

**METATOOLS**  
BASIC DESIGN TOOLS  
(RELEASE 2.0)

# METATOOLS

Basic Design Tools (Release 2.0) - Manual for Release 2.0 (Version 6.1.2016)

## **Hello user,**

nice that you have or that you want to download the second "major" release of METATOOLS. Thanks for the unexpected great response and the positive feedback to release 1.0/1.2!

This time I'll try to explain the functions of the toolbar in English. Please be patient about my spelling, it's not my mother tongue! I have made this plugin for my personal work as an architect mainly for the field of urban planning – that means I am not a programmer - and that maybe explains the simple and basic programming, please screw down your expectations.

This toolbar for Rhino 3D is for personal use and completely free of charge (Note the CREATIVE COMMONS License). If you like the plugin and my work, and you think METATOOLS should be supported and more developed, feel free to donate via paypal: [printschler\[at\]metatektur.org](mailto:printschler[at]metatektur.org)

And last but not least, if you want to collaborate or if you have questions relating to my work, feel free and get in contact with me. Enjoy using METATOOLS!

Sincerely

**Architect M.Sc.**

**Josef-Matthias Printschler**

**Mai 2016, Stuttgart/Germany**



"METATOOLS is a collection of simple tools for the solution of practical problems and issues in the daily architectural design process."

The Toolbar and its features are very simple programs and i make no claim to completeness or perfection. I have to point out that i am not responsible for any system crashes in connection to the use of the featured functions. On my platform all works without major problems. Just try it out...JMP



## **METATOOLS**

**Basic Design Tools (Release 2.0)**

Release Date: 6/1/2016

Release updates in comparison to Release 1.2:

1. Corrected some formal errors
2. New buttons/functions 14,15,16
  - + 14 Curve to Square
  - + 15 Randomhoehe Extrude
  - + 16 Draw Hatch
3. Manual in english

Platform: Rhinoceros Version 5.SR4 Educational, Copyright Robert McNeel & Associates

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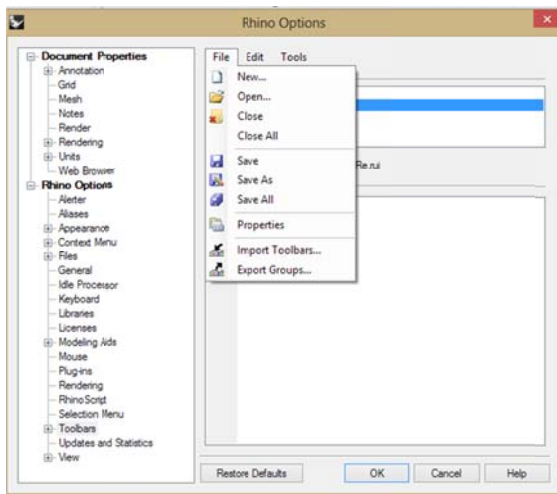


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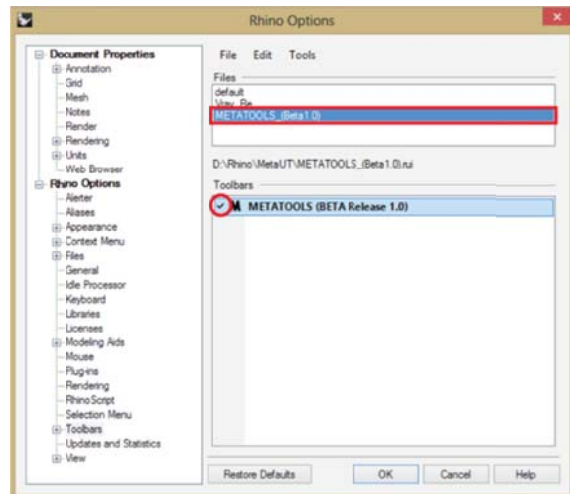


# INSTALLATION

1. Download METATOOLS Release 2.0 (official download locations: [Metatektur.org](http://www.metatektur.org) and/or <http://www.food4rhino.com>)
2. Extract the ZIP
3. Start *RHINO 3D*
4. Navigate to *TOOL > TOOLBAR LAYOUT > FILE > OPEN*. (Picture 1)
5. Click on *OPEN* and navigate into the extracted zip directory - there select: *METATOOLS\_(Release2.0).rui*
6. Be sure that the toolbar is enabled/selected (Picture 2)
7. Click on *OK*



