## Introduction

Stairs symbols provided by DD3 are great but often the shape of the building isn't compatible with them. The method described herein shows

- how to draw steps so the bevel effect can be applied to each one
- how a multipoly can affect the way a fill style is applied
- how to use transparent entities to shade the steps in regard of their respective heights
- how to handle circular or irregular stairs
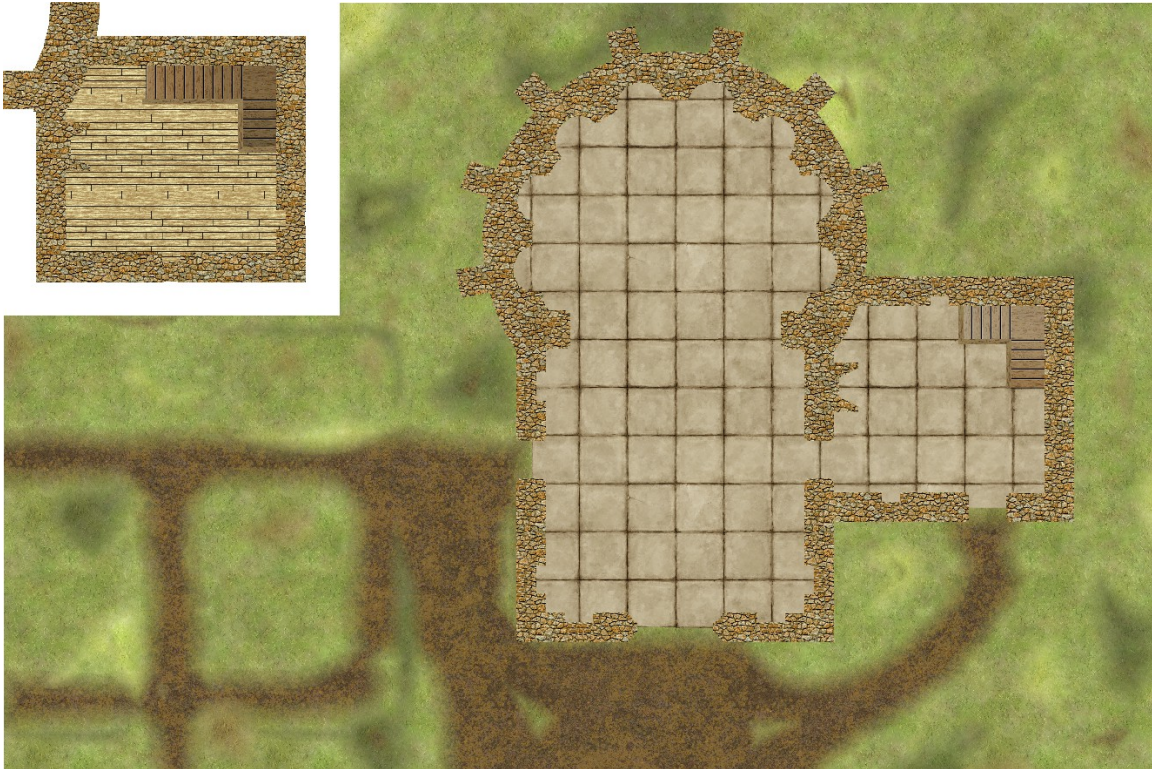


## About the Bevel effect

This effect only affects the edges of all the drawn area of a given sheet, similarly to the **Edge Fade, Inner** effect discussed in part 7(p49-50). If all the steps of a stair are one next to the other, only the outer edges will be beveled. The solution is to leave a small gap between steps:
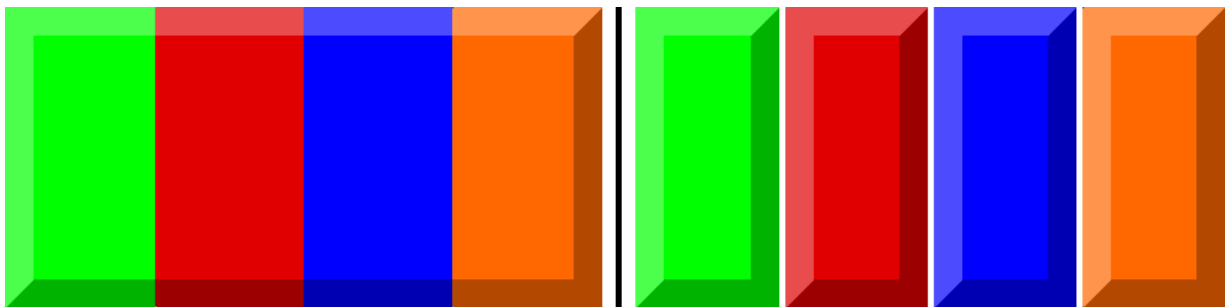


Left: only the outer edges of the global rectangle are affected by the **Bevel** effect. Right: by creating a small gap between the rectangles, each one is individually beveled.

