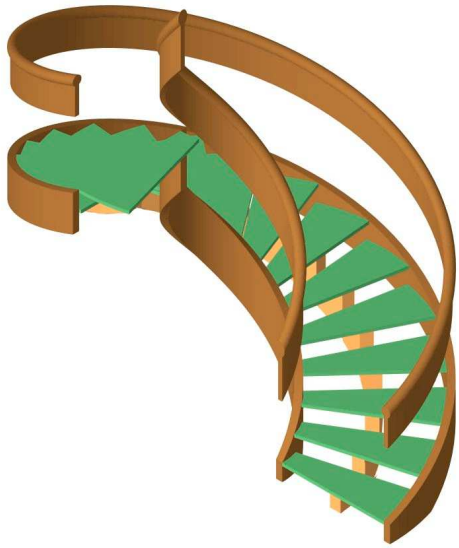
BOOLE & PARTNERS

CONSEIL EN SYSTEMES D'INFORMATION
EDITION DE LOGICIELS PROFESSIONNELS

StairDesigner VI

Stair Design to Measure



User Manual - Version 6

StairDesigner Std / Pro / Pro_DXF / Pro_RB

StairDesigner VI

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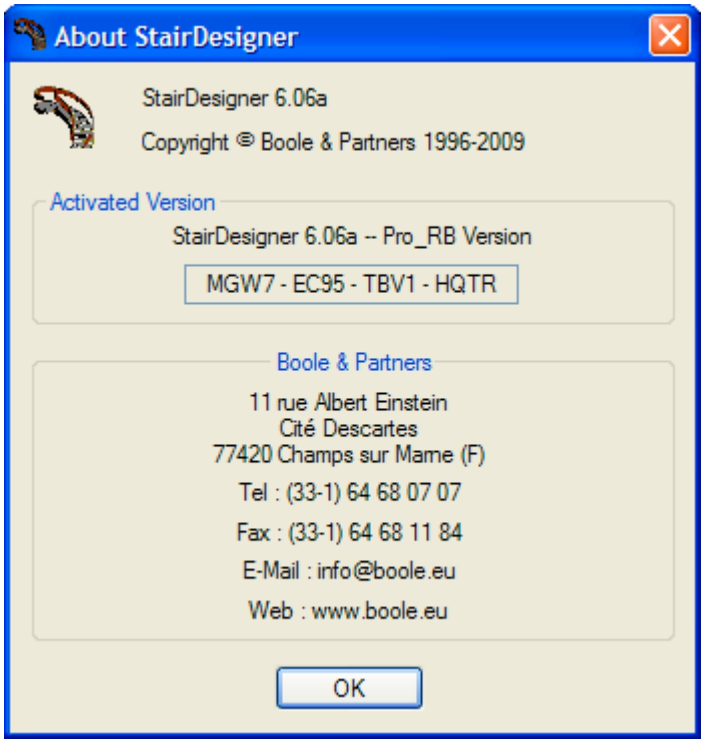
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StairDesigner VI

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For any request related to ***StairDesigner****, please contact BOOLE & PARTNERS:*

Tel : 33 (0)1 64 68 07 07.

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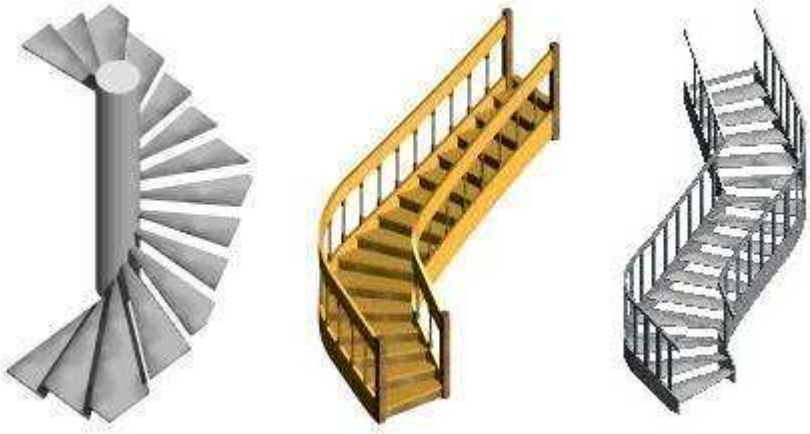
I. INTRODUCTION

Preface

Stair design has no other limit but the architect's and stairmaker's creativity as they compete in order to give their stairs the architectural position that we owe them. We actually use them so often that we sometimes forget they are there.

Whether they are made of wood, metal, stone or mixed materials *(metal and wood, stone and glass)*, all stairs follow the same common design rules but their variety of shape is unlimited.

This is why no single software would be able to cover all the stair shapes and styles. However, it can analyse every aspect of a stair up to fabrication details or give at least the foundation of the more complex ones.



Stair examples

I. 1 PRESENTATION

StairDesigner VI is a software that helps designing stairs to measure. It was developed by **BOOLE & PARTNERS**, editor for professional software since 1988, whose product range benefits of the experience of thousands of licences used in more than 30 countries.

StairDesigner VI is available in the following 4 versions:

- **StairDesigner VI-Std** : Standard version, limited to printouts in A4 format.
- **StairDesigner VI-Pro** : Prints out templates on a scale of 1:1.
- **StairDesigner VI-Pro_DXF** : Prints out 2D and 3D DXF files.
- **StairDesigner VI-Pro_RB** : Optimizes concrete stair coverage.

I. 2 INSTALLATION

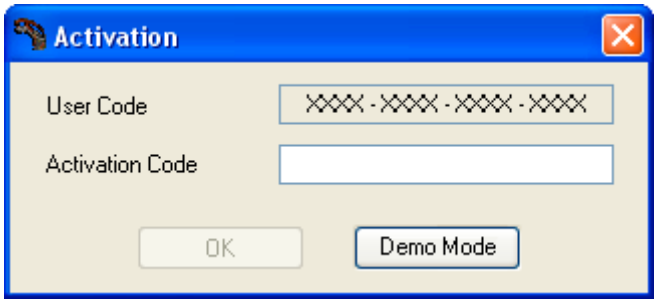
StairDesigner VI can be installed on every personal computer that runs with Windows ***(Windows 98 / 2000 / XP Pro / Vista)***. You can install it with the file "**InstallStairDesigner.exe**" that is available on CD or the website **www.boole.eu.**

When you execute the file "**InstallStairDesigner.exe**" the following window opens:



Now just follow the instructions: the installation only takes a few seconds.

Once **StairDesigner VI** is installed, you may execute it via the shortcut on your desktop. Clicking on the "Demo version" button allows you to use **StairDesigner VI** in its demo mode until you enter the Activation Code we will provide you.



To receive the Activation Code, you have to send us your user code per E-mail or Fax.

@ IMPORTANT:

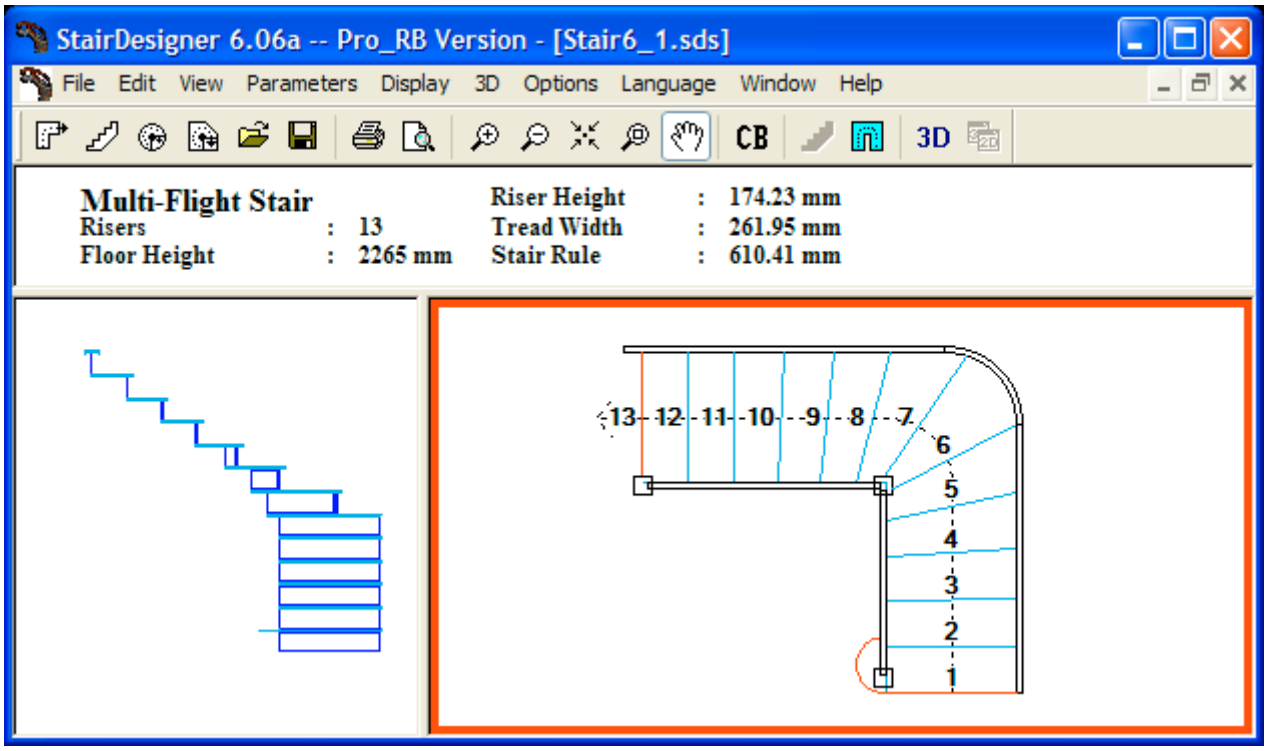
You should absolutely **uninstall StairDesigner VI** before altering your hard drive.

To do this, open the menu "Start/ Programs" of your computer and execute the command "Boole & Partners/ StairDesigner 6/ Uninstall StairDesigner".

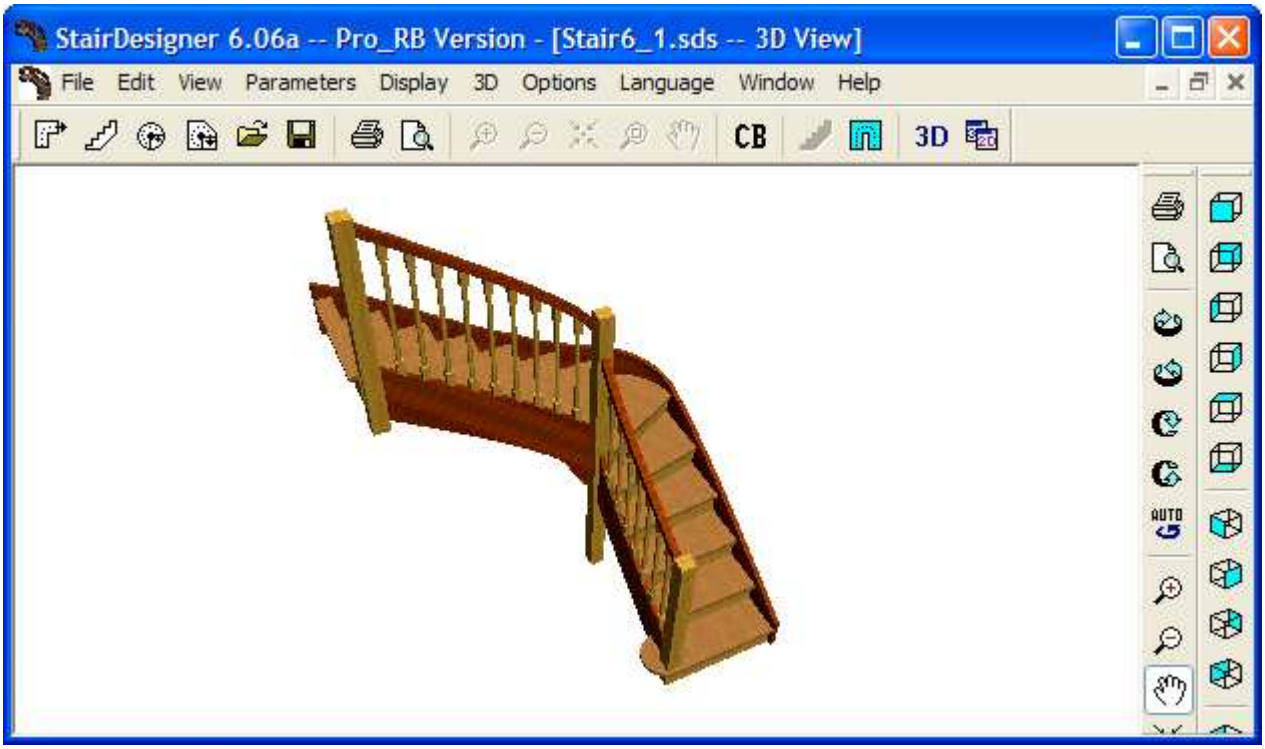
ATTENTION: Do not forget to write down the code provided during the uninstallation.

I. 3 STAIRDESIGNER WINDOWS

StairDesigner VI has a 2D working window that displays different elements of the stair during its creation *(plan view, stringboards, steps, newel posts, cut strings, etc.)* and a 3D displaying window. The symbol **"3D/ 2D"** switches between the two.



StairDesigner 2D window



StairDesigner 3D window

II. WINDING PRINCIPLES

The winding of a stair is the rule that places every step and influences every fabrication detail.

The aesthetics and comfort of a stair depend on the quality of its winding.

A well wound stair looks harmonious and is comfortable to climb.

One may consider that a stair is well wound if the climbing movement is similar to the climbing movement of a straight stair.

StairDesigner VI uses the general winding function of BOOLE & PARTNERS that results from more than fifteen years of experience in winding calculation techniques.

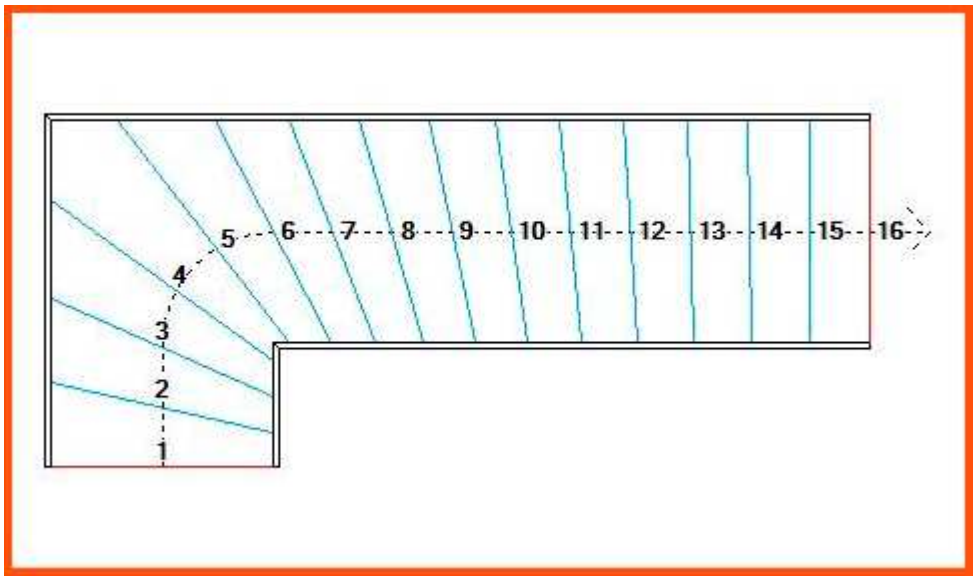
II. 1 INTEGRAL WINDING

L-Shaped Stairs

The winding is calculated from the last fixed step *(obligatory position)* of the first flight to the first fixed step of the second flight.

If you did not fix any steps, **StairDesigner** automatically winds all the steps between two successive flights.

In the following example, every step has been wound apart from the first *(No.1)* and the last one *(No.16)* that are fixed because of the shape of the staircase.