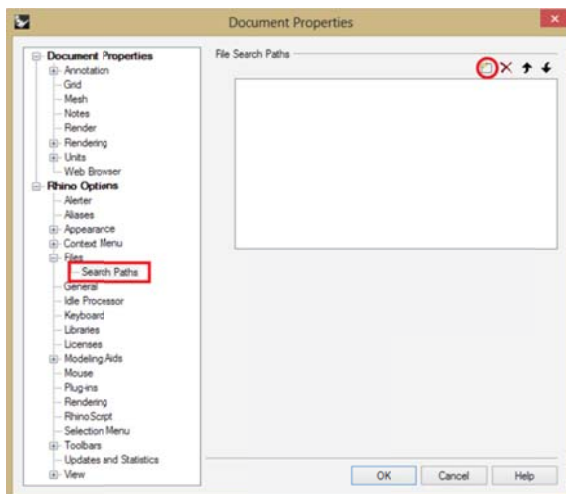
Picture 1



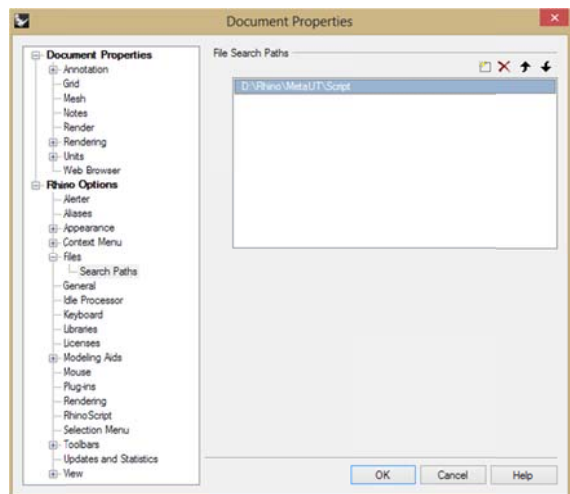
Picture 2

Now we have to tell rhino where the script/txt files for the toolbar are – we reference the search path.

8. Navigate to *FILE > PROPERTIES > FILES > SEARCH PATHS*
9. Click on *NEW* (Picture 3) – create a new search path
10. Now navigate into the tool folder (zip) and select the *Script* directory
11. Now you should see the reference under *FILE SEARCH PATH* (Picture 4)
12. You did it! Now you can try, use the toolbar and experiment with the script /txt files!



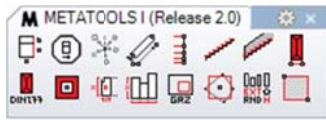
Picture 3



Picture 4



















# FUNCTION OVERVIEW



Picture 5: Toolbar Release 2.0

The following functions are included in METATOOLS (Release 2.0).

1		<b>GOLDEN SCALE</b>	Divides a length into the $a$ or $b$ length of the golden scale and offsets a curve with this length.
2*		<b>OKTO SCALE</b>	Divides a length into the 8 diatonic steps of an octave.
3		<b>COPY BLOCK TO POINTCLOUD</b>	Copies a block definition to the points of a pointcloud with a random scale and a random rotation. For example useful for trees in the render production.
4		<b>TREPPE EBENE</b>	Very simple stair/steps generator – for fast concept renderings.
5*		<b>TURN STAIRCASE</b>	Calculates the partition of a half turn staircase in the zimmermann's method.
6*		<b>STAIR TREADS</b>	
7*		<b>STAIR RAILING</b>	
8		<b>ZEILENBEBAUUNG</b>	Convenient for the concept phase in the urban scale (e.g. ribbon development). About a previously defined structure width, a area (NGF), a floor area proportion (for example ~ 25%) and a number of floors the building area will be calculated (BGF).
9		<b>ZEILENBEBAUUNG DIN277</b>	Same functional diagram as Button 8 but the input is structured according to the German DIN 277. (BGF = KGF + [NGF = NF + TF + VF])
10		<b>FLÄCHE HOF</b>	Useful for calculating the area of a “courtyard development”.
11		<b>FLÄCHENZUSCHNITT I</b>	Calculates a certain number of space widths according to floor areas predefined in a txt / csv file. Output: curves with text in the center.
12		<b>FLÄCHENZUSCHNITT II</b>	Calculates a certain number of space widths according to floor areas defined by user input in the command line. Output: curves with text in the center.
13		<b>GRUNDFLÄCHENZAHL (GRZ/GRAD)</b>	Calculates the degree of development (relationship built up area to site).
14		<b>CURVE TO SQUARE</b>	Calculates the area of any closed curve and outputs this area as a rectangle placed in the geometric center of the root curve. Useful for size comparison.
15		<b>RANDOMHOEHE EXTRUDE</b>	Extrudes curves to closed volume bodies. The extrusion height is predefined by a maximum height and scaling range.
16		<b>DRAW HATCH</b>	Just draw rectangular hatching.


\* These buttons will not be discussed in the following function description. They are mostly functional – but they must be necessarily revised.

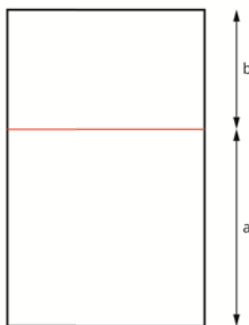


# FUNCTION DESCRIPTION

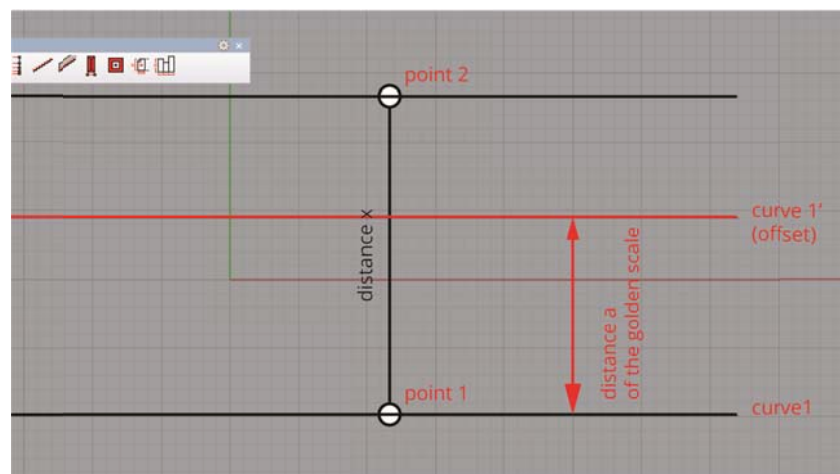
## 1 - GOLDEN SCALE

This button Divides a length into the  $a$  or  $b$  length of the golden scale and offsets a curve with this length. Example, offset length  $b$  of *distance x* (Picture 7):