## Drawing the steps

The **STAIRS** sheet is already included in the template:

1. Click on the Sheet Indicator and check the box left to the **STAIRS** sheet name. Click **Hide All** then on the "H" box of **WALLS TOP** and **FLOORS** to keep them visible. If the **Activate Sheet Effects** box is checked, uncheck it to speed up redraw. Click on **OK** to close.
2. *Zoom* 🔍 on the lodging.
3. From the menu toolbar invoke **Tools→Snaps→Grid Settings** and select the **5' Grid, 10 snap** settings. If it doesn't exist, click **New**, select **2d Rectangular** and modify the settings to conform to the picture below.
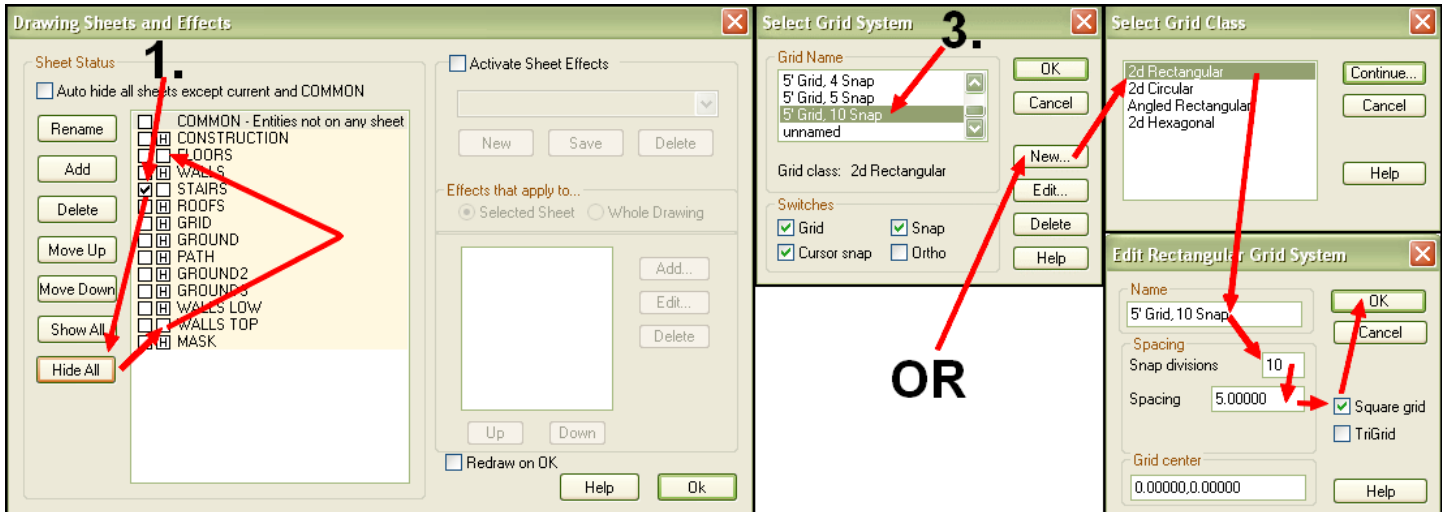


4. Click on the Fill Style Indicator then on the **Brush Pattern** tab and choose the **Solid** fill style. Click on **S**. Usually, this icon is used to set the **STAIRS** sheet and the blue color #3. Here it just sets the color because the sheet was already made current at **1.** The blue is used to contrast with the rest of the map, steps will eventually have individual colors.
5. Verify that **SNAP** in on and use the *Box* 🔲 tool (**BOX**↵) to draw the first step.
6. Right-click *Scale* 🔧, choose *Non Visual Scale XY* (or just type **SCALEXY**↵) and select the blue rectangle. Right-click **do it** (**d**). At the command line prompt answer **1**↵ for the x-scale (or right-click, it's the default) and **0.8**↵ for the y-scale. Because the x-scale is 1, you can select any point on the rectangle's bottom line as Scale Center, using a snapping point.
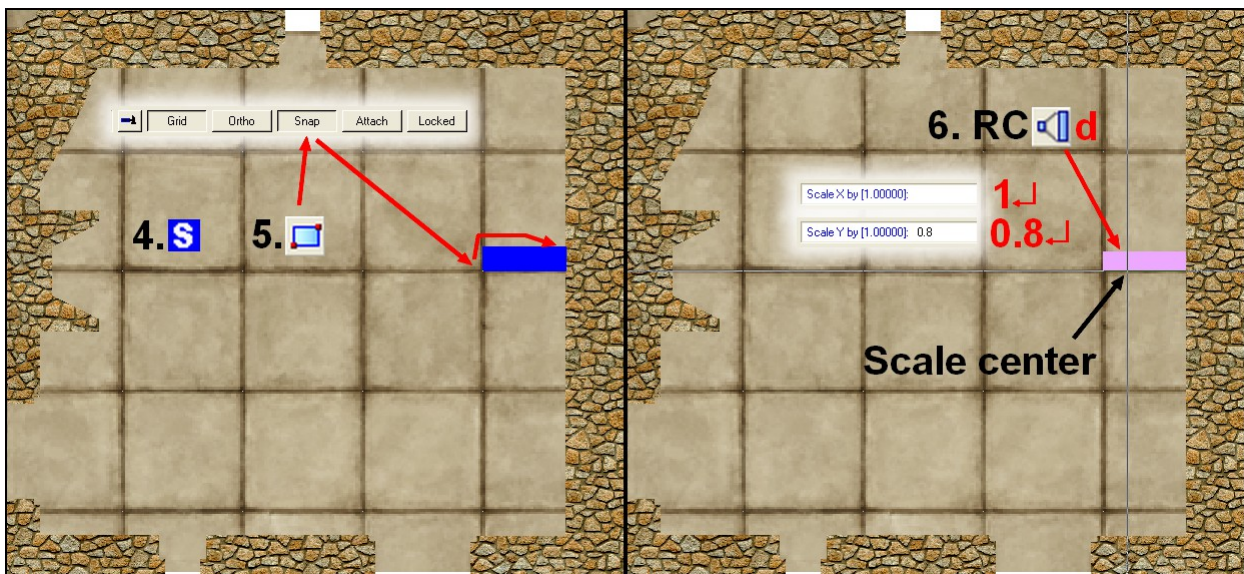
7. Launch the *Copy* 🔳 tool (**COP↵**).  Select the blue rectangle and type **d** (or right-click **do it**). The command line prompt reads "Copy from point". Click the nearest possible to the lower left corner of the rectangle, it automatically snaps to the precise point.
8. Now the prompt reads "Place (shift = Rot15°, Shift+Ctrl = Rot, Ctr = Scale)", with the help of a snapping point just click 1' above the point selected on step **7.**
9. Repeat **8.** respectively 2', 3' and 4' above the origin point. Right-click to end.
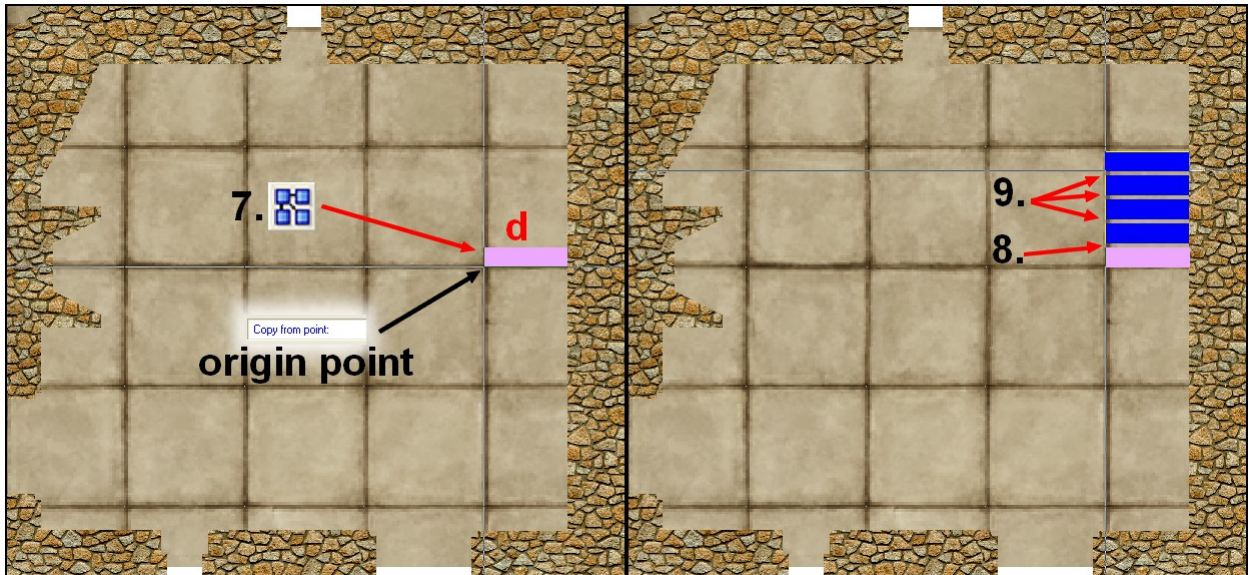