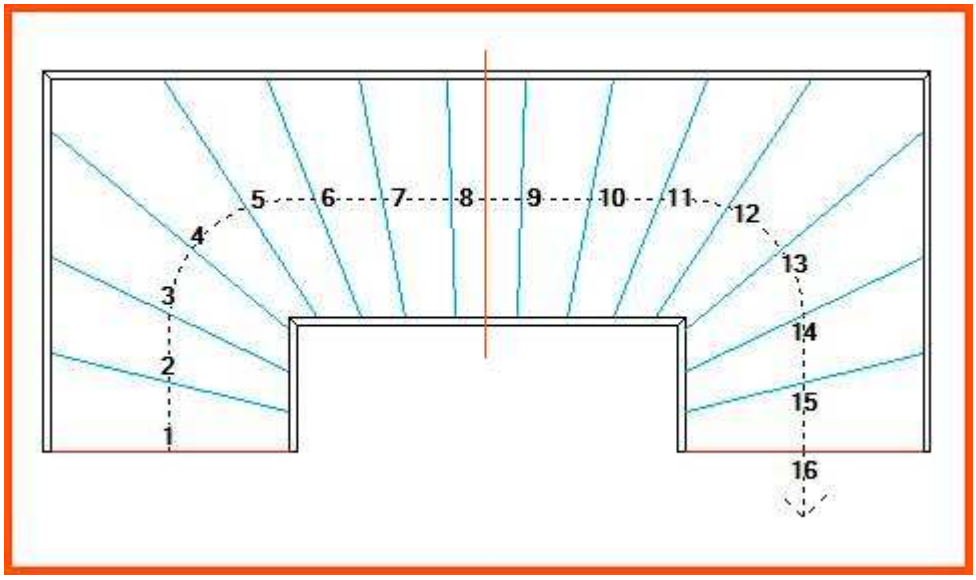
Freely wound L-shaped stair

The winding operates on the step angle but it observes the equal distribution of the steps along the tread line.

U- or S-Shaped Stairs

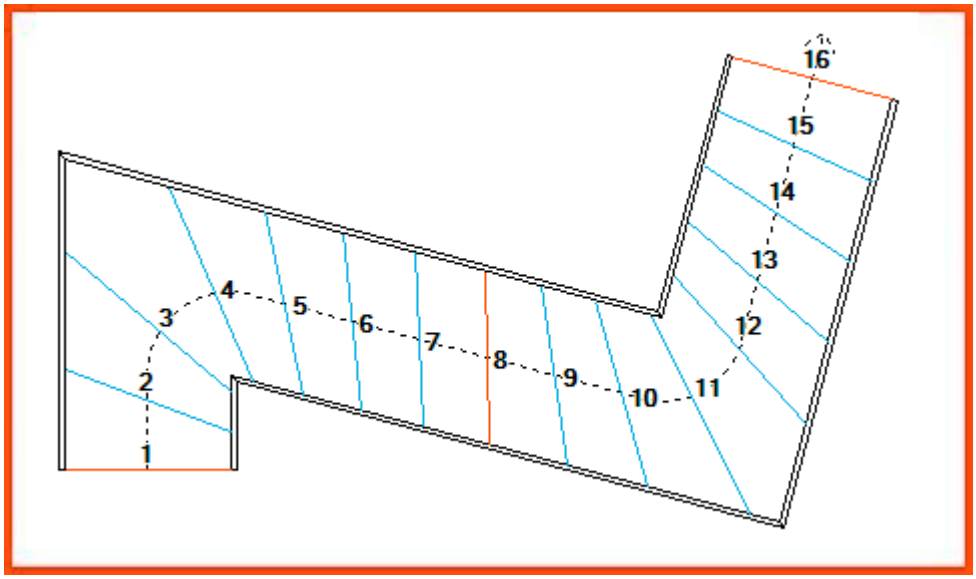
When the stair contains more than two flights *(3 or more)*, **StairDesigner** inserts a virtual step in every intermediate flight so as to create a sequence of calculations between two successive flights.

In the following example, a virtual step was inserted between steps No.8 and No.9 *(pictured in red)* and two winding calculations succeed each other and merge in order to guarantee the harmonious shape of the stair.



U-shaped stair: 2 successive windings with a virtual step

When you fix one or more steps in an intermediate flight, **StairDesigner** deletes the virtual step and the winding is based on the fixed steps *(which is the case of step No.8 in the following example).*



S-shaped stair: 2 successive windings with a fixed step

II. 2 WINDING COEFFICIENT

The **StairDesigner** winding function uses two coefficients for each inner corner of the stair:

- The local winding coefficient *(LWC),*

- The distant winding coefficient *(DWC).*

These coefficients vary from **0 to 100** *(with an average of **50**).* They determine the position of each step and more precisely the rotation around their intersection with the tread line, this point being fixed on the tread line

Click the right mouse button on an inner corner and **StairDesigner** opens a context menu giving access to the winding coefficient window.



When designing a stair, the default values *("**50**")* for the LWC and DWC are used automatically. You may access them via the **StairDesigner VI** general parameters. They can also be modified clicking on the **"CB"** symbol of the general menu.

However, you may fix both coefficients for every inner corner of the stair and act separately on each winding between two successive flights.

In general, when you increase *(resp. decrease)* a coefficient, the winding of the steps narrows *(resp. widens),* with one distinction:

- **LWC** influences the steps near the inner corner,

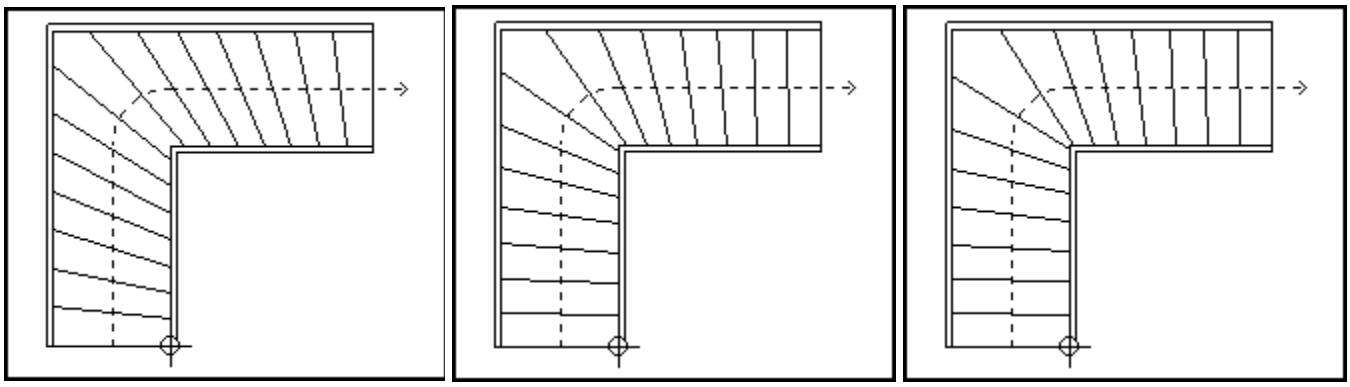
- **DWC** influences the steps far from the inner corner.

The effect of each of the coefficients is explained on the following pages.

Local Winding Coefficient

When the local winding coefficient of an inner corner increases, the winding of the steps narrows around this inner corner, with an impact on all the steps in the winding zone.

However, the effect of the LWC diminishes the further the steps are away from the inner corner.



LWC = 50 **LWC = 75** **LWC = 100**

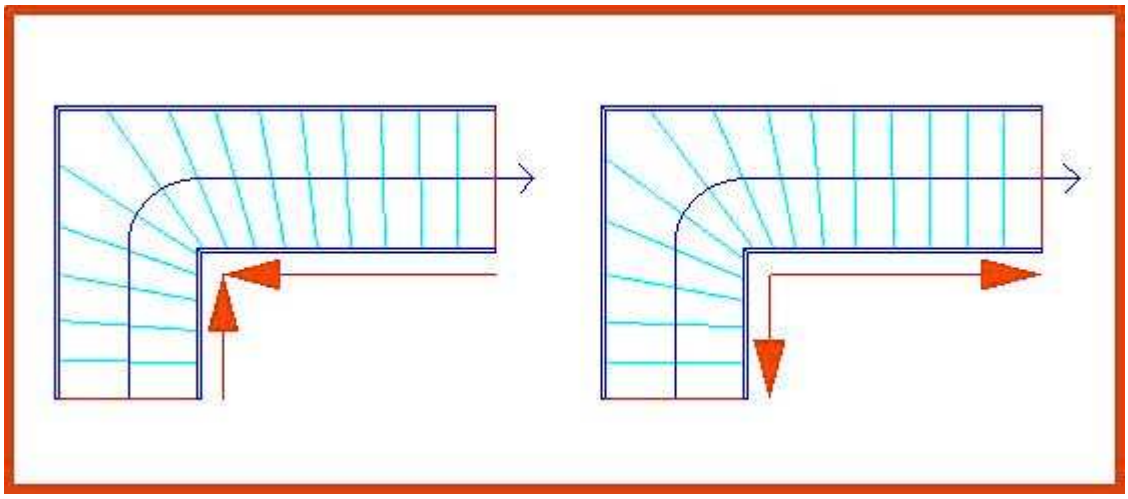
In the above example, the winding was successively calculated with three different values LWC = 50, 75, and 100 *(maintaining the DWC at 50)*.

From 75 to 100, the steps around the inner corner are still slightly narrowing, whereas those far from the inner corner cannot straighten themselves up any more.

Distant Winding Coefficient

An increase of the distant winding coefficient makes the steps far from the inner corner straighten up which has an impact on all the steps in the winding zone.

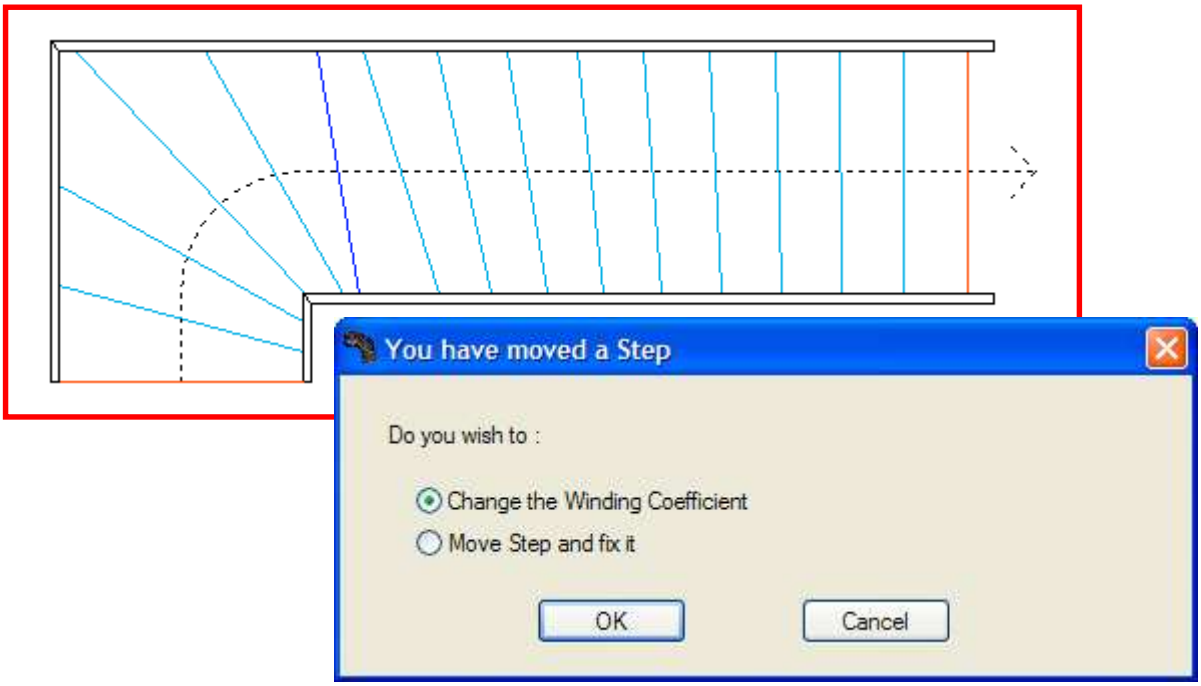
Contrary to the LWC, the effect of the DWC diminishes the nearer the steps are to the inner corner.



Left: effect of the local coefficient – Right: effect of the distant coefficient

Self-Correcting Winding

When you manually modify the position of a step, **StairDesigner** suggests, if this correction is possible, to automatically modify the local winding coefficient. This avoids cutting the winding in two.

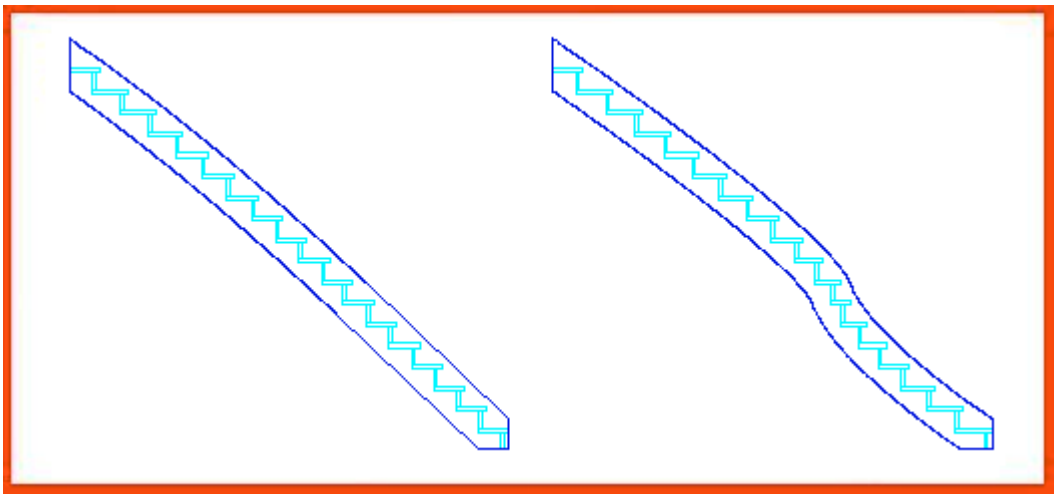


Effect of the Winding on Stringboards

When the local winding coefficient decreases, the winding of the steps widens, they are equally distributed and the inner stringboard tends to be straight.

However, this is only the case if the two successive flights have the same lengths.

If you increase the LWC, the stringboard takes the shape of a hockey stick.

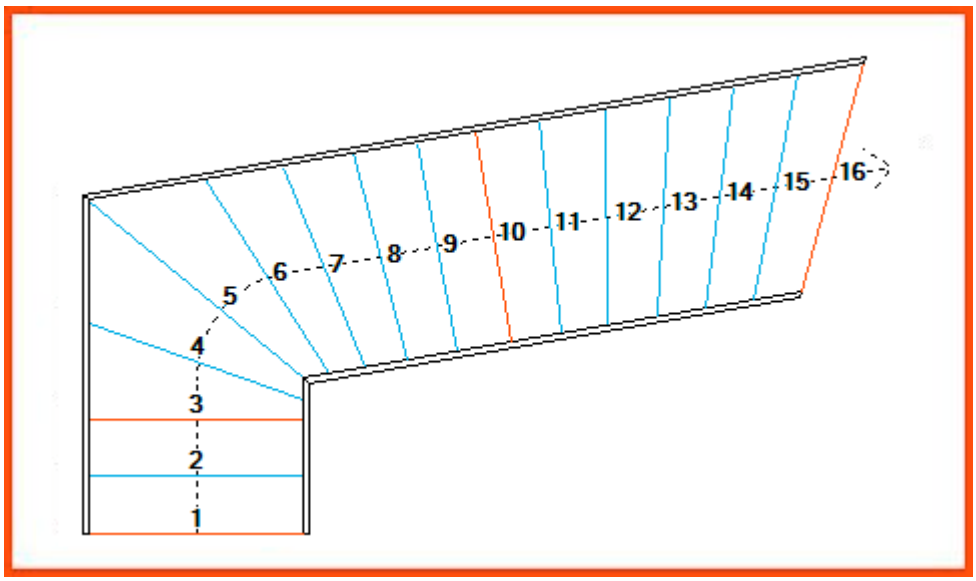


Left: LWC = 50: almost straight stringboard - Right: DWC = 80: hockey-stick shape

II. 3 SPECIFIC WINDING SITUATIONS

Equal Winding

If a winding zone between two fixed steps does not have an inner corner; **StairDesigner** equally distributes the steps between the two edges of the stair.