- 1 Bush button 
- 2 **Command line: Wähle Punkt 1 der Länge a+b**  
Select *point 1* (startpoint distance  $x$ )
- 3 **Command line: Wähle Punkt 2 der Länge a+b**  
Select *point 2* (endpoint distance  $x$ )
- 4 **Command line: Wähle die Kurve die versetzt werden soll.**  
Select curve to offset with the distance  $b$
- 5 **Command line: Wähle die Seite auf die die Kurve versetzt werden soll.**  
Point and click for the offset direction
- 6 Output is a offsetcurve



Picture 6: Golden scale lengths




Picture 7: Offset curve in golden scale

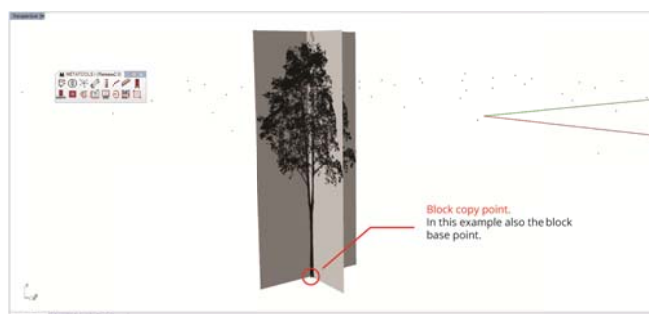
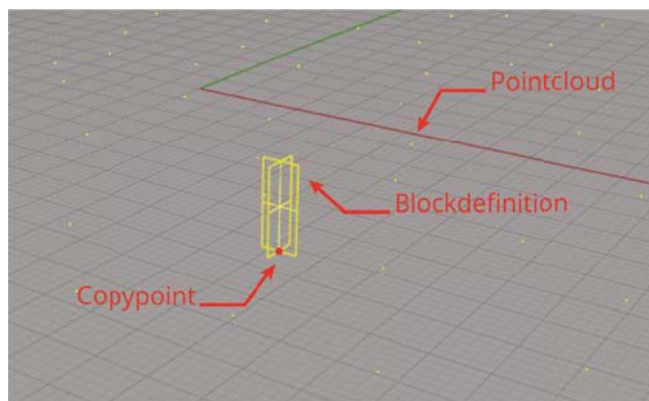
## 2 - OKTO SCALE

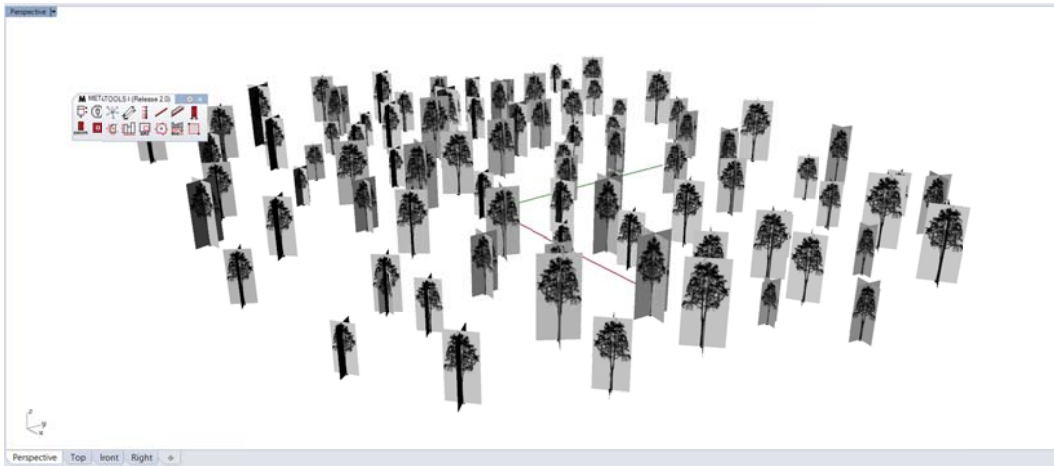
Not explained in this version.