10. Use the *Box* 🔲 tool (**BOX↵**) to draw the square corner step, relying again on snapping points.
11. Right-click 🔳 and select *Mirrored Copy* (**MIRCPY↵**). Select the five rectangular steps and right-click **do** it (**d**). Click the top-right corner of the square step then its bottom-left corner to define the mirror line and create the 5 uppers steps.
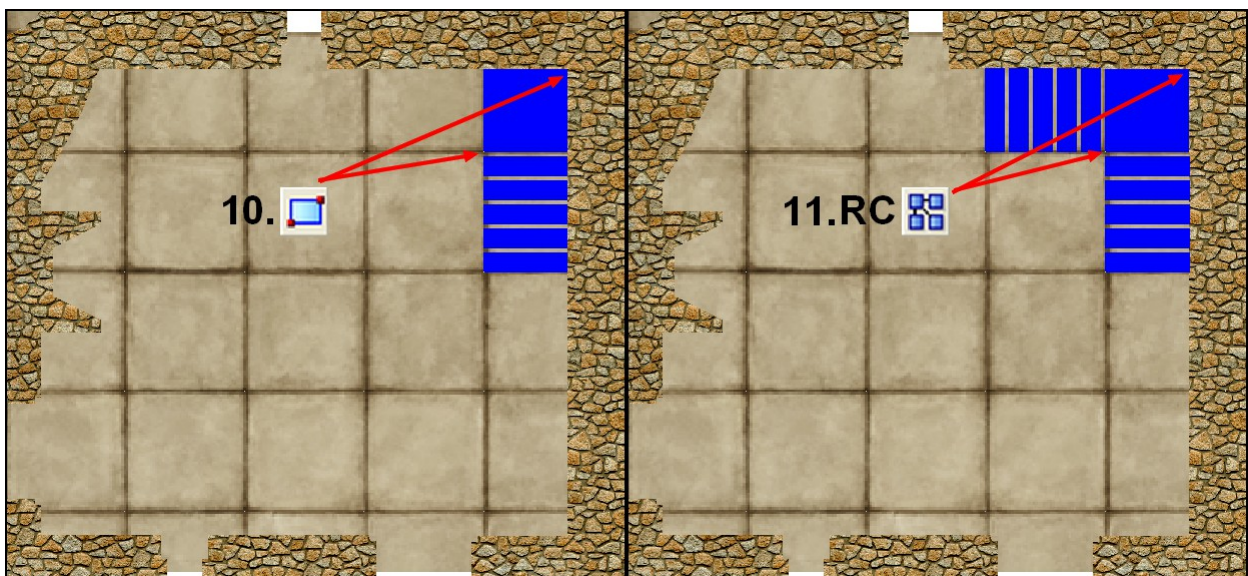
12. Right-click *Change Properties* 🖼️ and choose *Change Color* (**CHANGEC**↵). Select the first step from **5.** and right-click **do-it** (**d**). Type **40**↵.