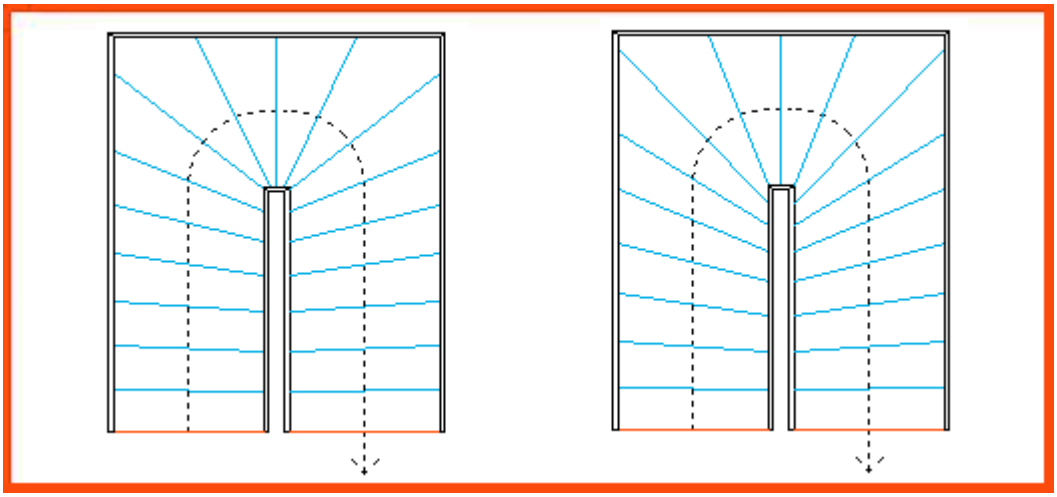


In the example above, two steps *(No.3 and No.10)* have been fixed. Thus, there are three winding zones: steps 1 to 3 and 10 to 16 are equally distributed.

Centred Winding

When the well hole of a stair is quite narrow, the standard winding function leads to a radial pattern that is often thought to be less harmonious.

For this reason, **StairDesigner** offers an optional mode called "centred winding".



Left: winding with radial pattern - Right: centred winding

III. STAIR RULE

III. 1 BLONDEL RULE

Nicolas-François Blondel (1618-1686) was the first architect to study the relation between the height of a step and its tread width.

He found that the length of a comfortable step on an even surface is the double of the step height on a vertical ladder. He concluded that two times the step height plus the tread width correspond to the length of a step.

The length of a comfortable step is about 62 cm. The **Blondel Rule,** also called Stair Rule, says:

$$60 < (2xH + T) < 64$$

Due to recent increases in the size of the human body those values may be replaced by 62 and 66.

III. 2 CONTROL FUNCTION

In addition to the Blondel Rule, the control function avoids the stair being:

- Too steep, which leaves too little space for the feet on the steps and would make it difficult to climb, or
- Too shallow, which would take up too much space.

The parameters "height" and "tread width" are controlled by means of a maximum and a minimum value so that the inclination of the stair remains at **33° ± 5°**.

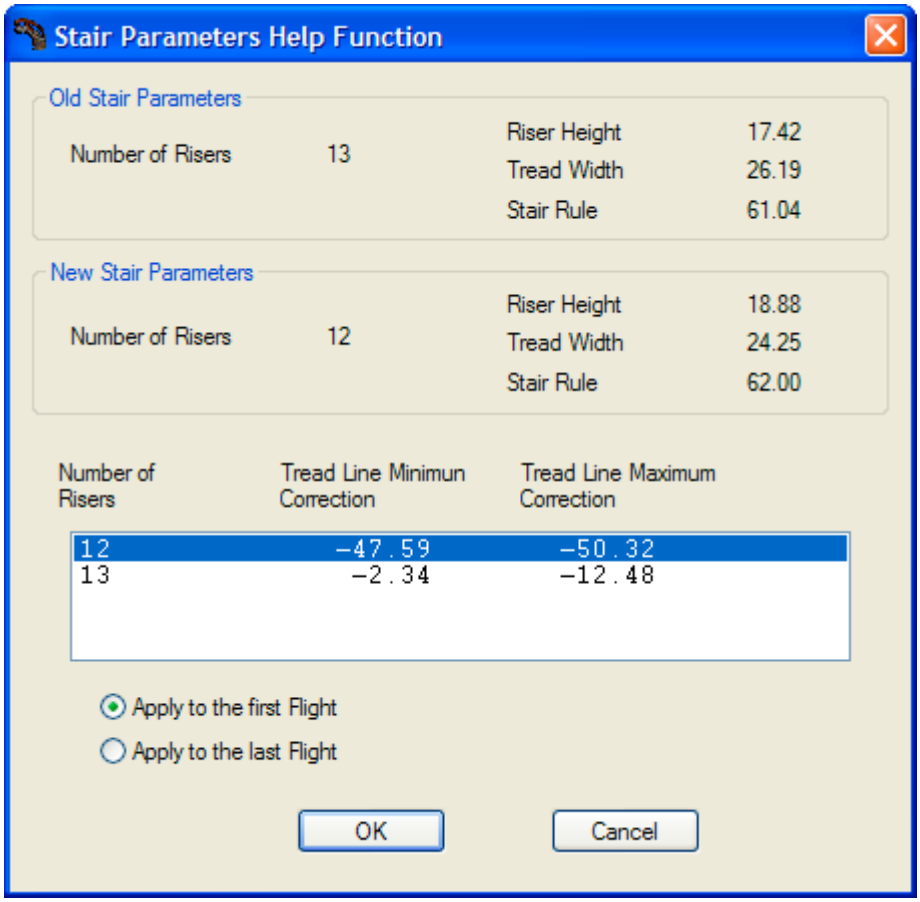
StairDesigner offers a control function for the three parameters of the tread line *(you can see whether the stair observes these three parameters thanks to the red or green point on the OK button of the window "stairwell parameters").*



III. 3 HELP FUNCTION

If the input stair is not conform to the predefined minimum and maximum control values, the button "Help" of the "Stairwell parameters" window suggests:

- Either to modify the number of steps if this alone is enough to make the stair conform,
- Or to lengthen *(or shorten)* the tread line of the first *(or the last)* flight, then to modify the number of steps.



<u>Event No.1</u>: Modification of the Number of Steps

In the first event, **StairDesigner** only shows the numbers of the steps that have to be modified in order to conform the stair to the control values without correcting the tread line.

<u>Event No.2</u>: Modification of the Number of Steps and the Tread Line

When the stair cannot be conformed by the modification of the number of steps alone, the length of the tread line has to be modified and the "Help" function shows a list of all the necessary corrections.

Every suggestion of step numbers corresponds to a variation of the length of the tread line *(with minimum and maximum values)*. The chosen solution always takes into account the smallest possible variation.

IV. STAIRWELL

A stairwell corresponds to the space a stair takes up. It is defined by its:

- Plan view,
- Total height, or floor height,
- Total number of steps and
- If necessary, the position of intermediate landings as well as the distribution of the steps between these landings.

It is convenient to indicate whether the thickness of the stringboards is or is not included in the stairwell *(stringboard in stairwell / off stairwell).*

Be sure not to mix up the stairwell with the ***well hole*** *that corresponds to the hole made in the ceiling of the upper floor.*

IV. 1 MULTI-FLIGHT STAIRWELL PARAMETERS

The window below shows how to input a stair with several flights.

Every flight is defined by its length along its reference side *(left or right)*, its width and its angle with the previous flight. You can add a new flight using the button "Add flight" until a maximum of 7 flights.



Stairwell with Parallel Sides

By default, **StairDesigner** displays the reduced window above with one angle between two successive flights, corresponding to a stairwell with parallel sides.

A click on the ">>" button shows the advanced window below with two further columns that differentiate left and right angles.

You can input stairwells with non-parallel sides using the advanced window (see end of the chapter).



When the case "Left rotation" is ticked, this flight will turn to the left whereas the default rotation is to the right.

The start angle *(resp. end angle)* is the angle of the first *(resp. the last)* step to its own flight *(the value "0" corresponds to a step that is perpendicular to the flight).*

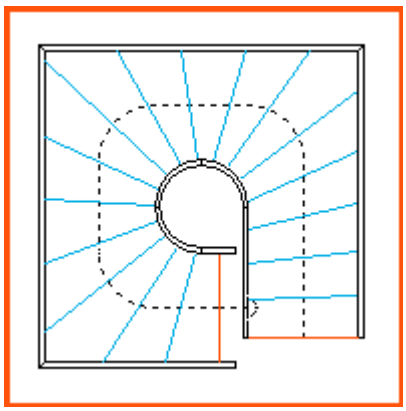
Place the cursor on the line of the flight you want to delete and click on the button "Delete flight" *(by default, the last flight is deleted).*

The button **"Reset"** resets the winding of the stair *(by re-establishing the tread line and the winding coefficients by default)* and deletes all the newel posts.

The length of the landing step is deduced from the length of the last flight.

When the option "Stringboard in stairwell" is ticked, the thickness of the stringboards is deduced from the dimensions of the stairwell.

The main stringboard parameters, e.g. their thickness, are directly accessible through the button "Stringboard parameters".

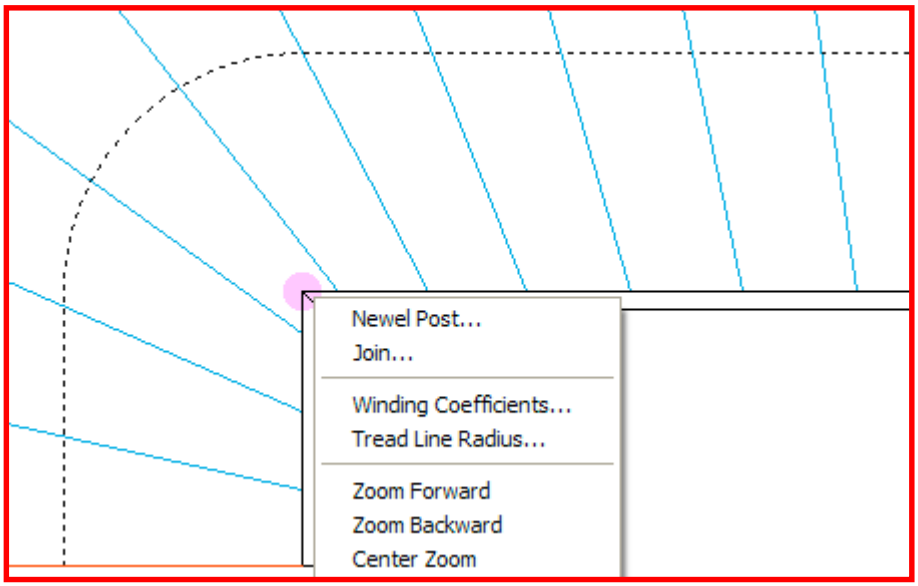


In the current version, the number of flights is limited to 7 *(there are 4 in the example above).* Those flights must not overlap each other in the plan view.

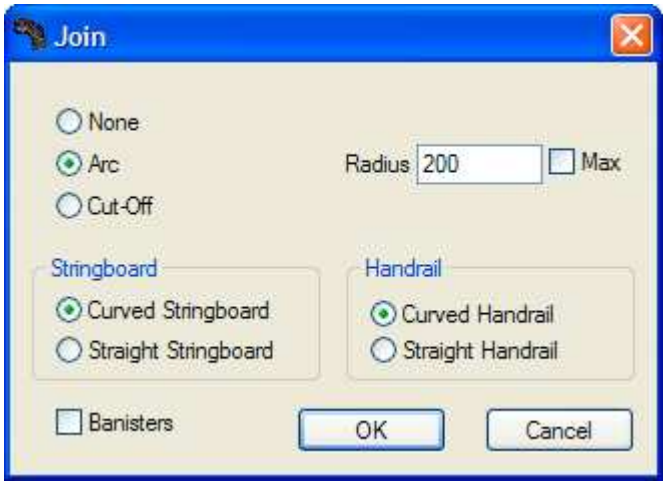
IV. 2 JOINS BETWEEN SUCCESSIVE FLIGHTS

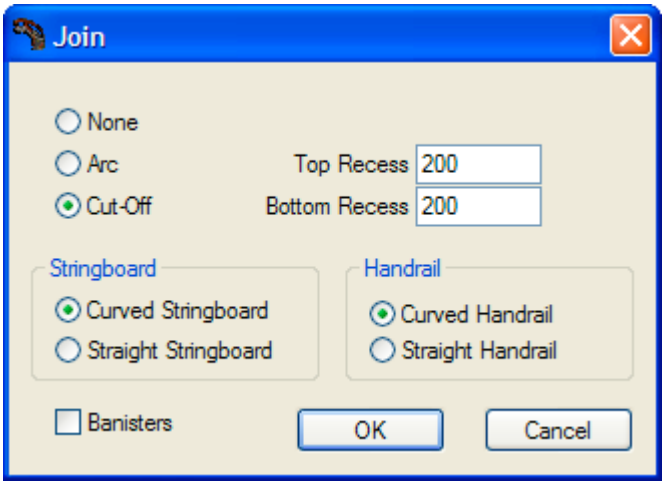
Right-click on the inner corner between two successive flights to:

- Create a newel post in which both stringboards will end, or
- Create a join with an arc or a cut-off.



Choose the option "Join" in the context menu above to open the following window. It varies depending on the options "Arc" or "Cut-off":





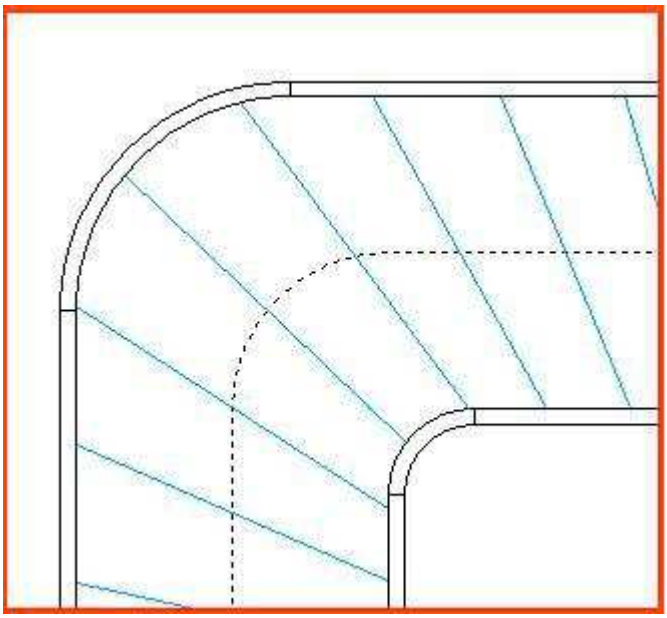
If you choose an arc, the parameter "Radius" defines the radius of the arc created between two flights.

If you choose a "Cut-off", the two parameters "Bottom recess" and "Top recess" define the positions of its ends depending on the original intersection.

The following parameters define the kind of stringboard and handrail *(curved or straight),* and whether there are banisters in the join.

Joins with an Arc

The following example shows two joins with an arc. The inner one has a radius of 200 mm, the outer one of 500 mm.

