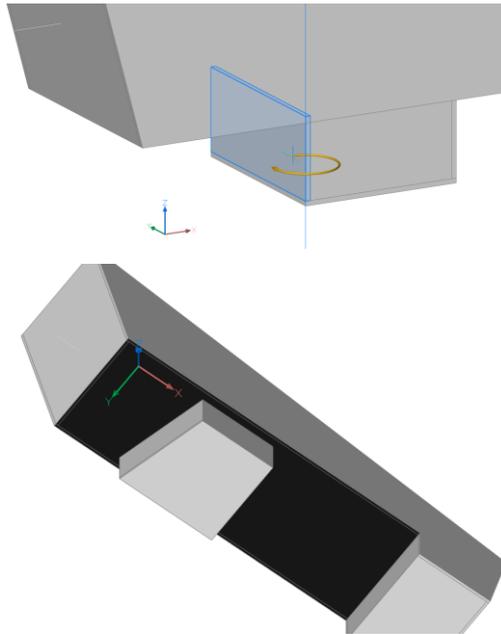
8. The connectivity can also be kept when rotating entities. Select the same wall and in the **QUAD** under the **Model** tab click **ROTATE** .

9. A yellow widget appears that indicates the rotation direction and axis. Move your cursor close to the



right edge to rotate from the Z-axis and press **Enter**.

- Before typing any value, press the **CTRL** key to enable **Connectivity Mode**  and type **15**. (see image for final result)



Exercise 3: Mechanical Parts

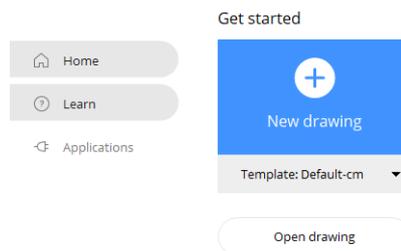
On this exercise you will get to see how you can also use the direct modeling tools for mechanical design. We will use an existing model. The model is an excavator bucket and the following steps will give you an exmple of how to redesign the bucket tooth.

3 Opening the model

- Click **Open drawing**. Select file **Bucket_Assembly.dwg**

Make sure you are in the **Modeling** workspace. Switching between workspaces can be done from the status bar. If you right-click on the tab displaying BIM, the list of different workspaces will be displayed. Click on **Modeling** to switch.

Note: Drawing units is in millimeter (mm)

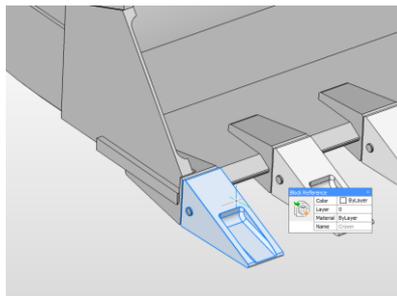


- Create a copy of the Bucket's Crown (Teeth)**

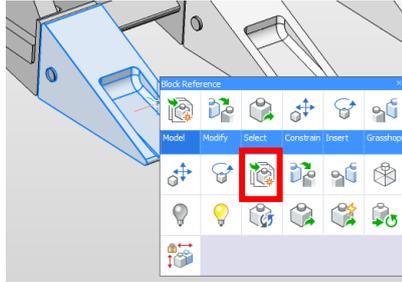
- Select** the Crown (see image)
- QUAD** appears, select from the