13. Repeat **12.** for every step using the color number indicated on the picture below, right (41 to 47 and pure white 15 to finish).
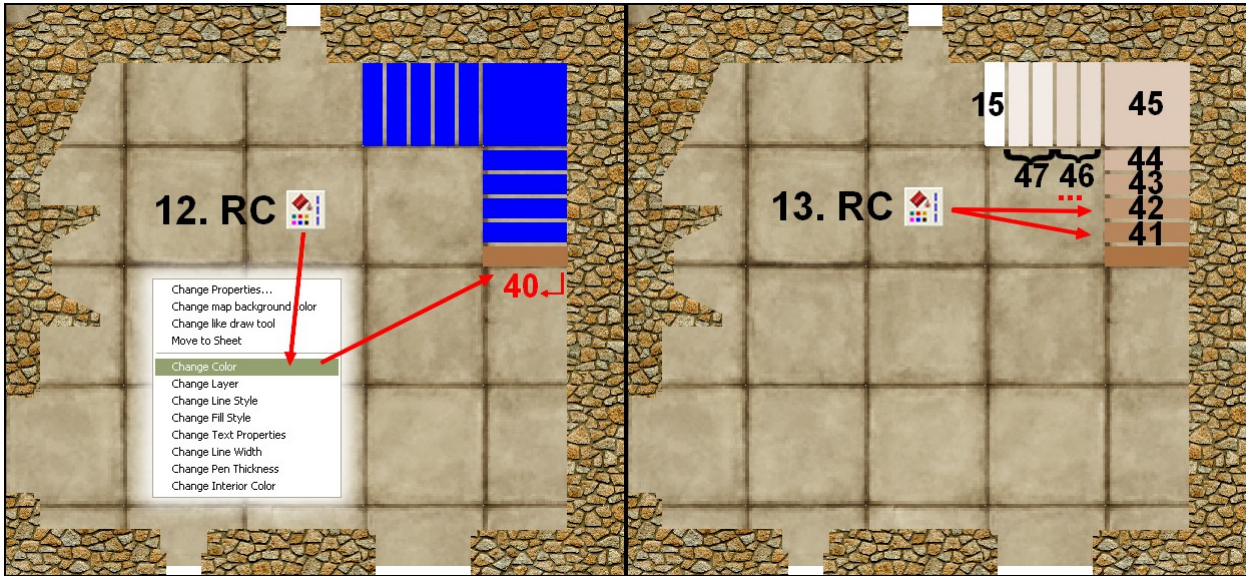


## Texturing the steps

The color gradient of the steps would be good on a vector map but is not really compatible with the fill styles used for the walls and the floors. To combine both the color gradient and bitmap fill styles the rectangles will get partially transparent and a new sheet below will receive the textured steps:

1. Create[5] a new **STAIRS_v** fill style for the stair with a picture file of your choice or this one, (read the legal terms before, and convert to PNG). The "v" stands for vertical due to the wood grain.

2. With a picture editor, clone the picture file and rotate it 90° (clockwise or counterclockwise, not important) to create a **STAIRS_h** fill style (some DD3 fill style already provide horizontal and vertical versions of the same picture file).

3. Add[5] the **STAIRS UNDER** sheet between the **WALLS** and **STAIRS** sheets.

4. Click on the Sheet Indicator, make sure the left box of **STAIRS** is checked and click **Hide All**.

5. Right-click 🔲 and select *Copy to Sheet* (**COPYSHT**↵). Select all the steps and right-click **do it** (**d**). Click on the **STAIRS UNDER** name to gray the line. Click **OK**.

6. Click on the Sheet Indicator again, check the left box of the **STAIRS UNDER** sheet, click on **Hide All** then on **OK** to close the sheets list.



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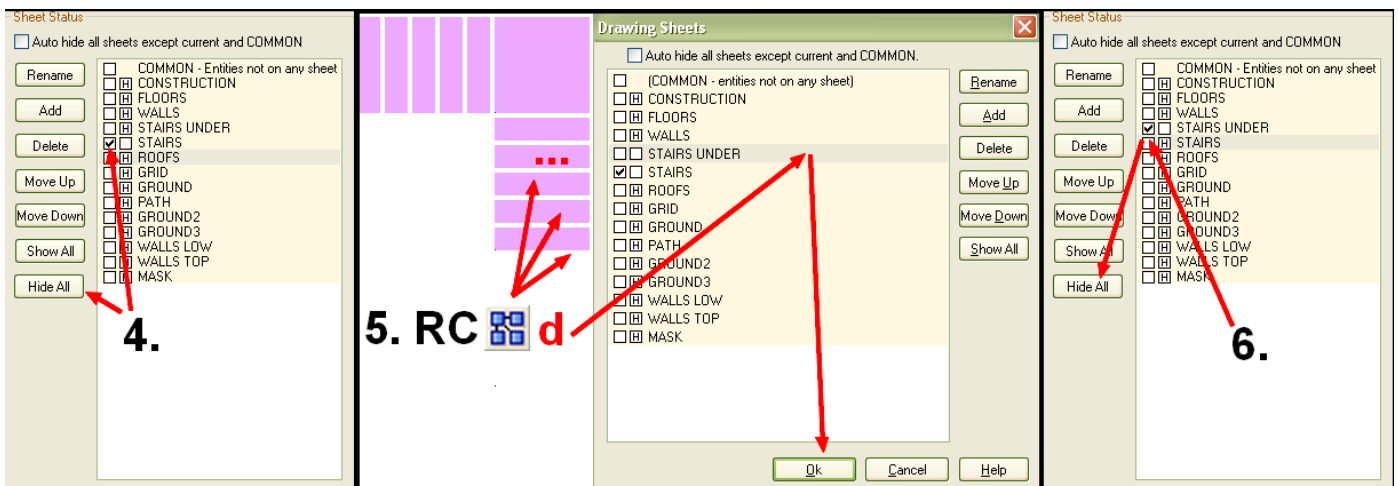
5    Refer to part 6 to get the detailed steps for creating fill styles and adding sheets.