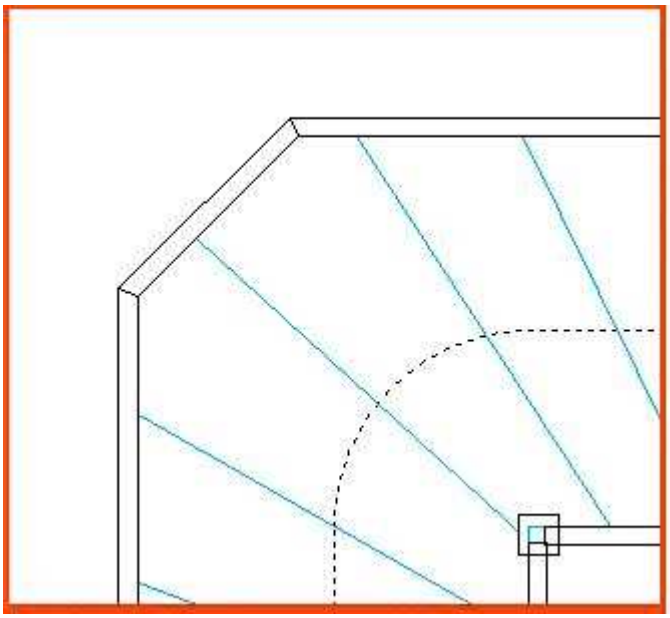




The stringboard with a circular join corresponds to the join and two curved stringboards. Because of its twisted shape, it cannot be cut flatly.

Joins with a Cut-Off

The following example shows a join with a cut-off of 300 mm x 300 mm.





There cannot be a newel post where there is a join with a cut-off.

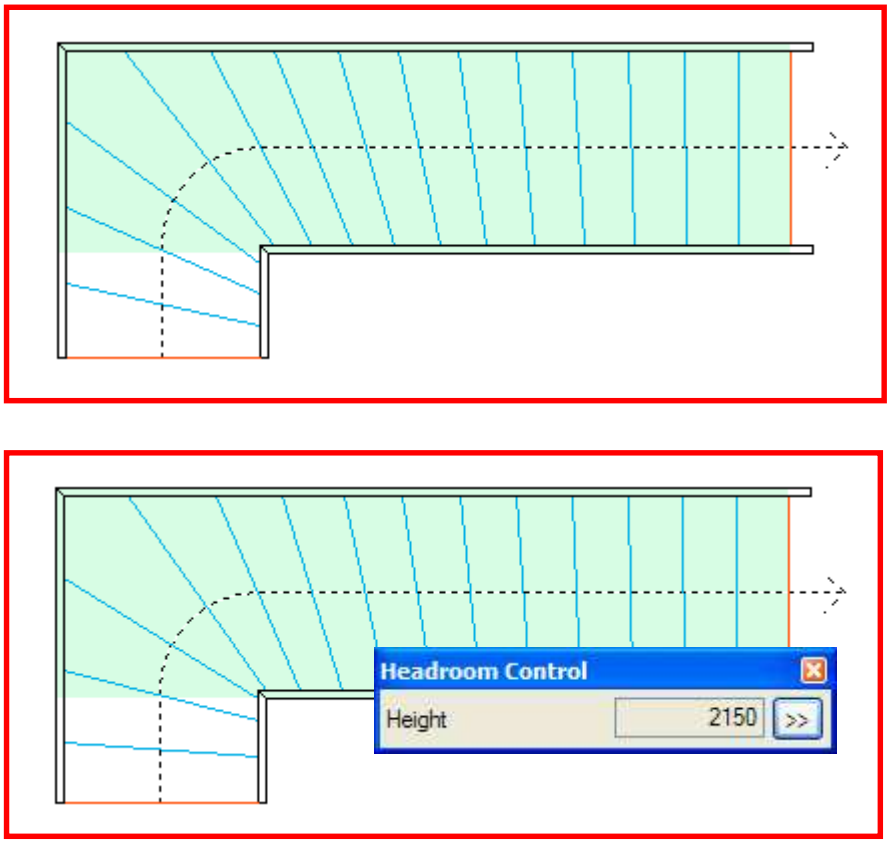
IV. 3 HEADROOM CONTROL

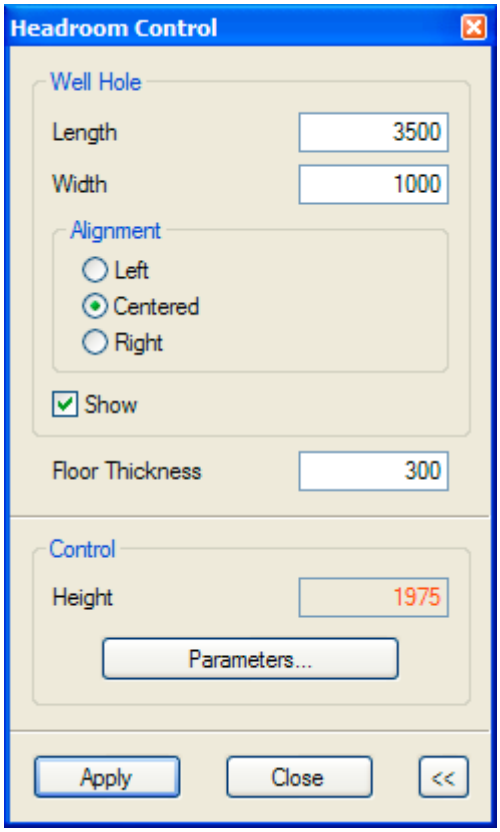
Using the headroom control, you can check if there is enough space over the steps so that the head does not hit the ceiling.

The "Headroom control" function allows you to define the dimensions of the well hole from the last step, its alignment and the floor thickness.

By clicking the button "Parameters" you can define the minimum passage height, as well as the level of tolerance that allows a part of the step to not observe the height limit.

The "Control" section shows the guaranteed passage height with the given tolerance.





In the above example, the minimum passage height is 2 metres *(2000 mm)* and the tolerance level is 10%.

The first winding *(upper stair)* guarantees a passage height of 1975 mm, marked in red in the "Control" section because it does not observe the desired minimum height.

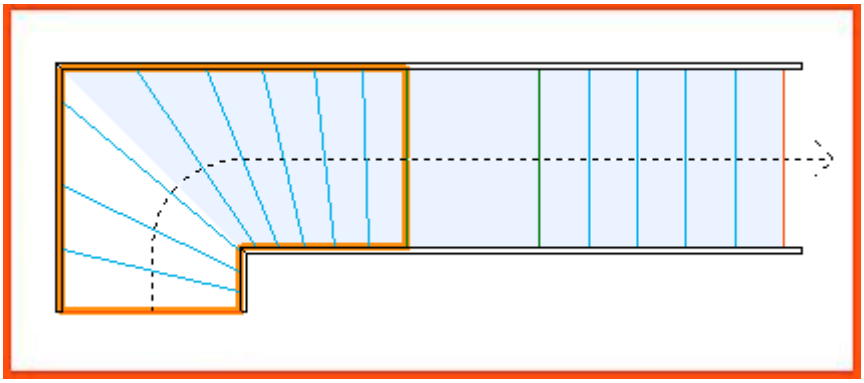
In the second winding *(lower stair)*, the local winding coefficient has been increased and step No.3 inclined so that 90% of the nosing is under the well hole.

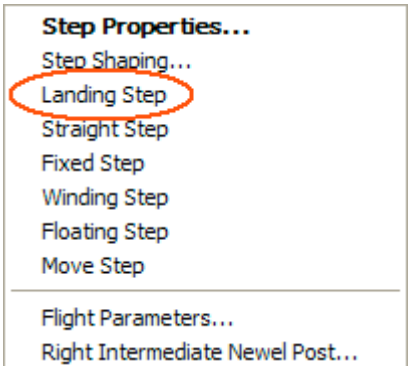
The passage height increases by one step height from 1975 mm to 2150 mm, now exceeding the minimum height of 2000 mm.

IV. 4 INTERMEDIATE LANDINGS

Where there are no intermediate landings, all the steps are equally distributed along the tread line so as to guarantee a constant tread width.

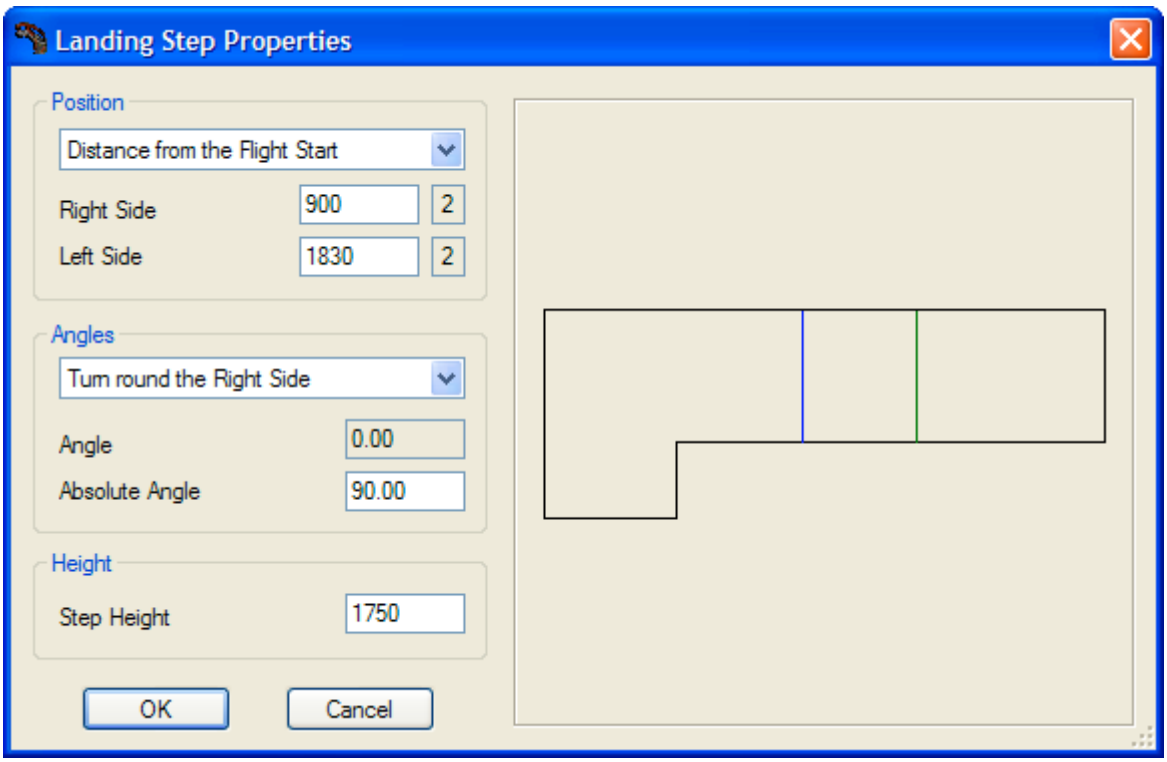
Double-click on the context menu below to create an intermediate landing limited by the selected step and the following one.





The "Intermediate landing" function allows you to insert an intermediate landing at any point of the stair. It divides into two or more interlandings, each with their own height and tread width.

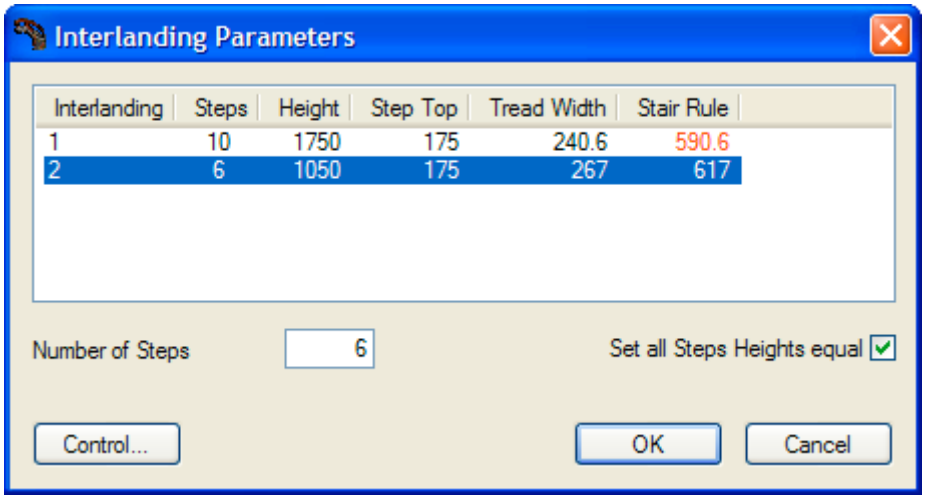
The two successive steps that limit an intermediate landing can be moved freely, either by clicking on the function "Move step" or by double-clicking on the step itself. This opens the following window in which you can determine the position of the step:



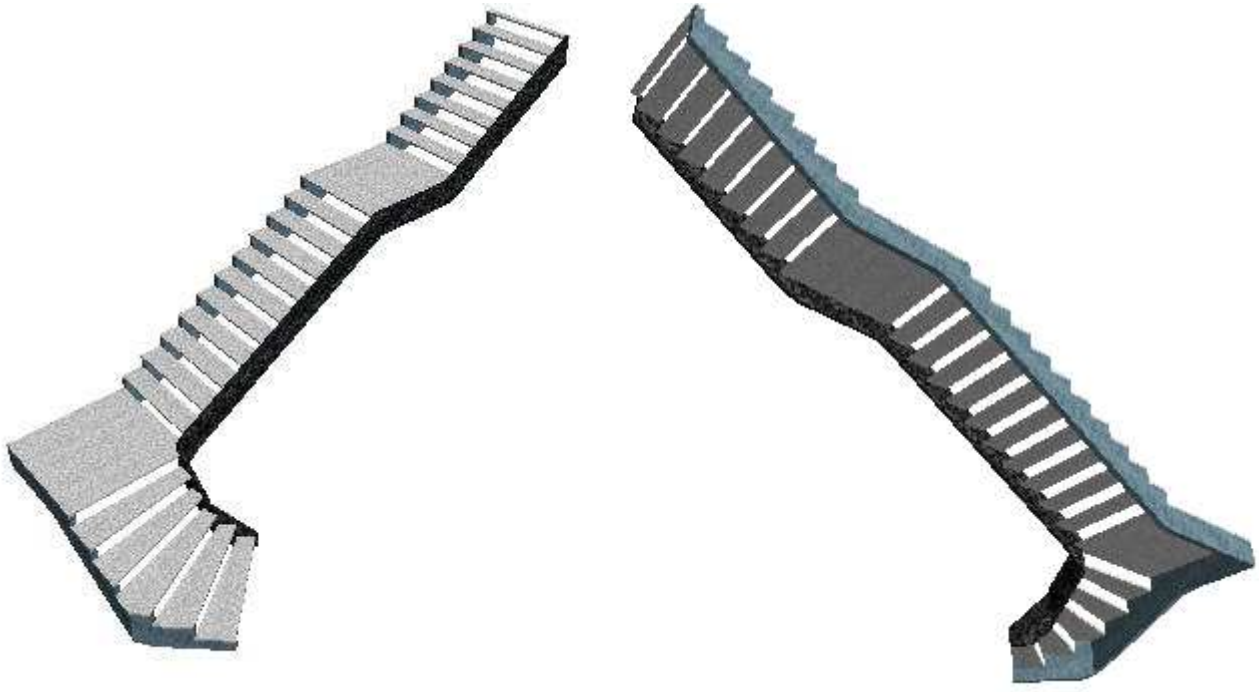
Step Height and Tread Width of Interlandings

The command "Landing parameters" of the "Parameter" menu shows the number of steps, their height and tread width as well as the tread line for every interlanding *(the non-conform values are marked in red).*

You may define the number of steps separately for each interlanding and the option "Set all step heights equal" adjusts the heights of all landings.



A stair can have one or more intermediate landings, either between two successive flights or along one flight.