### 3 - COPY BLOCK TO POINTCLOUD

- 1 
- 2 **Command line: Skalierungsfaktor:**  
Input the scale factor ("*Skalierungsfaktor*" = *sf*) in the command line. This factor will be randomized for each block instance. The future random scale of each copied block will be defined in xyz [Block(x,y,z)] space as follows: [Block ( $x*1+sf,y*1+sf,z*1+sf$ )]
- 3 **Command line: Waehle den Bereich des zufaelligen Winkels.**  
( $0=$ Winkelbereich $\leq 360$ ): Input angular range ("*Winkelbereich*") in the command line. This range will be randomized for each block. A factor of 360 means, random rotation of 360 degrees. A factor of 0, means no rotation.
- 4 **Command line: Waehle die Pointcloud aus.** Choose the point cloud.
- 5 **Command line: Waehle die Blockdefinition.** Choose the block definition.
- 6 **Command line: Waehle den Kopierpunkt der Blockdefinition.** Choose the cointerpoint of your block definition. In this example also the the block base point, maybe usefull :)





Picture 8: Scalefactor=1, Angular range=360



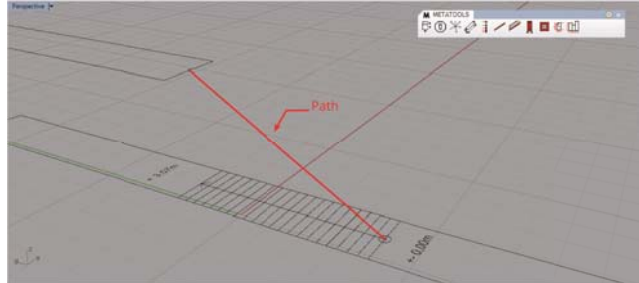
Picture 9: Scalefactor=0.5, Angular range=0



## 4 - TREPPE EBENE

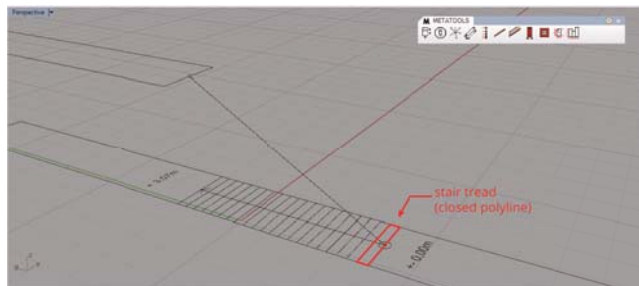


- 2 **Command line:** Bitte wähle einen Pfad.  
Please select a path.



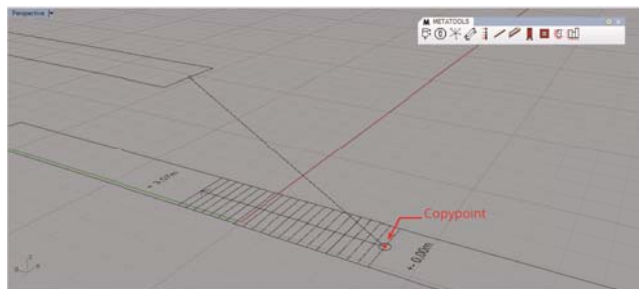
Picture 10: Select a path.

- 3 **Command line:** Bitte Wähle die Trittstufe/Kurve.  
Select the curve for the stair tread.

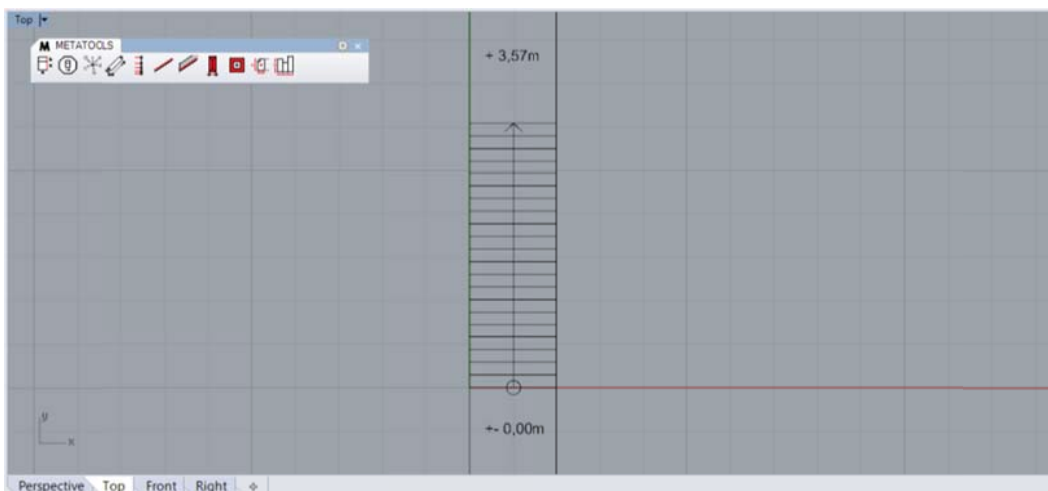


Picture 11: Select the tread curve.

- 4 **Command line:** Wähle den Kopierpunkt.  
Choose the copy point.