7. Click on the *Multipoly* 📧 icon (**MPOLY**↵) and select all the horizontal steps and the square one and right-click **do-it** (**d**).

8. Click on the *Multipoly* 📧 icon (**MPOLY**↵) and select the remaining (vertical) steps and right-click **do-it** (**d**).

9. Right-click *Change Properties* 🏠 and choose *Change Fill Style* (**CHANGEFS**↵). Select the first multipoly by selecting any of its steps and right-click **do-it** (**d**). Type **STAIRS_h**↵ or alternatively right-click to open the Fill Style Selector and make the **STAIRS_h** fill style current.

10. Repeat **9.** with the vertical steps multipoly and the **STAIRS_v** fill style.
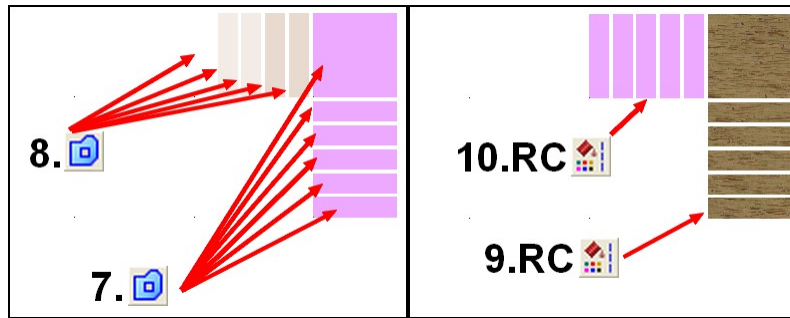


**Multipolys and fill styles**

It was already mentioned (parts 2 and 5), that Multipolys can be used when using arcs or hollow parts in a filled shape.

When unconnected polygons are converted in a single entity with the *Multipoly* 📧 command, bitmap fill styles are applied globally on the whole area covered (left picture) whereas when keeping entities individually, the fill style is applied from the top left corner of each polygon, making every horizontal step a clone of the preceding (right picture).



11. Click on the Sheet Indicator and make the **FLOORS**, **STAIRS**, **GROUND**, **PATH**, **GROUND1-3**, **WALLS LOW**, **WALLS TOP** and **MASK** sheets visible by clicking on their "H" boxes. Select the **STAIRS** sheet by clicking on its name (gray background). Check **Activate Sheet Effects**. Click the right **Add** button and select the **Transparency** effect on the pop-up. Set the opacity value on the second pop-up to 25%. Click **OK**.
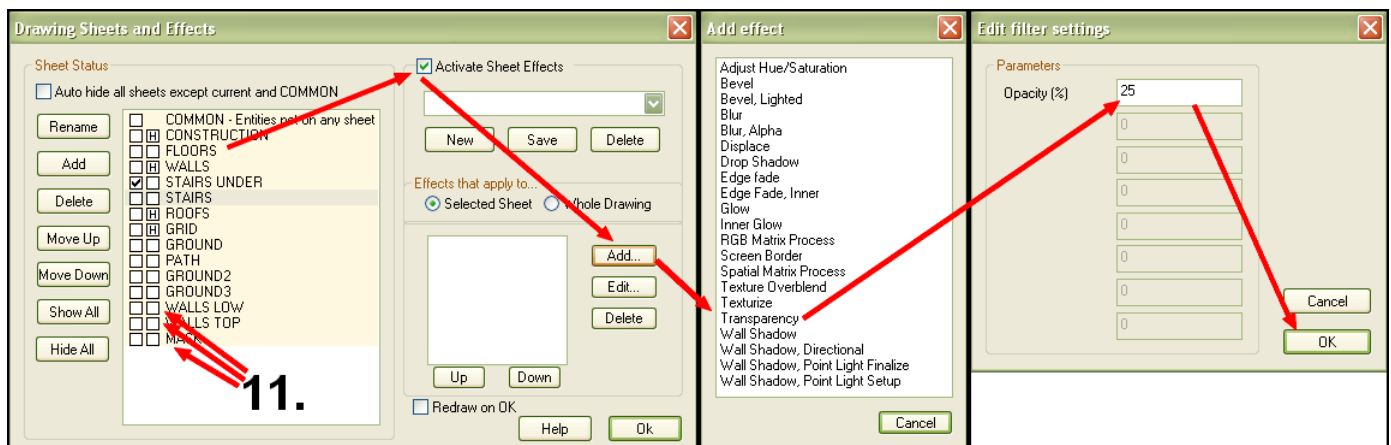
**12.** Select the **STAIRS UNDER** sheet (gray background). Click the right **Add** button and select the **Bevel** effect. Set the length to 0.25, the Strength to 30, Invert Colors to 0 and Fade to 0. Click **OK** to close the pop-up and **OK** to close the sheets list.
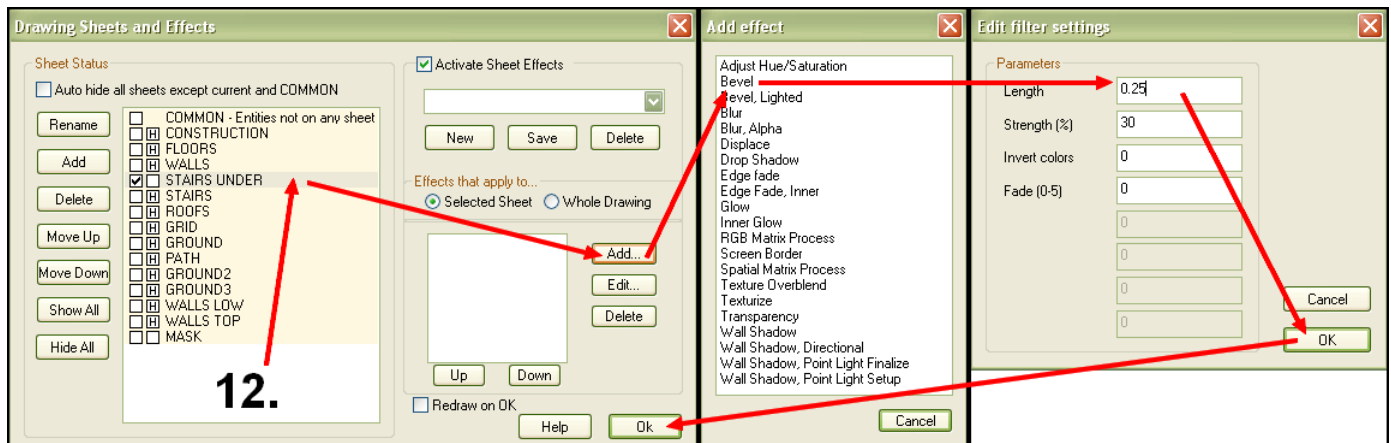