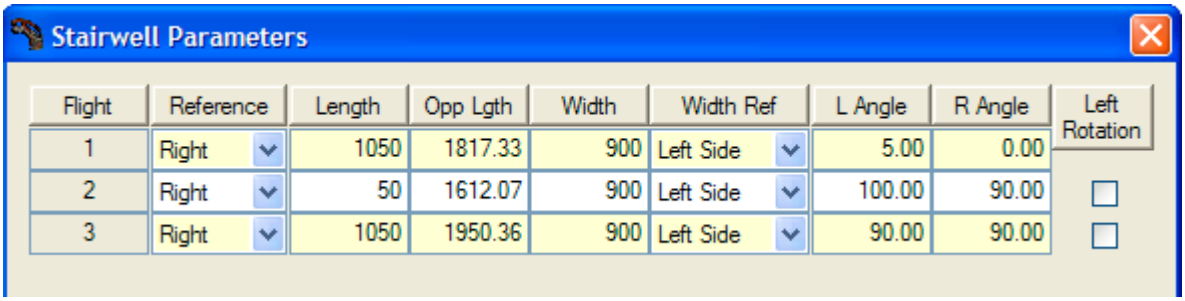
In the example above *(two views)*, you can see a stair with two intermediate landings. The first one is between flight No.2 and No.3, the second one along the third flight.

IV. 5 FLIGHTS WITH NON-PARALLEL SIDES

With **StairDesigner** you can create flights with non-parallel sides.

You can input this kind of stair by differentiating the left and right angles between two successive flights in the advanced window.

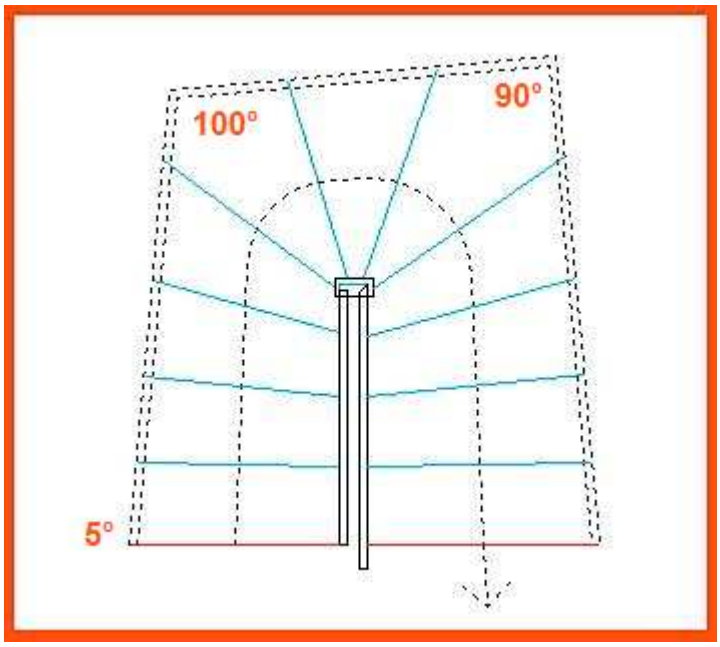
In the example below, the first flight has a vertical right side and a left side that is inclined to the right by 5°.



Flight	Reference	Length	Opp Lgth	Width	Width Ref	L Angle	R Angle	Left Rotation
1	Right	1050	1817.33	900	Left Side	5.00	0.00	
2	Right	50	1612.07	900	Left Side	100.00	90.00	☐
3	Right	1050	1950.36	900	Left Side	90.00	90.00	☐

Likewise, the right side of the second flight is perpendicular to the right side of the first one, whereas its left side is at a 100° angle to the previous side *(and thus, it is inclined by 5° upwards compared to the horizontal)*.

Both left and right sides of the third flight are perpendicular to the corresponding sides of the second one and maintain an angle of 5° between them.



This kind of construction allows for example to fix cut strings on the walls of a room that is not right-angled, however maintaining perpendicular inner stringboards.

This makes the fabrication and assembly of wooden stairs easier.

V. STEPS AND RISERS

V. 1 STEP CATEGORIES

In **StairDesigner**, a step[(*)] can have 4 different categories, marked by 4 colours:

- **Wound : *light blue***
- **Floating : *orange***
- **Fixed : *red***
- **Landing : *green***

***(*)**: In **StairDesigner**, step means the line along the nosing.*

A **wound step** belongs to the winding zone between two fixed steps and its position is defined by the winding coefficients.

The rotation of a wound step either corrects the local winding coefficient or fixes the step.

In both cases, the positions of the other steps are automatically corrected.

When a wound step becomes fix, the winding zone to which it belongs is cut in two.

A **floating step** also belongs to a winding zone but it can rotate freely around the tread line without influencing the other steps.

A **fixed step** separates two winding zones.

A straight step is a fixed step whose predefined position is perpendicular to the tread line (it is either perpendicular to the flight or to the arc).

A **landing step** forms an intermediate landing with a second adjacent step.

These categories are accessible through the context menu you can see by right-clicking on the step.

When you select a step in order to modify it, its colour becomes dark blue no matter its category.

<u>Direct Modification of a Step Category</u>

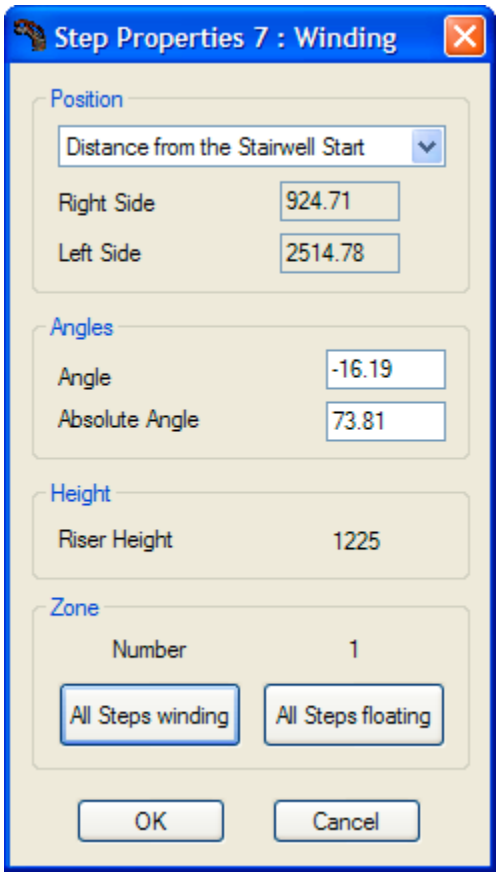
A step category can be modified with its context menu *(see below).* This has different consequences on the position of the steps.

Fixing an originally wound step for example, modifies the winding of the steps below and beyond.

However, transforming a wound step into a floating or landing step does not influence the position of the other steps but can affect later modifications.

Modification of a Step Category after a Rotation

In order to rotate a step you can either double-click on it and then fix the angle in one of the two "Angle" boxes or execute the command "Move step" of the context menu and then rotate the step manually around the tread line with the help of the mouse.





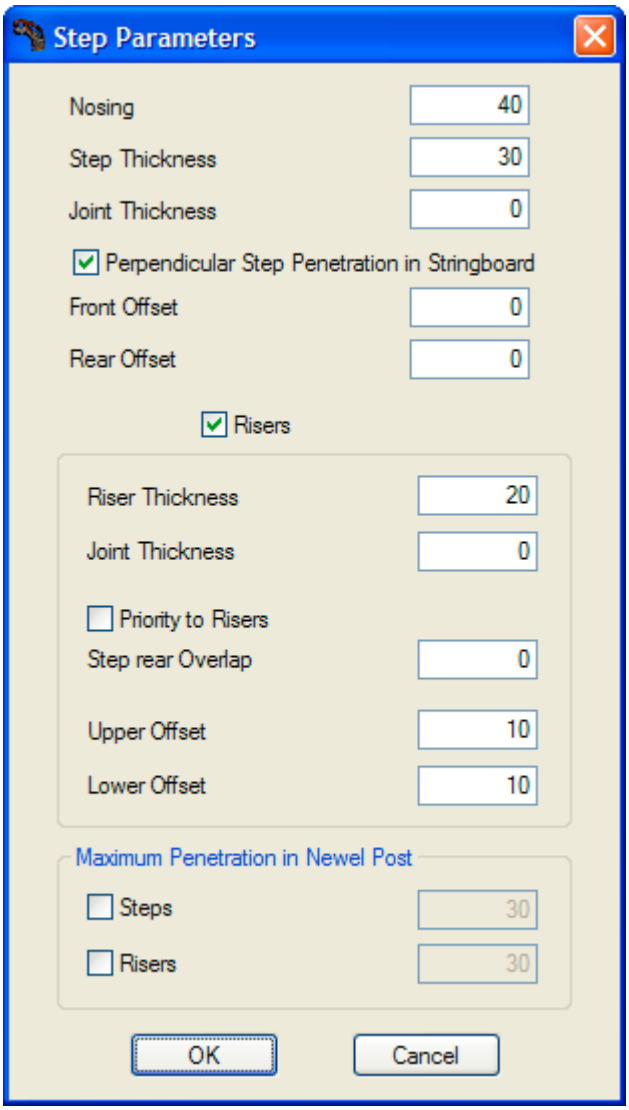
After the rotation of the step by one of the two methods above, the self-correcting winding function analyses if the step can be maintained as a wound step by modifying the local winding coefficient.

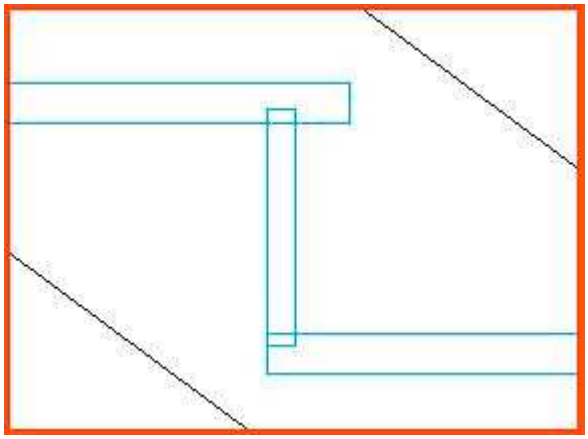


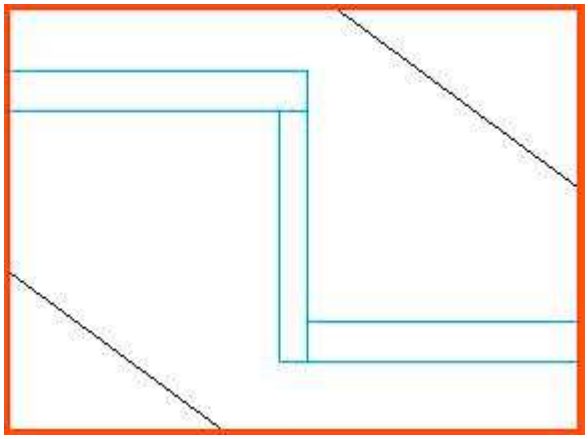
If it is impossible to maintain the step category "wound", its category will be modified to "fixed".

V. 2 STEP AND RISER PARAMETERS

Using the window "Step parameters" of the parameter menu, you can define the main characteristics of the steps and risers, as well as their assembly details.







Assembly "Steps / Risers"

In the upper right above example:

- There is a nosing of 40 mm,
- There is a priority to the back of the steps on the risers,
- The risers have an upper and a lower offset of 10 mm in the steps.

In the lower right above example:

- There is no nosing,
- There is a priority to risers at the back of the steps,
- The risers do not have any offset.

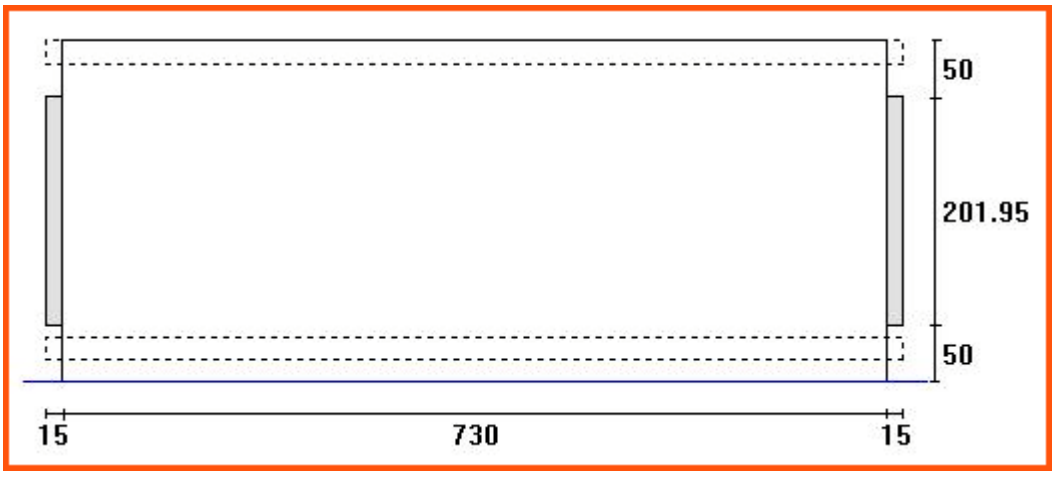
Perpendicular Penetration in the Stringboard

The penetration of the steps in the stringboard allows, when there is no offset, not to increase the cutting dimensions and to machine the stringboard perpendicularly to its front.



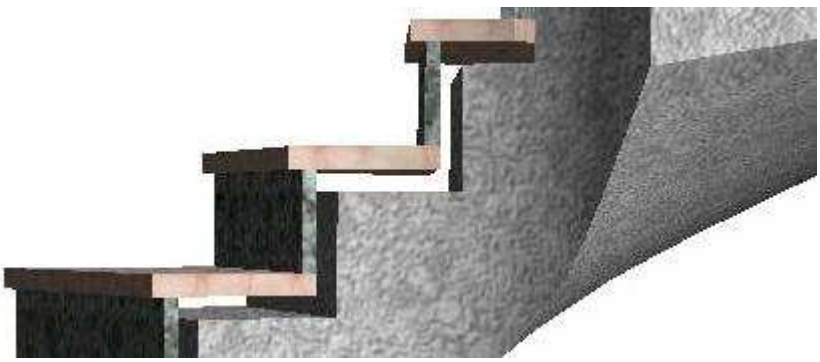
Step Offset

Both parameters "Front offset" and "Rear offset" define the offsets on the sides of the steps that penetrate the stringboard *(pictured in grey below)*.