Model tab **OPEN COPY** 

- This will open a new drawing called **Crown1**



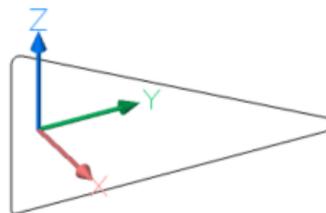
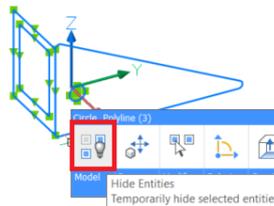
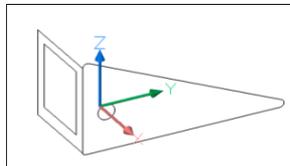
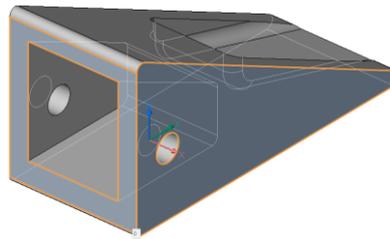
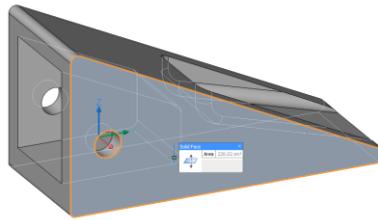
- From the **Crown1** drawing, do **Save As** and give it a new name. (ex. Crown_new)



3.3

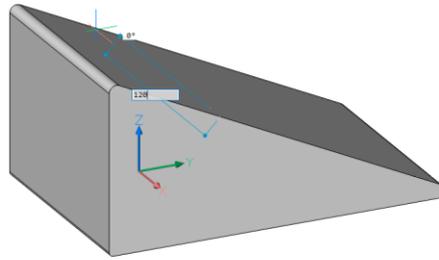
Extract Profile

- Select** face (see image). Make sure **Face Detection**  is enabled.
- Extract profile (selected face from **STEP 1**) with the tool **GENERATE BOUNDARY**  from the **QUAD**, under the Draw tab.
 - Select the back face and extract the profile with the **GENERATE BOUNDARY tool**.
- Now that the boundaries have been created, we can get rid of the original solid. This can be done by selecting the entire solid and from the **QUAD>MODIFY** select **ERASE** .
- Select** the generated back boundary and 2D circle from the profile boundary, from the **QUAD** select **HIDE**.
- The only entity now visible is the 2D extracted profile (polyline).

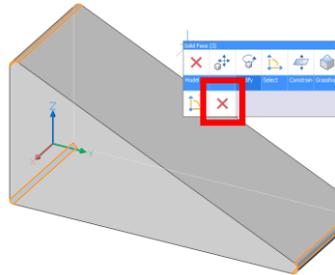


3.4 Give a basic form to the new Crown

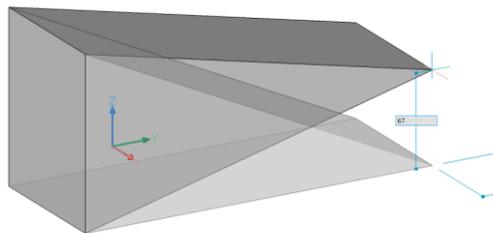
- 6. **Select** the polyline and from the **QUAD** select **EXTRUDE** . Type a value of **120**.



- 7. **Select** all 3 fillet (1 top and 2 in the bottom) and **DELETE** them.
- 8. Let's change the angle of the solid by selecting on of the bottom edge (see image for extra info), make sure the **Edge Detection** is enabled 



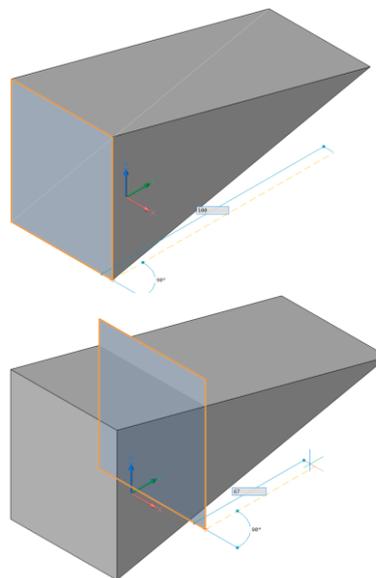
- 9. Use the **MOVE**  tool (or **MANIPULATOR**) to move the edge up (z-axis), input value **67**.