## Adding a railing

A wooden railing can be added to the **WALLS LOW** sheet, using the wood textures from the stairs:

1. Click on the Sheet Indicator and check the **WALLS LOW** left box. Click **OK** to close.
2. Click on the Fill Style Indicator, on the Bitmap Files tab if necessary and on the "v" button next to the current fill style to scroll down to **STAIRS_h**. Click **OK** to close.
3. Make sure that **SNAP** is on, and that you still use the 5' Grid 10 Snap settings and use the *Polygon* tool (**POLY**↵) to create the horizontal part of the railing. Right-click to end.

Note: on this example the polygon was outlined in blue to clearly show its nodes.

4. Click on the Fill Style Indicator and select the **STAIRS_v** fill style. Click **OK** to close.
5. With the *Polygon*  tool (**POLY**↵) create the vertical parts of the railing. Right-click to end.
6. Save the map.
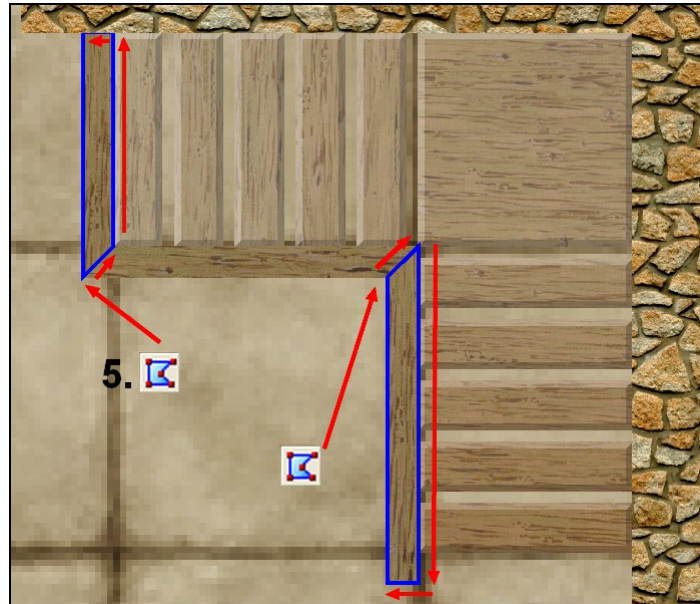




The stairs on the insert have been done following the method detailed herein, with the colors of the solid, transparent, rectangles ranging from 41 (lightest) to 32 followed by 0 (black).

Other method to create stairs include
- using the **Texture** effect with a bitmap file
- creating the whole stair as a symbol
- using picture editors to create shading masks
- create dozen of fill styles from light to dark versions of a base bitmap...
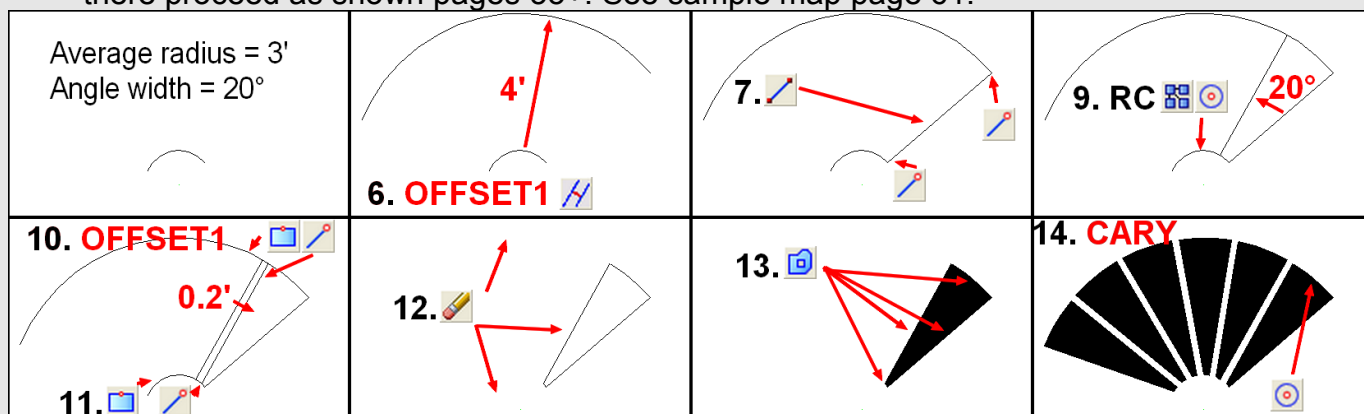
## Circular stairs