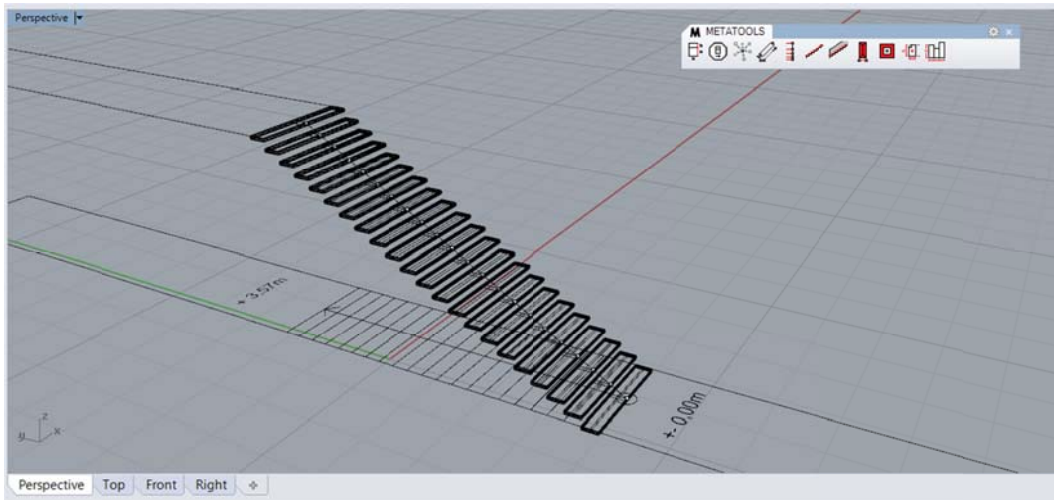


Picture 12: Select copy point.



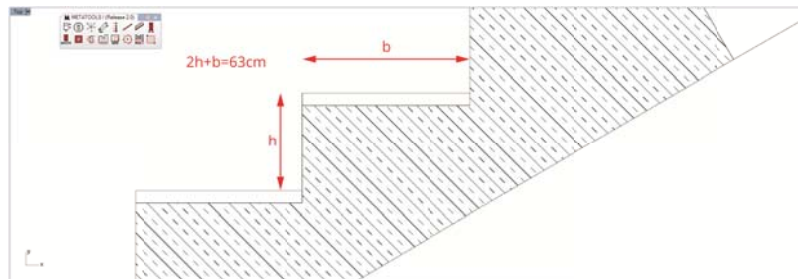
Picture 13: Top view, stair blueprint.





Picture 14: Finished stair.

The treads obtained do not necessarily represent the blueprint. Because the calculated slope ratio within the script is based on the rule:  $2h + b = 63$ .



Picture 15

## 5 - TURN STAIRCASE

Not explained in this version.

## 6 - STAIR TREADS

Not explained in this version.


## 7 - STAIR RAILING

Not explained in this version.

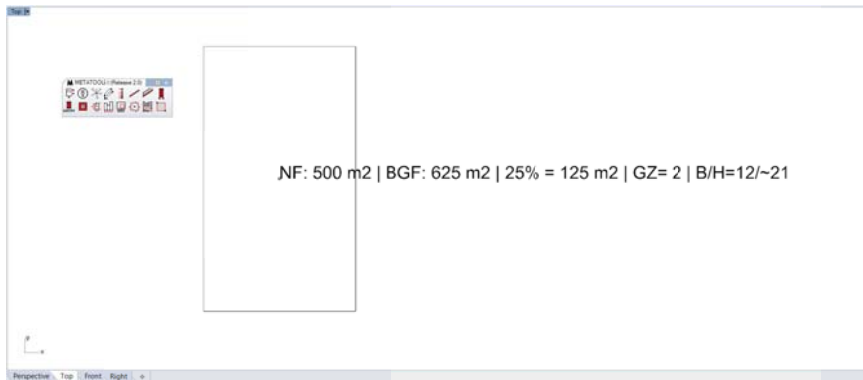


## 8 - ZEILENBEBAUUNG I

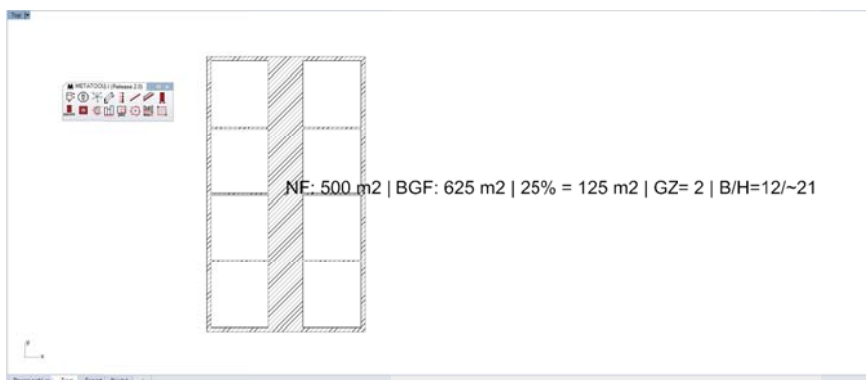
This function calculates the width of a building/room/space in relation to a user defined: area, building depth (height), traffic area ratio (Picture 17) & number of tiers. Output of this function is the calculated curve and text.

1. 
2. **Command line: Bitte geben sie die Flaeche (NF) in Qudratmeter an.**  
Input the area size in square meters.
3. **Command line: Geben sie die Gebaeudetiefe an. (Wohnbeauung ca.12m)**  
Input the depth of the building in meters. Note - a residential building normally has a depth around 12m.
4. **Command line: Geben sie die Geschosszahl an.**  
Please input the levels of the building.
5. **Command line: Geschossflaechenanteil (TF+VF+KGF) in Prozent.**  
Input the estimated traffic area ratio. Normally it is between 25%-35% of the total floor area.
6. **Command line: Waehlen sie einen Einfuegepunkt.**  
Please click for insertion point of the calculated curve.