3.5 Introduce New Faces

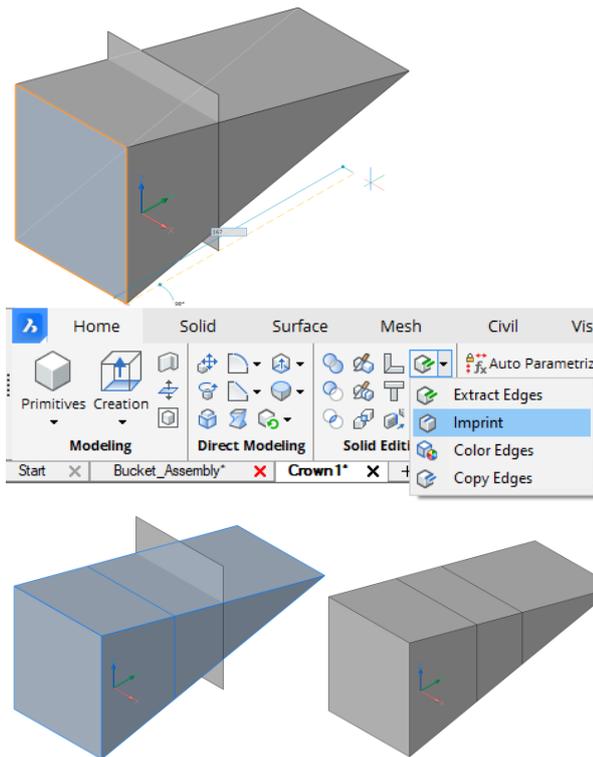
Faces will be copied to make it easier for further manipulation.

- 1. In the command line type **SOLIDEDIT**.
- 2. **Type F** for Face and press **ENTER**.
- 3. **Type C** for Copy and press **ENTER**.
- 4. **Select** front Face, press **ENTER** and select an END point as base point.
- 5. **Copy** face through the y-axis, type **100mm**, and press **ENTER**
- 6. You are still in the **SOLIDEDIT/FACE** command. **Type C** again to **COPY**, and press **ENTER**. Select same face as **STEP 4** and press **ENTER**.
- 7. You will be prompt to select a base point, select the same as in Step 4.
- 8. The face will be copy again through the y-axis again, type **167**, and press **ENTER**.



Note: Faces could also be copied with the **MANIPULATOR**.

9. Now let's **IMPRINT** the faces into the solid. Go to the **Ribbon, Home > Solid Editing** tab, expand the Edge editing and select the Imprint tool.
10. You will be prompted to select a solid, select the SOLID.
11. After selecting solid, you will be prompted to select an entity to imprint. Select one of the faces, press **ENTER, type Y** for YES and press **ENTER**.
12. You will be prompted to select another entity to imprint. Select the second face, **type Y** and press **ENTER 2x** to accept and to exit command.



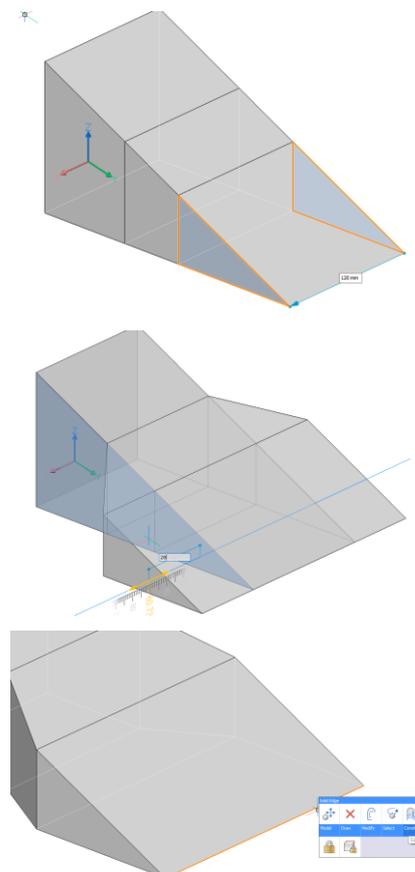
3.6 Continue shaping the Crown

Now that we have the faces imprinted into the solid, we can easily manipulate the solid to give it a more advance form.