Step and Riser Joints

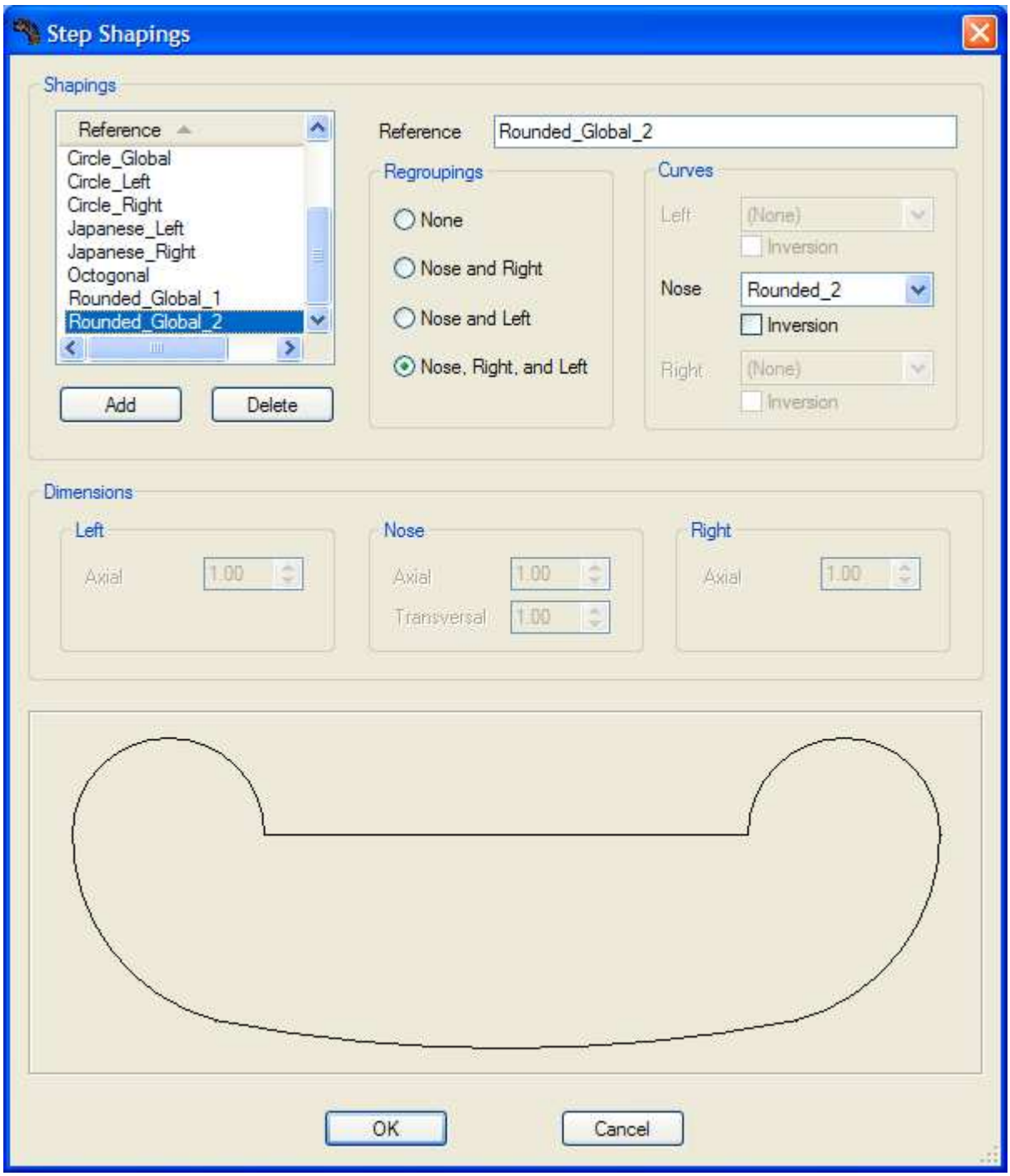
These joints allow some space between the steps and risers and their cut string. They are mainly used for the mortar in marble stairs.



V. 3 STEP SHAPING

The step shaping corresponds to a set of curves that is applied to the nosing and the left and right sides of the step, either separately or altogether.

In **StairDesigner**, these shapings are created from the available curves.



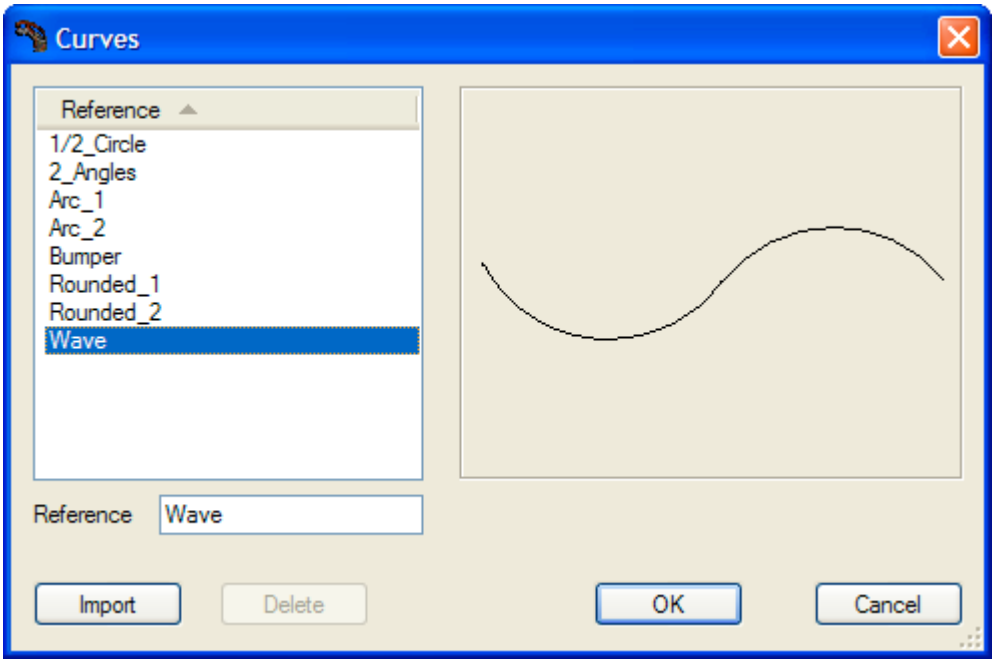
In the above example, one curve is applied to the nosing and both sides of the step together.

Once the shaping has been applied to the step, every curve can be continually distorted, either vertically or horizontally.

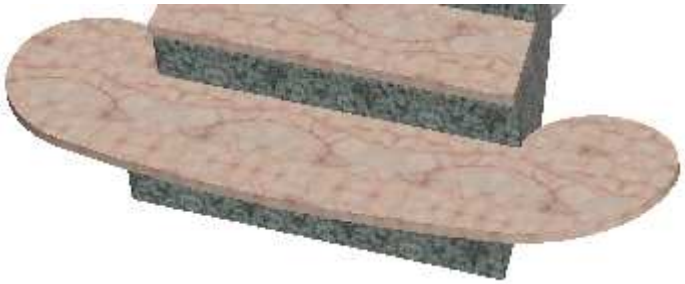
Shaping Curves

The curves used for the shaping are originally polylines in DXF format that have been drawn in a CAD software, then imported in **StairDesigner**.

Using the window "Curves" of the parameter menu, you can manage the curve list, import new ones and delete existing curves as long as they are not used by an existent shaping.



The below left example shows a curve that has been applied to the nosing and both sides together, whereas the below right example shows a curve that has been applied to the nosing alone.





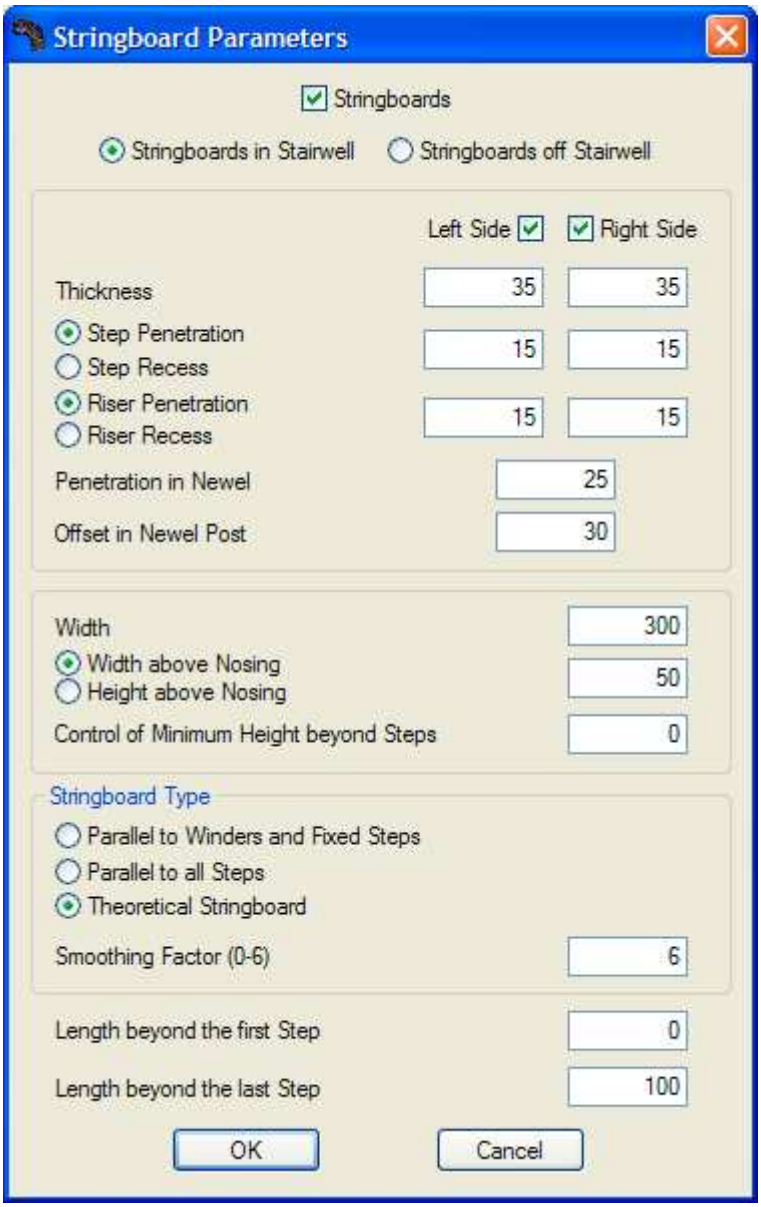
In the example on the right, the horizontal distortion of the shaping allows the design of alternating tread stairs.

VI. STRINGBOARDS

VI. 1 STRINGBOARD PARAMETERS

In the window "Stringboard parameters" of the parameter menu you can define:

- Whether the stair has stringboards *(left and right)* and if so, whether the stringboards are in or off the stairwell.
- The thickness and the width of the stringboards *(left and right).*
- The penetration of the steps in the stringboards and the penetration of the stringboards in the newel posts.
- The offset of the stringboards in the newel posts *(see the 3D illustration below).*
- The distance between the upper side of the stringboard and the nosings and the way this is calculated: constant distance in width or height.
- The stringboard type *(parallel to all steps or theoretical stringboard).*
- The lengthening of the stringboard beyond the first or the last step.





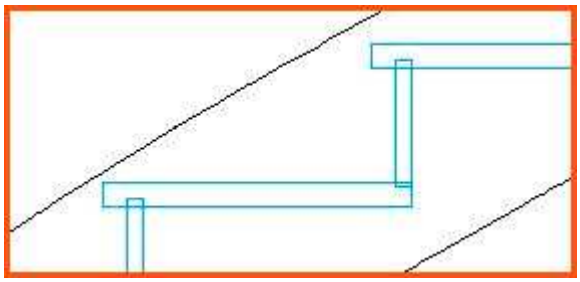
VI. 2 VARIOUS STRINGBOARD SHAPES

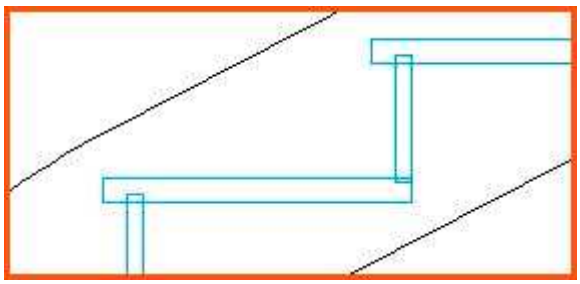
Theoretical Stringboard or Stringboard Parallel to All Steps

In **StairDesigner** the theoretical stringboard is parallel to all freely wound steps when you have not fixed any step.

If a wound step is fixed, for example straight, the distance between the upper side of the stringboard and the steps is no longer constant *(figure below left).*

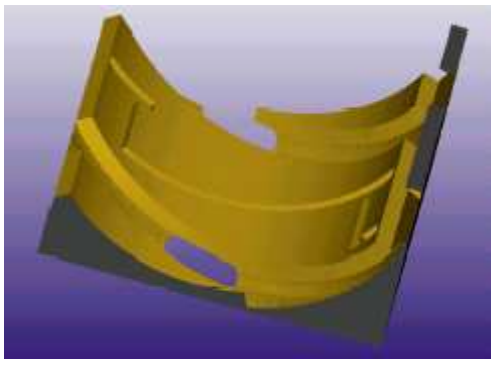
The option "Stringboard parallel to all steps" re-establishes this equal distribution *(figure below right).*





Twisted Stringboards

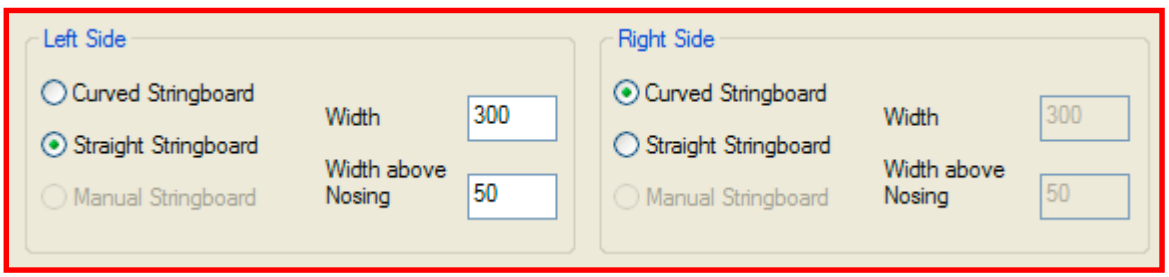
When there is a join with an arc, the twisted part of the stringboard is the curved part of the plan view.



Twisted Stringboard designed with **StairDesigner** and machined with AlphaCam

Straight or Curved Stringboard

A double-click on the step opens the flight window. Then you can change the curved stringboard into a straight one and define its width.



VII. CUT STRINGS AND SOFFITS

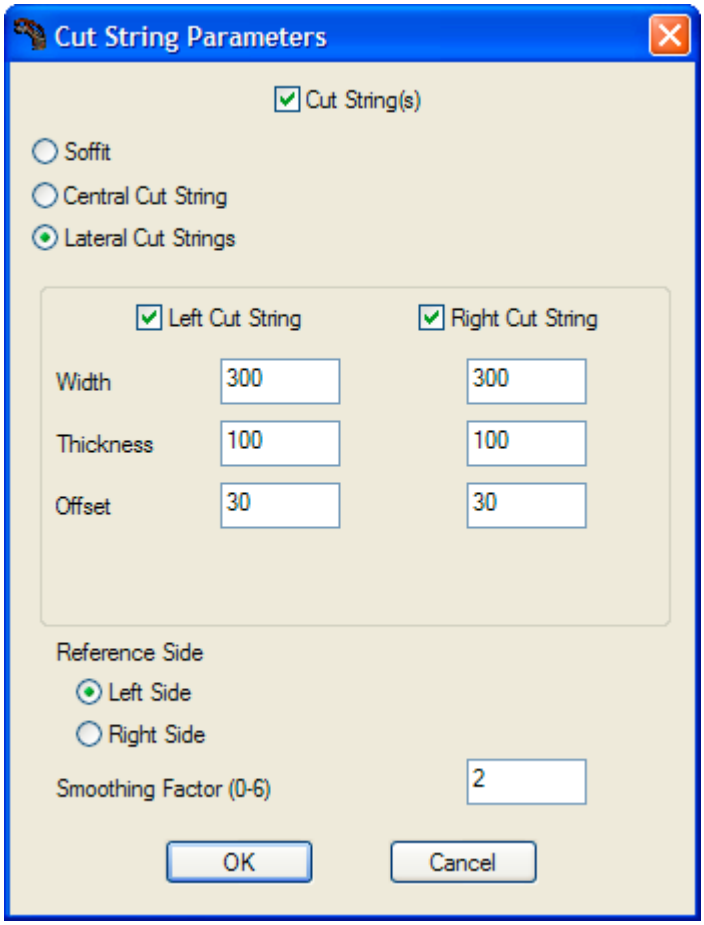
VII. 1 THE THREE CUT STRING TYPES

Cut strings are the elements under the steps that take their jagged form and support them.

There are three types of cut strings:

- **Soffits** that are generally made of concrete and cover the whole width of the stair,
- **Central cut strings** that are close to the tread line and
- **Lateral cut strings** *(left and right)* that are generally fixed on the wall.