For example you have a building depth of 12m, a floor area sum of 500m<sup>2</sup>, two floors and a traffic area ratio of 25%. How width the building will be? (Picture 16)




Picture 16: Output of the function. wide ~ 21m (area 500m<sup>2</sup>, traffic floor ratio 25%, 2 floors and depth 12m)



Picture 17: Note! - Traffic area ratio includes also the projected wall area (hatch). With a corridor wide of 2m, a wall thickness outside 0.3m and wall thickness inside 0.2m the calculated traffic floor ratio in this example is about 30%. As we know its always somewhere between ~25% and ~35%

## 9 - ZEILENBEBAUUNG DIN 277

Same functional diagram as Button 8 but the input is structured according to the German DIN 277 (Grundflächen und Rauminhalte von Bauwerken im Hochbau). (BGF = KGF + [NGF = NF + TF + VF])

- 1 
- 2 **Command line: Bitte geben sie die Baukoerperbezeichnung an.**  
Insert building designation – for example “school”
- 3 **Command line: Bitte geben sie die Nutzflaeche (NF) in Qudratmeter an.**  
Please input the usable area in square meters
- 4 **Command line: Konstruktionsgrundflaechen (KGF) Anteil in Prozent.**  
Please insert the construction floor area in percent. In relation to the typology of the building it is about 5-7%
- 5 **Command line: Verkehrsflaechen (VF) inkl. Technische-Funktionsflaechen (TF) Anteil in Prozent.**  
Please insert the traffic area (VF) and the technical area (TF) ratio in percent. In relation to the building it is about 20-25% percent
- 6 **Command line: Gewuenschte Baukoerper- Raومتiefe.**  
Please input the depth of the building
- 7 **Command line: Waehlen sie einen Einfuegepunkt.**  
Please select an insertion point





! Note the wide of the building/area is accurately calculated but rounded in the caption output!



Picture 18: Function output

## 10 - FLÄCHE HOF

This button calculates the area of a “courtyard development” (built up area). Select the curves, the order of the selection do not matter - but please make sure that the curves do not overlap.

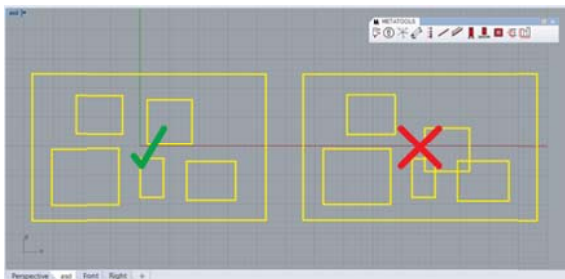
-   Outputs the area as a text in the geometric center and in the command line.
-   Area output only in the command line.

1  

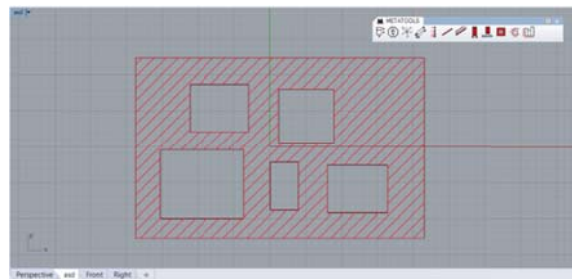
2 `Command line: Waehlen sie die Kurven aus.`

Please select the curves. Be sure there is no overlapping. (Picture 18)

3 Area output in the command line and as text



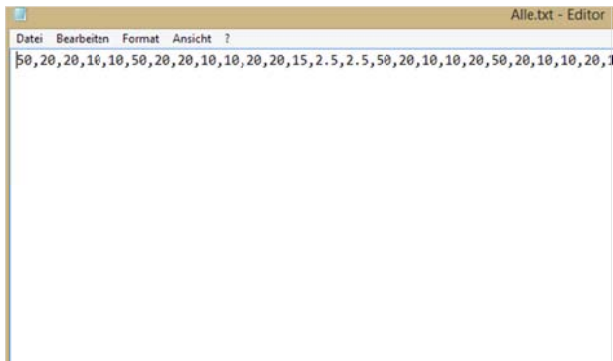
Picture 19: Curves should not overlap




Picture 20: The calculated area

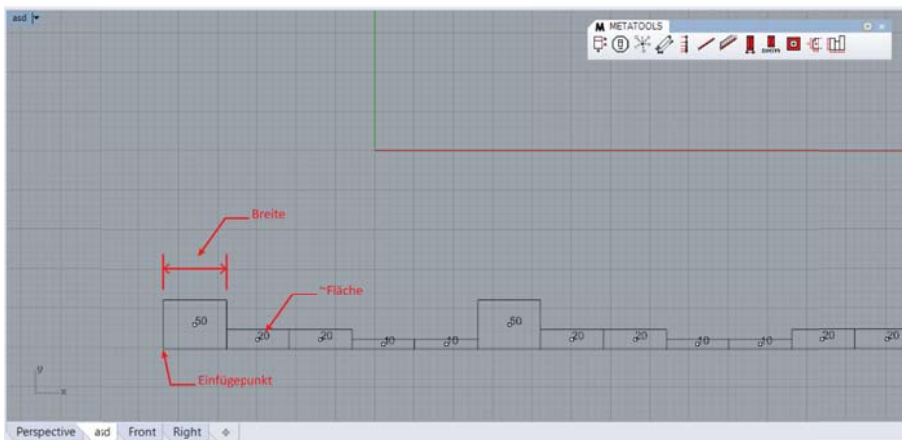
## 11 - FLÄCHENZUSCHNITT I

Calculates a certain number of space widths according to floor areas predefined in a txt / csv file.