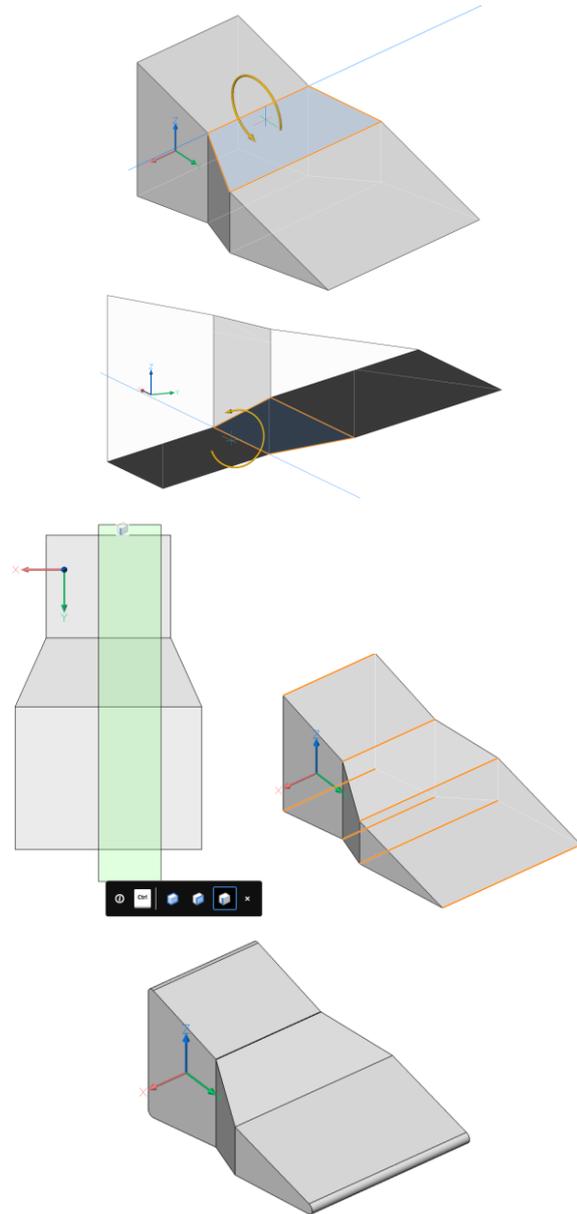
1. Type in the command line **DMRECOGNIZE**, type **256** and press **ENTER**. This will allow BricsCAD to automatically recognize the relations of edges between coincident faces.

Note: You can find more info here [Design Intent Recognition](#)

2. **Select** faces as in the image.
3. From **QUAD** select the **PUSH/PULL**  tool to make that area of the crown wider. **Input** value **30**.
4. **Select** the blade's edge, then from the **QUAD** add the **FIX**  constraint. This will keep the length the same during rotation.
5. Now select top middle face, and from the **QUAD** select the **ROTATE**  tool (see image to know your starting point). Rotate downwards. **Input** value is **5**.



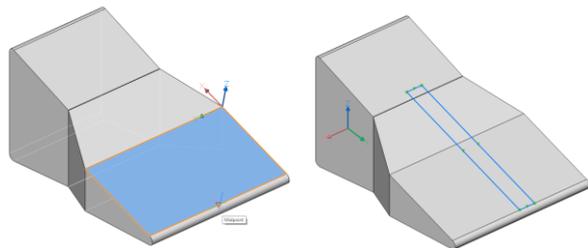
- Repeat **STEP 5** with bottom middle face. **Rotate** upwards. **Input** value is **5**.
- Add fillets to all horizontal edges. This can be done by doing a window select. When selecting only cross the horizontal edges. (Make sure **Edge Detection** is enabled ) Once they edges are selected, use the **FILLET**  tool from the **QUAD**. **Type 6**, for the radius.