The window "Cut string parameters" of the parameter menu shows these three types. According to the type, you can choose their width, thickness and offset:



Central Cut Strings

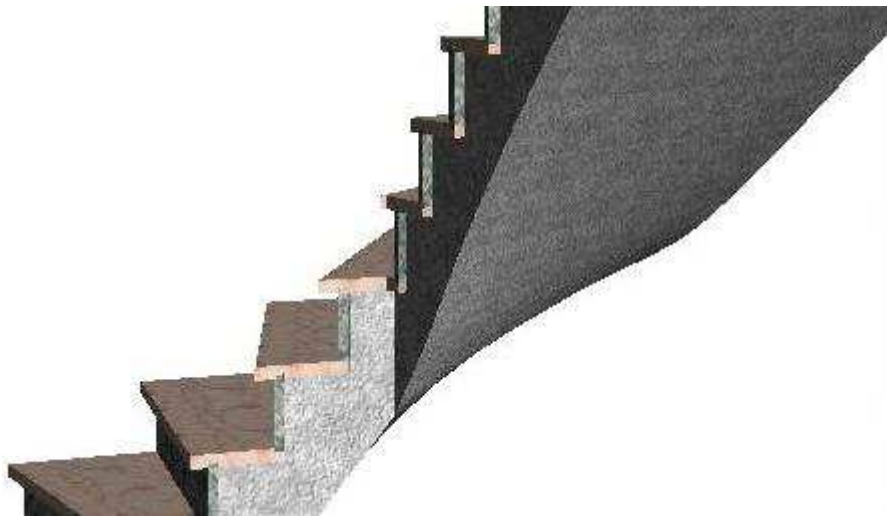
The central cut string consists of a lower part with a smooth surface and an upper part where the steps are fixed.

In **StairDesigner**, the lower part is called "Central cut string".

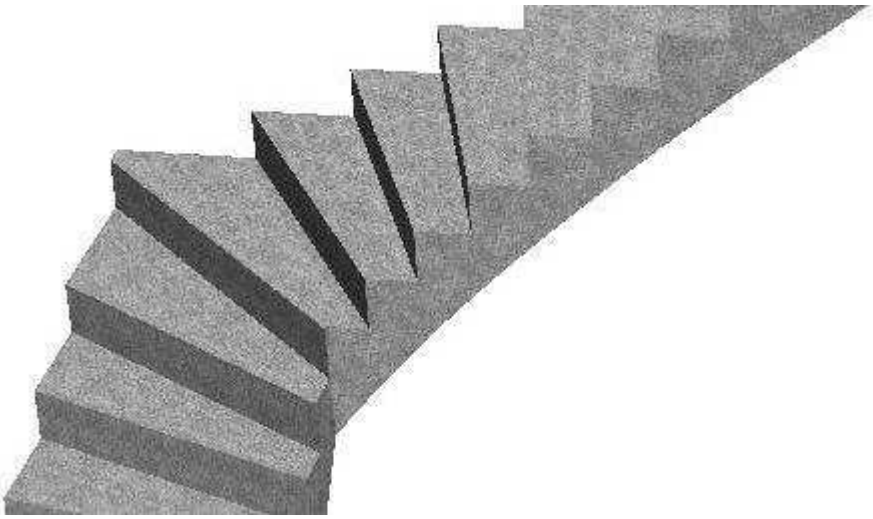
VII. 2 SOFFITS

The soffit of a stair is a cut string defined by the total width of the stair.

When the soffit is covered by steps and risers it can have a lateral recess compared to the steps:



The stair may also consist of the sole soffit:



Soffit and Winding

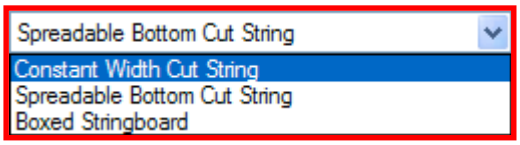
The winding of a stair takes into account the visible steps.

In the case of a covered stair, the winding thus takes into account the covered steps and not the steps of the soffit. The latter is defined by the winding plus a recess.

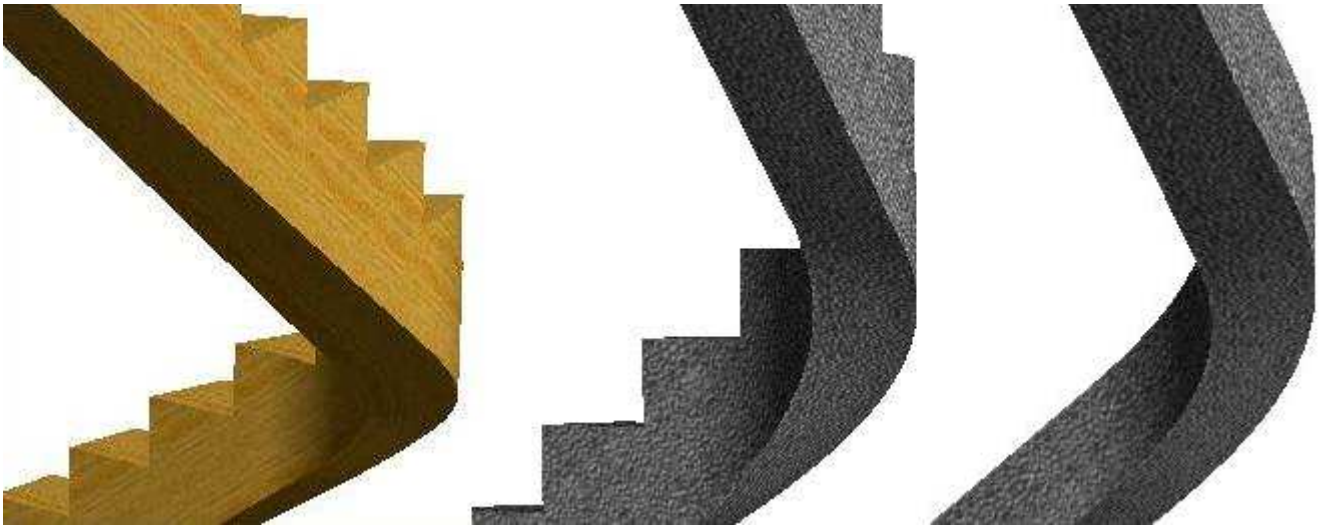
Vice versa, when a wound soffit is covered, the finished stair does no longer observe the winding rules *(see chapter "Concrete Stair Coverage").*

VII. 3 CENTRAL CUT STRINGS

When the option "Central cut string" in the "Cut string parameters" window is ticked, the following list appears so you can choose between three types of cut strings:

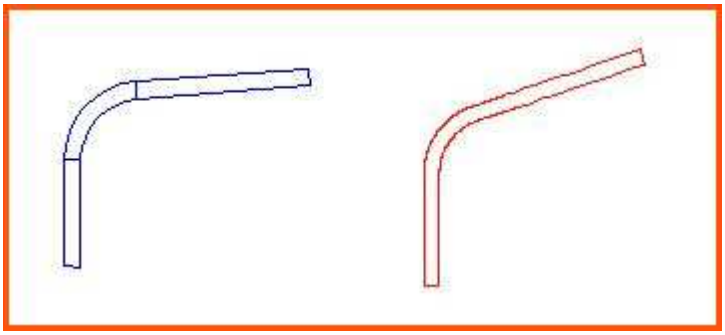


The constant width cut string *(below left)* is generally used in wooden constructions, whereas the spreadable bottom cut string *(middle)* or the boxed stringboard *(right)* are used in metal constructions.



The main advantage of the boxed stringboard is that its sides have a constant width whereas the sides of the spreadable bottom cut string are irregular.

However, the first two central cut strings can be incongruent with the tread line while the boxed stringboard must be the same as the tread line because the development of its sides is only approximate.

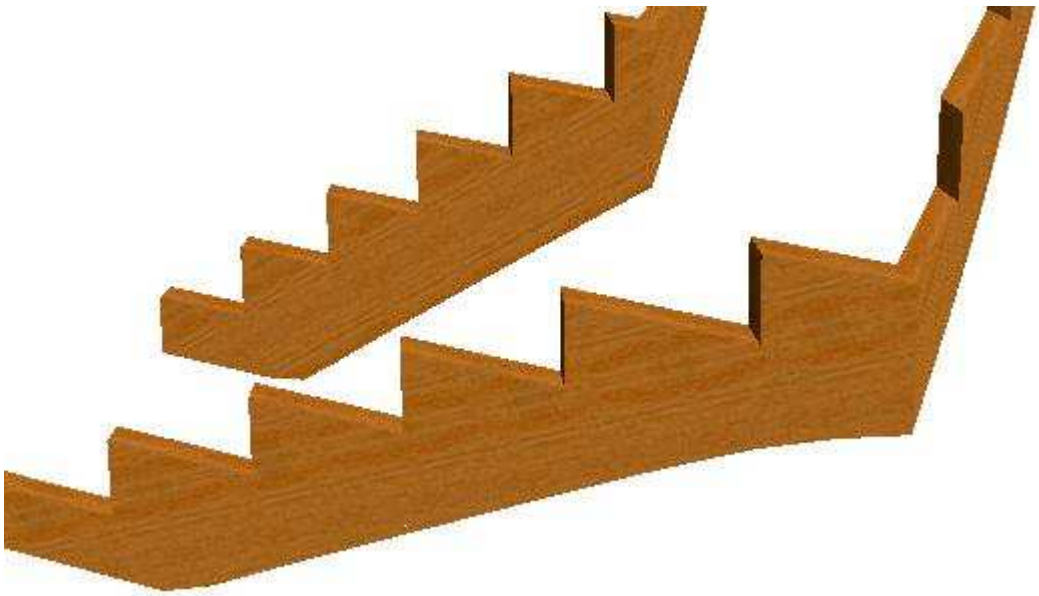


The above figure shows the three parts of the underside of a boxed cut string *(left)* and the underside of a spreadable bottom cut string *(right).*

VII. 4 LATERAL CUT STRINGS

Lateral cut strings are an alternative for stringboards. They support the steps and risers that directly rest on the cut strings.

The indentation is bevelled so as to fit the form of the wound steps.

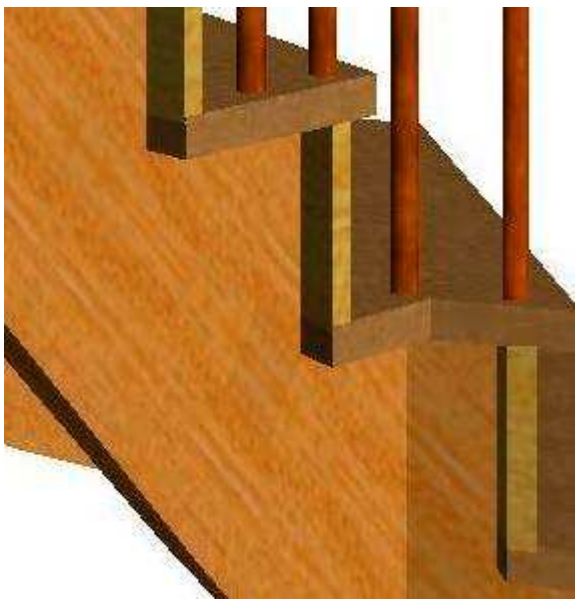


Both lateral cut strings of an L-shaped stair

When a cut string is fixed on the wall it ends at the same point as the steps *(below left)*. When it is fixed otherwise there can be a lateral offset *(right)*.



Lateral cut string outside



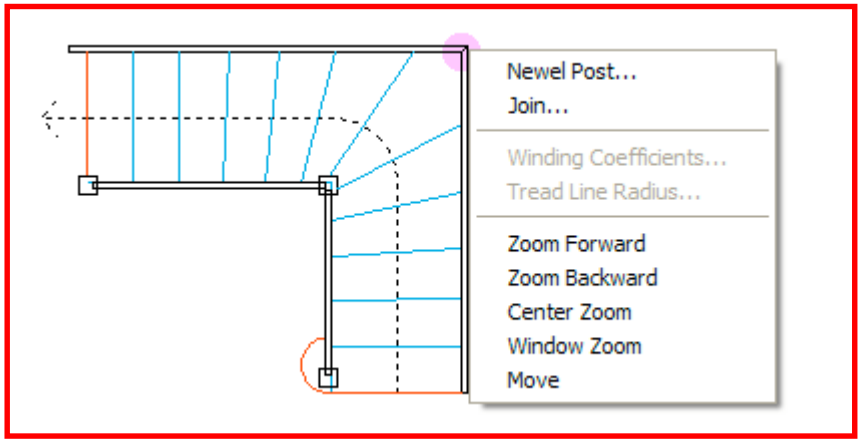
Lateral cut string inside

VIII. NEWEL POSTS

VIII. 1 THE THREE NEWEL POST TYPES

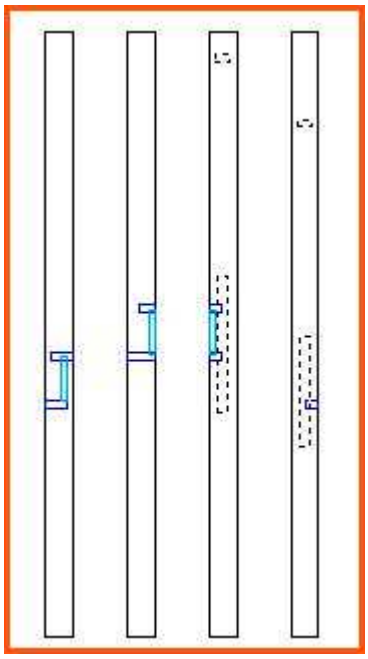
In **StairDesigner** there are three types of newel posts: extremity newel posts, corner newel posts and intermediate newel posts *(along one flight)*.

You can create a newel post by right-clicking on the pink zones on the extremities and corners *(for the first two types)* or between the steps *(for the third one)*.



The inner corner newel post of the figure above is illustrated in 3D below left *(semi-transparent)* and its four developed sides in the middle.