Picture 21: Textfile with the predefined space areas


- 1 
- 2 **Command line: Waehlen sie einen Einfuegepunkt.**  
Please choose a insertion point.
- 3 File browser opens, choose the txt file
- 4 **Command line: Geben Sie die Raumbreite an.**  
Input the overall space width.
- 5 Curve output



Picture 22: Output button 11

## 12 - FLÄCHENZUSCHNITT II


This button corresponds to the function of button 11 - with the difference that the parameters for calculation are queried in the command line.

- 1 
- 2 **Command line: Anzahl der Raeume:**  
Input, how many rooms/spaces/buildings?
- 3 **Command line: Geben Sie die Raumbreite an.**  
Insert space width
- 4 **Command line: Einfuegepunkt.**  
Click for insertion point
- 5 **Command line: Raum X^n:**  
Input areas, one behind the other
- 6 The curves with the desired area sizes and the predefined width are created



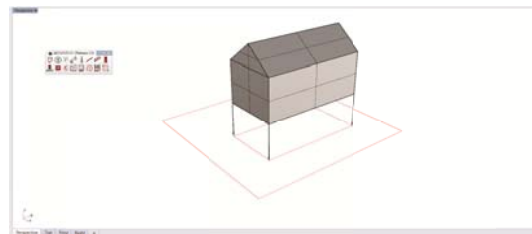
## 13 - GRUNDFLÄCHENZAHL (GRZ/GRAD)

This button calculates the degree of development (relationship built up area to site).

- 1 
- 2 **Command line: Waehle das Grundstueck (Kurve).**  
Select the building site. It must be a closed curve
- 3 **Command line: Waehle das/die Gebaeude (Kurve).**  
Select build up area of the building(s). Of course there could be more than one building on the site
- 4 **Output of the relation in the command line: Grundflaechenzahl: 0.196490853262247**  
**(GRZ/Grad)Flaeche Grundstueck: 772.788848596694 m2 / Grundflaeche Gebaeude:**  
**151.845940252314 m2**  
That means the buildup area needs 20% of the site/plot. Nice to know ;-)