3.7

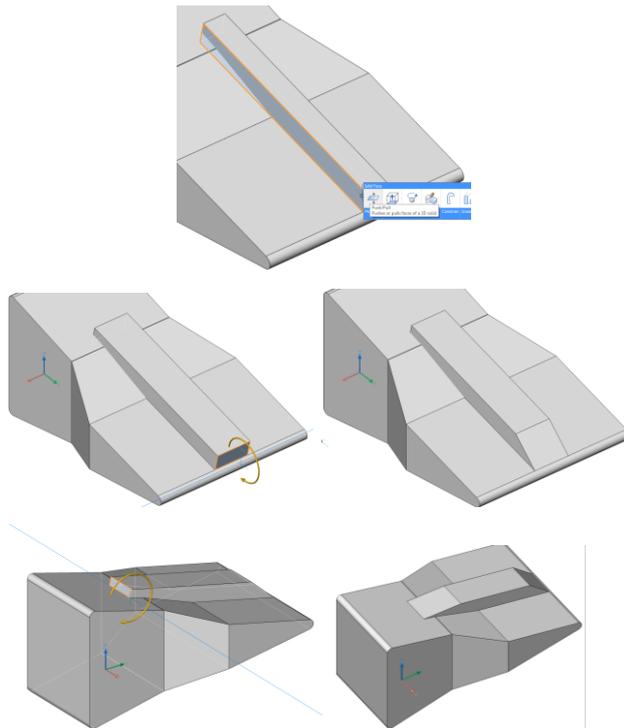
Add Protrusion feature

- From **QUAD** select to draw a **RECTANGLE**  first insertion point will be in the middle of the blade. Dimensions **20x200** (see image for more info).
Note: You can temporarily lock the UCS plane of the blade's face by pressing SHIFT.
- EXTRUDE**  the 2D rectangle upwards (make sure you select **UNITE** when extruding). **Input** value **20**.



Note: When extruding you are prompt to different options. The options can be seen in the command line and in the Rollover Tips. If you press the CTRL key, you can toggle through the options in the Rollover Tips.

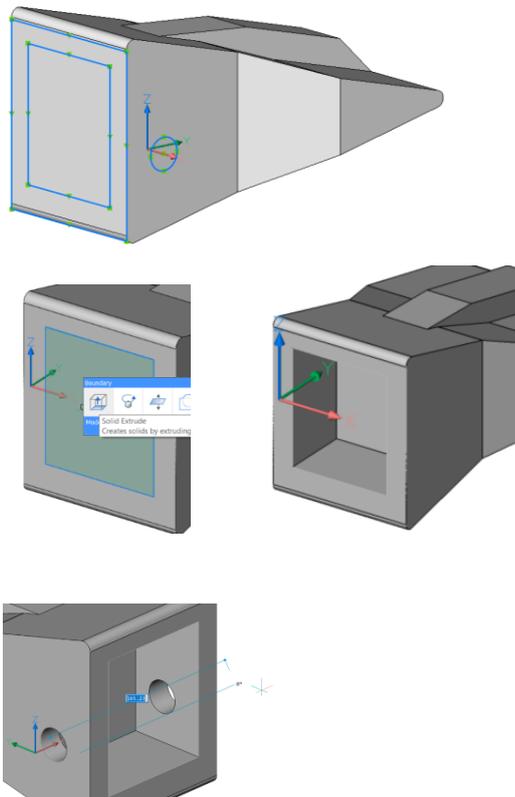
3. **EXTRUDE**  the left face of the new extrusion. **Input** value **20**.
4. Rotate front face of the extrusion, by selecting from the **QUAD** the **ROTATE**  tool. First select the bottom edge and then rotate inwards. **Input** value is **60**.
5. Rotate back face of the extrusion. Follow **STEP 4**. Rotate inwards. **Input** value is **80**.



3.8 Add opening

Add an opening to the back of the tooth crown.

1. Let's bring back to view generated boundaries. You can do this from the **QUAD>GENERAL** select **SHOWENTITIES**.
2. Enable **Boundary Detection** .
3. Select the inner rectangle. From the **QUAD** select **EXTRUDE** . Move the cursor into the Crown and enter a value of **58**.
4. Extrude the circle profile through both sides of the Crown. Select the circle. From the **QUAD** select **EXTRUDE** . Move the cursor through both sides of the Crown, so there are 2 holes.



3.9

Add fillets

To finish we will add two interior fillets.

1. Select the inside lower and upper Edges. From the **QUAD>MODEL>FILLET**. Enter a value of **6**.