To adapt the method to circular stairs you need to create the first step then use the *Circular Array* tool to duplicate it.

1. Right-click ⊞ and choose *Copy to Sheet* (**COPYSHT⏎**) to copy all walls part containing arcs designing the staircase to the **STAIRS** sheet.
2. Click on the Sheet Indicator, check the left box of the **STAIRS** sheet, click **Hide All** then **OK**.
3. If the arcs delimiting the stairs are included in a multipoly, *Explode* 🪄 it (**EXPLODE⏎**). *Erase* 🧽 (**ERA⏎**) all the wall part not involved in the stairs.
4. Determine the average radius of your steps. If you have only the smaller arc, the average radius is the small radius plus half a step's width. If you have only the outer arc, the average radius is the longer radius minus half a step's width. If you already have both arcs, the average radius is the half of the radii sum. Use **Info→List** to get the radii if you have no other mean (e.g. grid interval) to know their values.
5. Determine the angle width of a single step. The formula is $360° \times \dfrac{\text{step depth}}{2 \times \pi \times \text{average radius}}$. In most cases, $\pi$ can be rounded to 3 and a step depth of 1' is a good value too, which simplifies the formula to: angle width = $\dfrac{60°}{\text{average radius}}$. For example, with an average radius of 3' (typical of a 1' inner radius and a 5' outer radius), the angle width would be 20°. If the inner radius is 15' and the outer one 20' the average radius is 17.5' yielding an angle width of $60 \div 17.5 \simeq 3.43°$. The angle width must be precise only if you need a full 360° circular stair.
6. If necessary, **Draw→Offsets→** *Offset One* (✂ if you have CA46 or **OFFSET1⏎**) a single staircase side by the steps width on the relevant side.
7. With the *Line* tool ✏ (**LINE⏎**) draw the edge of the raising of the lowest step. Start this line using the grid snapping, or from the arc's center (with the *Center Modifier* ◉ or **F4**) to any helpful point, or by joining the corresponding endpoints (🖊 or **F5**) of the arcs.
8. If necessary, use *Trim to* ☰ (**TRIMTO⏎**) to trim this line to the sides of the staircase.
9. Right-click ⊞ and choose *Rotated Copy* (**ROTCPY⏎**) to copy the line around the arc's center (*Center* ◉ or **F4**) by the angle width calculated at **5.**
10. **Draw→Offsets→** *Offset One* (✂ **OFFSET1⏎**) the copied line 0.2' toward the original line.
11. *Split* ▦ the arcs at the endpoints (🖊 or **F5**) of the offset line and at the endpoints of the original line if necessary.
12. *Erase* 🧽 (**ERA⏎**) the remaining parts of the arcs and the copied line from **9.**
13. *Multipoly* 🗗 (**MPOLY⏎**) the firs step.
14. Right-click ⊞ and choose *Circular Array* (**CARY⏎**). In the example, 6 spokes, 1 ring, the center is obtained by the *Center* ◉ or **F4** modifier on the outer arc (even if it's in the multipoly). The Copy Origin can be anywhere and the angle is the angle width of 20°. From there proceed as shown pages 55+. See sample map page 61.



| | | | |
|---|---|---|---|
| Average radius = 3'<br>Angle width = 20° | 4'<br>**6. OFFSET1** ✂ | **7.** 🖊 | **9. RC** ⊞ ◉ **20°** |
| **10. OFFSET1** 🗗 🖊<br>**0.2'**<br>**11.** 🗗 🖊 | **12.** 🧽 | **13.** 🗗 | **14. CARY** |

## Irregular stairs

In some cases, you might want out of the box stairs, such a winding stair around a peak or a bunch of stairs going down between roughly hacked walls. This implies drawing each step painstakingly...

1. Right-click ⊞ and choose *Copy to Sheet* (**COPYSHT**↵) to copy all walls part containing entities designing the staircase to the **STAIRS** sheet.
2. Click on the Sheet Indicator, check the left box of the **STAIRS** sheet, click **Hide All** then **OK**.
3. With the *Smooth Path* 🅂 tool (**SPLINE2**↵) draw a smooth line roughly at the same distance from both wall sides. Start at an end (in the example below: left) and overlap the other end by a generous amount (see **4.**).
4. Launch the **Draw → *Symbols Along...*** (**ESC**↵) tool, also called *Escarpment*. Set the **Distance** to the depth of the steps (1' in the example), the **Symbol Angle** to radial (mid radio button), the **Symbol** to **esc line center** and all the **Symbol Scale and Position** percentages to $8 \times$ step width to ensure that the lines cross the walls (see **7**). For example, if the width is about 5', set all percentages to 40%. Note that the first line is placed at the first point of the smooth path from **3.** but stops short of the other end due to rounding.
5. Since all the lines are symbols, *Explode* 🧨 them (**EXPLODE**↵). Hit **p** after clicking the icon or typing the command to select all the prior entities in one go, then hit **n** (not) and click the smooth path to un-select it or it will be converted in small parts. Right-click **do it** or hit **d**.
6. *Erase* 🖌 (**ERA**↵) the unwanted lines and the smooth path.