Picture 23





Picture 24

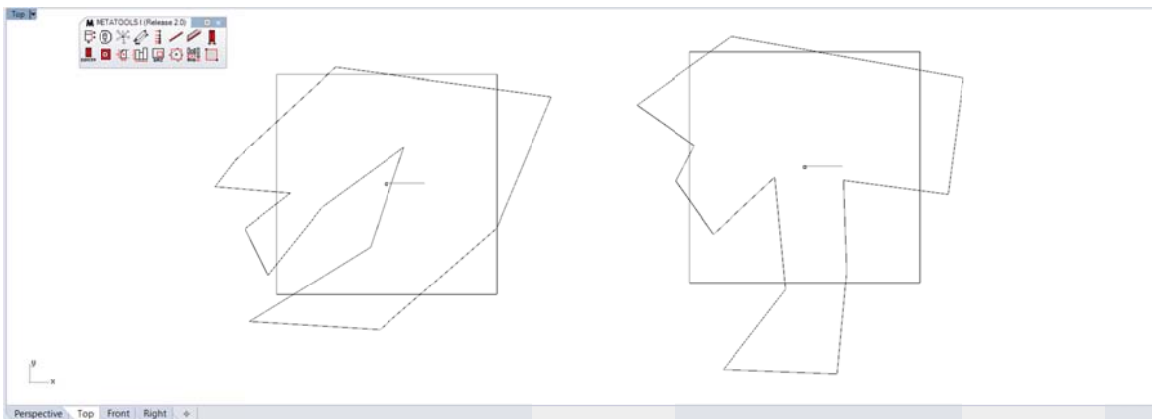


## 14 - CURVE TO SQUARE

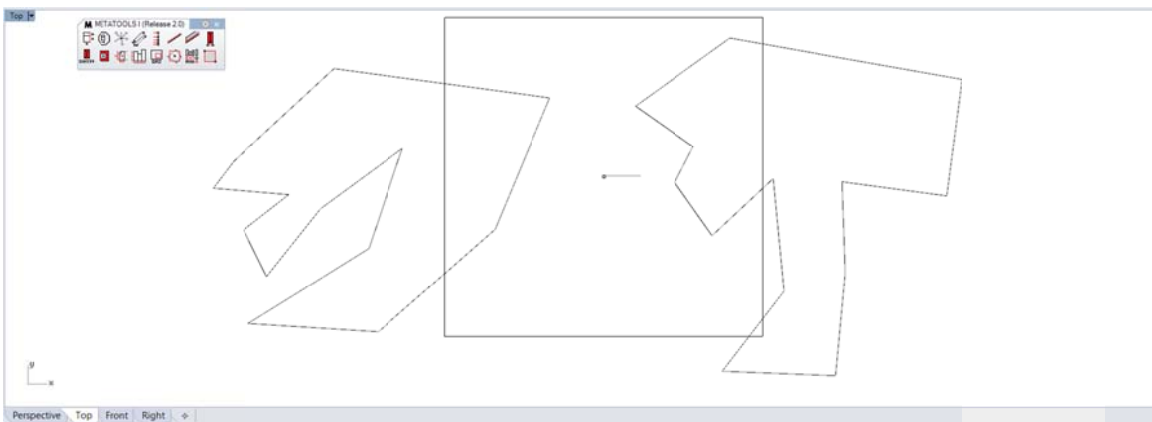
Calculates the area of any closed curve and outputs this area as a group (rectangle, text & center point) in the geometric center of the root curve. This function may be useful for visual/graphical size comparison.

- 1 
- 2 **Command line: Kurven**  
Select the curve(s). If you select more than one curve the function will calculate the area of all curves – output is in the geometric center of those curves (Picture 25, Picture 26)
- 3 Output is a group (curve, text & center point)

- 1 
- 2 **Command line: Waehle die Raumgroesse.**  
Choose the size of the rectangle in square meters
- 3 **Command line: Waehle den Einfuegepunkt.:**  
Click and choose the insertion point
- 4 Output is a curve, text & a center point



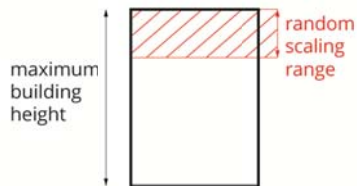
Picture 25: Output single curve selection



Picture 26: Output multiple curve selection


## 15 - RANDOMHOEHE EXTRUDE

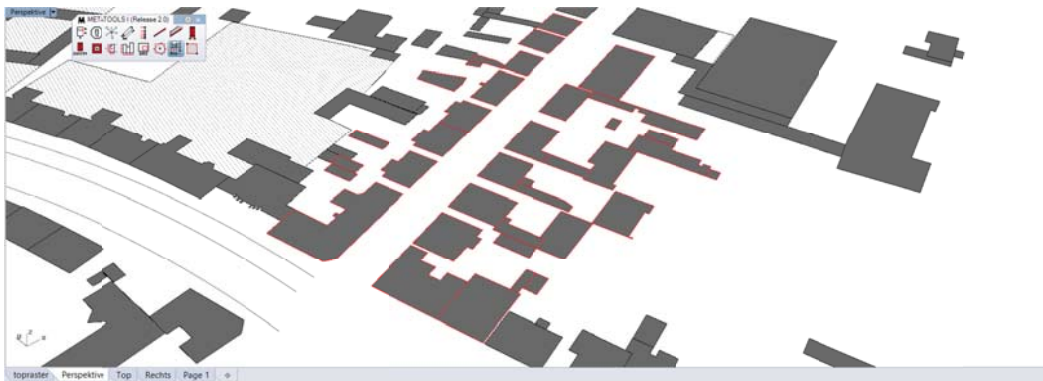
Extrudes curves to closed volume bodies/boxes. The random extrusion height is predefined by a maximum height and a random scaling range. For example useful if you would like to build up an urban environment for a render scene and the grasshopper is in the fields...



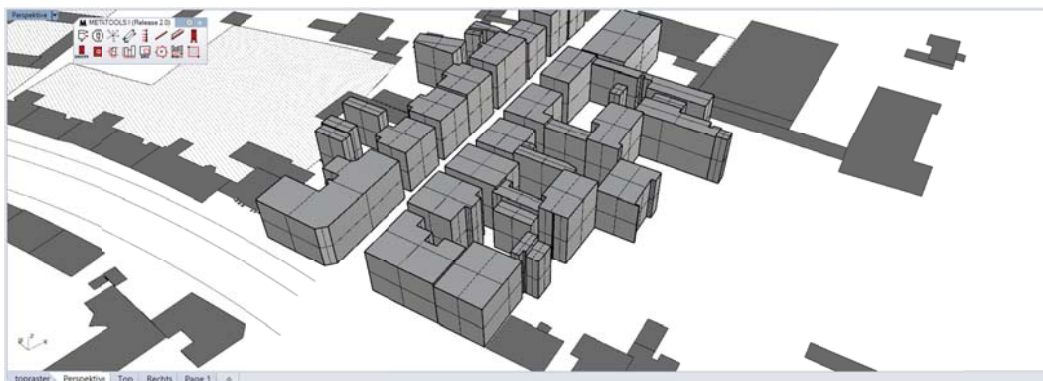
$$h = \text{maximum height} - \text{random scaling range}$$

Picture 27: Function calculation scheme (vertical section)

- 1 
- 2 **Command line: maximale Gebaeudehoehe:**  
Input the estimated maximum building height
- 3 **Command line: Randomhoehe:**  
Input the random scaling range.
- 4 **Command line: Kurven (bebaute Flaeche):**  
Select the closed curves. (Picture 28)
- 5 Output (Picture 29)



Picture 28



Picture 29



# 16 - DRAW HATCH

Draw a rectangular hatch.