## Irregular stairs (cont)

7. **Draw→Offsets→** *Offset One* (⟋ **OFFSET1**↵) all the steps except the first one 0.2' toward the first. Use Ctrl+R to redraw through the command if you lost track of the offset lines.
8. Use *Trim to* ☰ (**TRIMTO**↵) to trim all the lines to the walls. When you trim to a fractal path, the tool gets tricky if the lines to trim do not cross the fractal (see **4.**). *Trim to Intersection* ✕ (**TRIMINT**↵) the first and front last lines to the walls.
9. *Break* 🗔 (**BREAK**↵) the walls between the endpoints ✐ (**F5**) of second and third line.
10. Save the file.
11. Right-click *Explode* 🧨 and choose *Line to Path* (**LTP2**↵). Select all the elements of the first step and right-click **do it** (**d**).
12. Repeat **9.** to **11.** for each step and *Erase* ✐ (**ERA**↵) the last line.
13. Save the file. From there proceed as shown pages 55+. See sample map below.
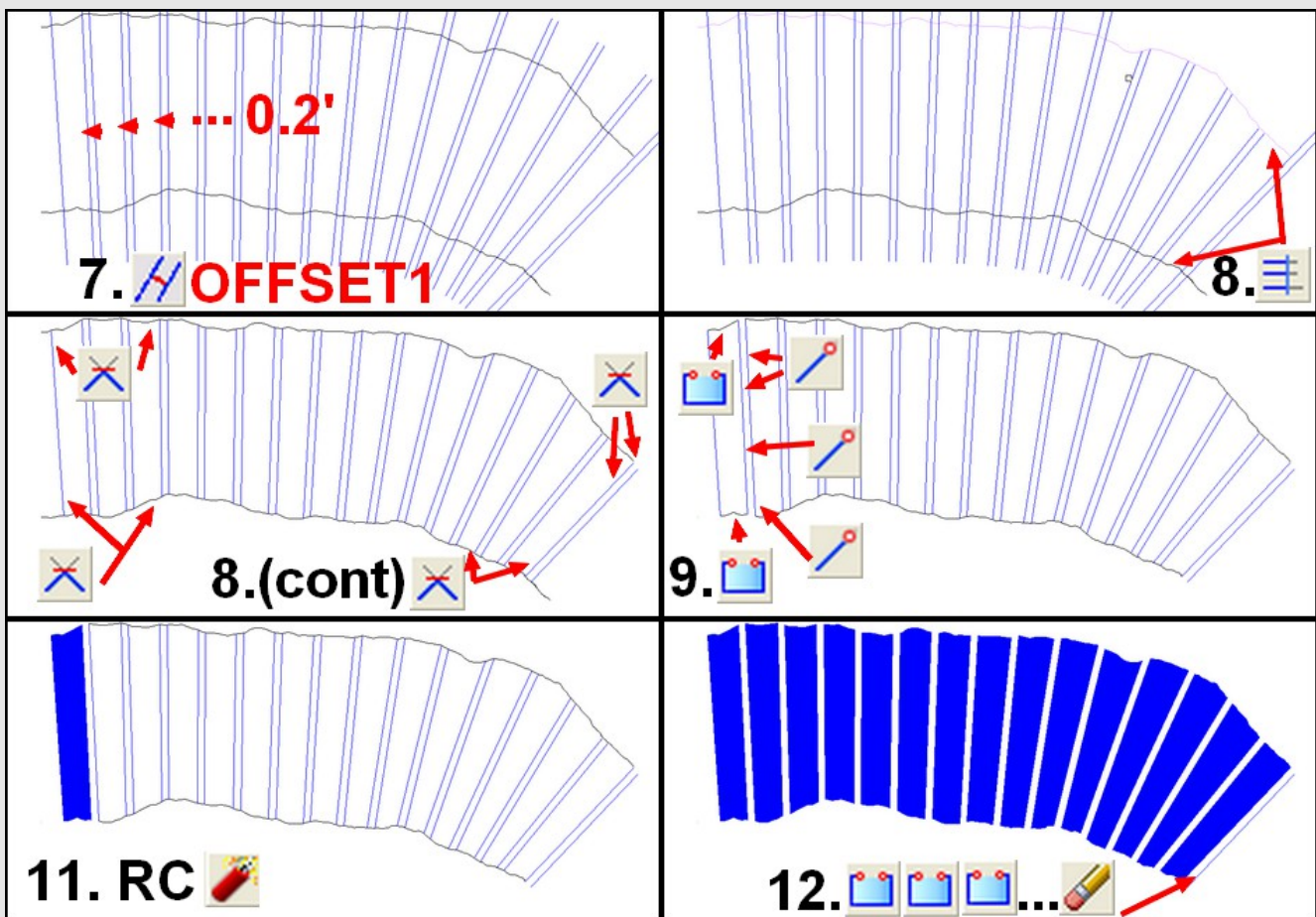
## Conclusion

Stairs have been added with a method that allows to benefit from a bitmap fill, a bevel effect and a color gradient:

- A multipoly made of separate polygons fills them globally
- Leaving a small gaps between steps enables the bevel effect
- Solid colors combined with a transparency effect provide a color gradient.

The method can also be adapted to diverse shapes of staircases.



In part 9, an advanced way of creating realistic shadows on the outside will be developed.