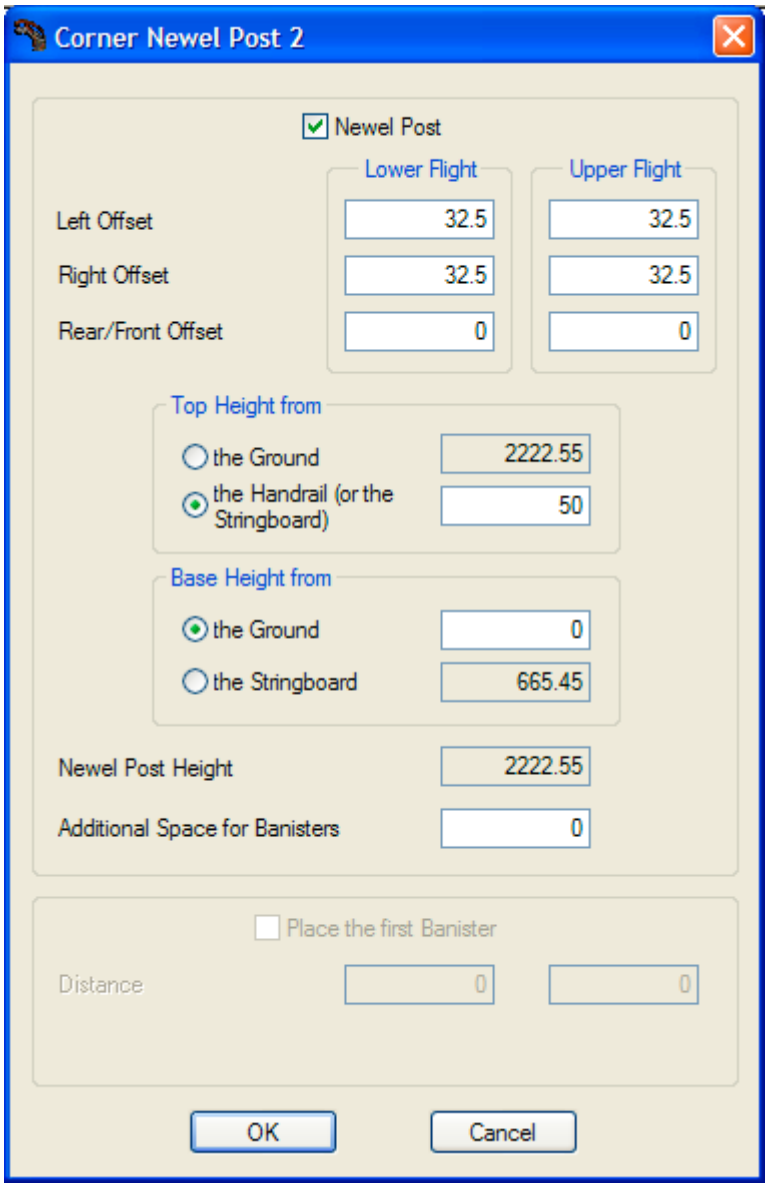


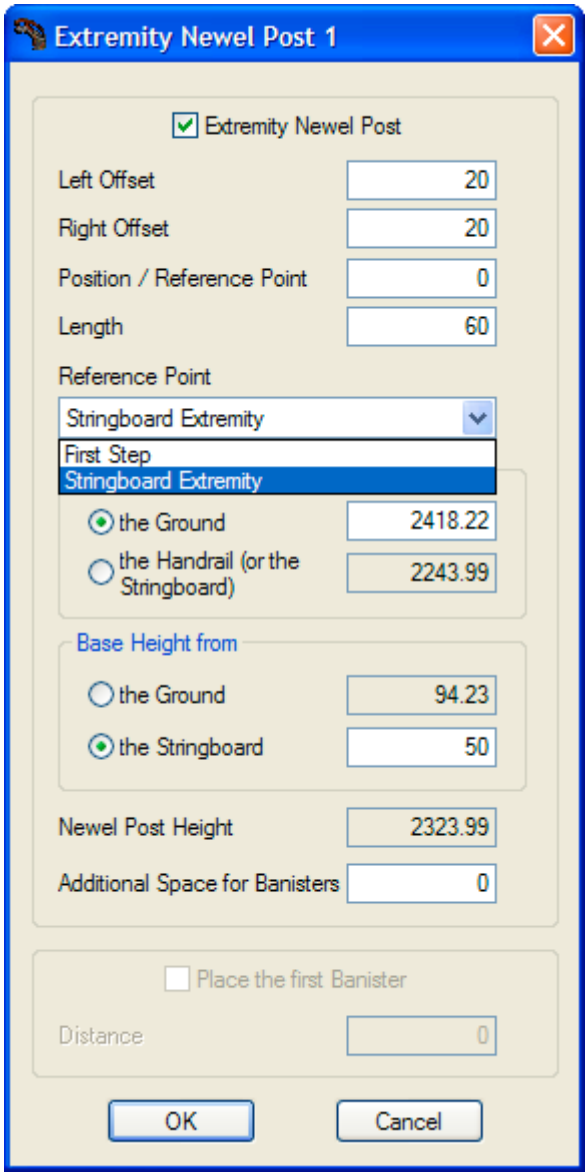
When the angle between two flights is not 90°, the offset parameters can create a six-sided newel post *(above right)* in order to avoid creating a fragile diamond-shaped newel post.

VIII. 2 NEWEL POST PARAMETERS

When you create a newel post, a parameter window opens according to the type of newel post you have chosen.

Once you have created the newel post, double-click in plan view to modify or delete it.





The section of the newel post is determined by its left and right offset and the thickness of the stringboard if there is one.

The height of the newel post results from the height of its base and its top that are defined separately.

The corner newel post can have one or two offsets *(see page 35).*

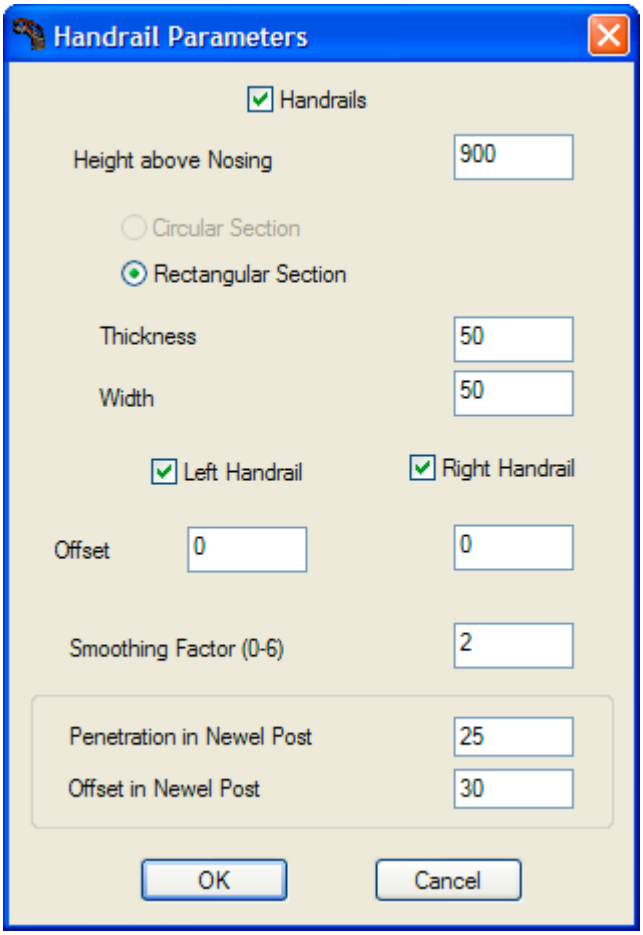
The position of the start *(resp. end)* newel post can be defined by the extremity of the stringboard or by the position of the first *(resp. last)* step.

IX. HANDRAILS AND BANISTERS

IX. 1 HANDRAIL PARAMETERS

In the current version of **StairDesigner**, handrails have a rectangular section so as to easily define the machining of its lower side that holds the banisters.

You can specify the handrail parameters in the following window:

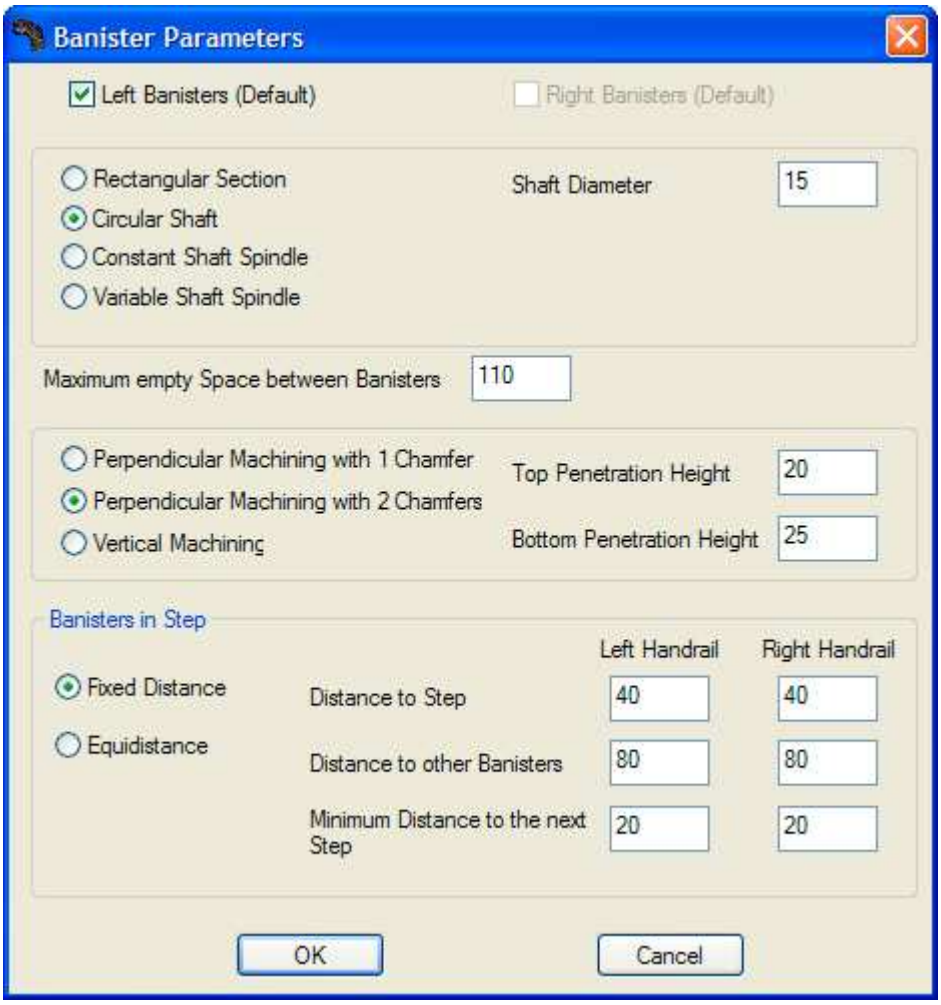


From side view, the handrails can be curved or straight independently from the stringboards, but in plan view, they follow the join *(arc or cut-off)* of the stair:



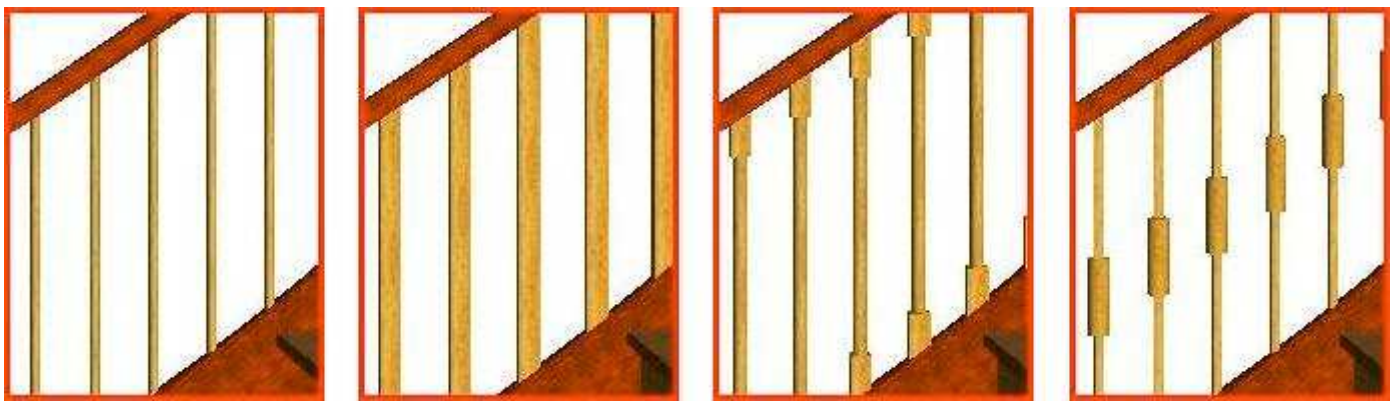
IX. 2 BANISTER PARAMETERS

The window "Banister parameters" of the "Parameter" menu offers a choice of four types of banisters, their machining and distribution:



A turned banister will be said to have a constant or variable shaft according to the height variations between the handrail and the stringboard that can be compensated by the height variations of the base or the shaft.

The figure below shows different banister models.

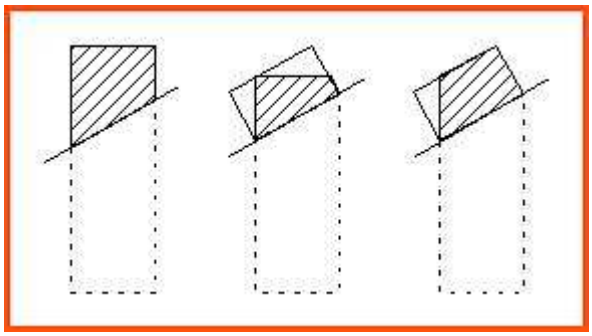


Circular Rectangular Turned *(shaft with or without base)*

IX. 3 BANISTER MACHINING AND DISTRIBUTION

Banister Machining

In **StairDesigner** you can machine banisters in three different ways:



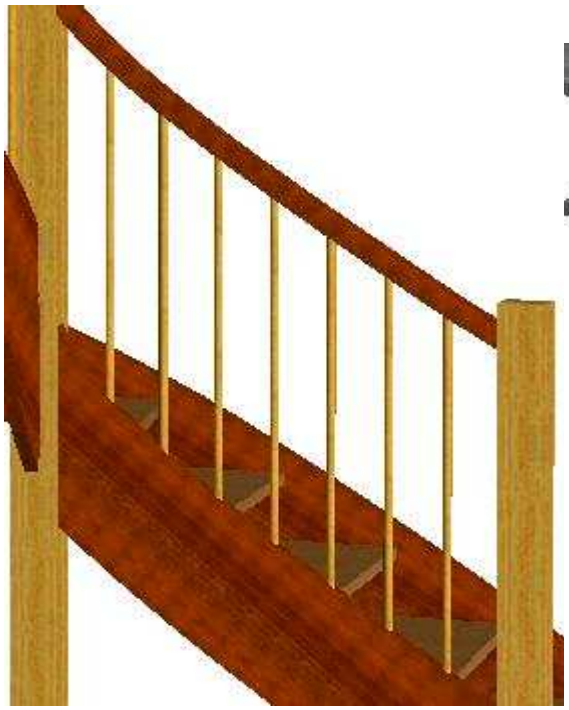
Vertical machining *(left)*: the banister itself is not machined but the underside of the handrail and the upper side of the stringboard must be bevelled.

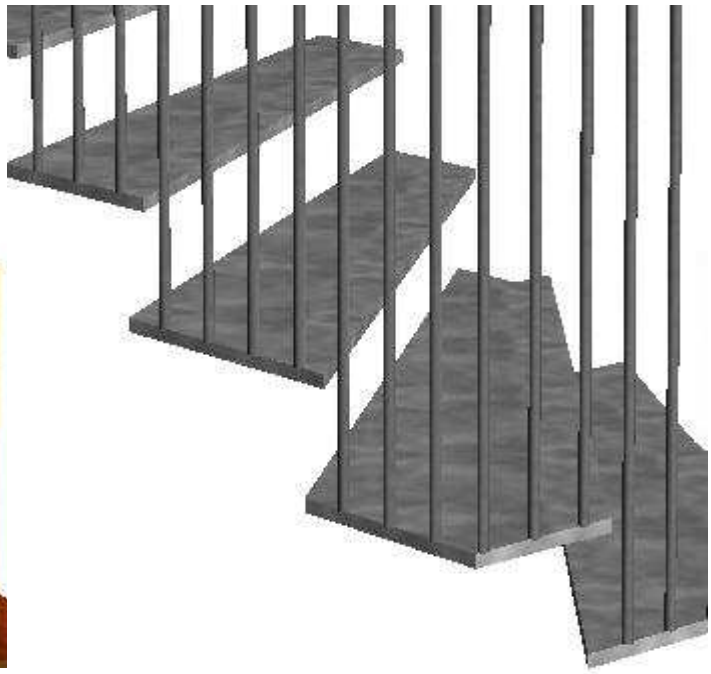
Machining with one chamfer *(middle)*: simplifies the machining of the handrail and the stringboard that are machined perpendicularly but the banister has to be bevelled.

Machining with two chamfers *(right)*: the cut-out volume is best exploited this way.

Banister Distribution

When there is a stringboard *(left)*, the banisters are equally distributed between the nearest newel posts. However, a cut string stair *(right)* requires specific calculations for the position of each banister.





3 to 6 banisters per step

X. CONCRETE STAIR COVERAGE

Preface

When an already cast concrete stair is to be covered in wood, marble or stone, the concrete has often to be transformed in order to obtain a harmonious result:

- Either because the steps of the existing concrete stair are irregular and thus do not observe the general winding rules,
- Or because the original winding of the concrete stair did not take into account the changes due to the coverage, as for example the thickness of the risers and joints or the nosings.

One thus has to "load" and "break" the existing concrete.

Please note that it is generally easier to load than to break.

An ideal solution with minimum effort may be obtained by optimizing the winding and according to the case, by moving the tread line, lengthening the first flight, changing the start and end angles or combining these modifications.

Finding such a solution is a demanding and time-consuming task for stairmakers.

StairDesigner VI-Pro_RB offers specific functions for the calculation and optimization of concrete stair coverage.

From the input of a concrete stair, **StairDesigner** uses a reversed calculation method to find the most convenient finished stair, taking into account your parameters.

StairDesigner tests a high number of wound stairs and calculates the transformation cost of the loaded and broken concrete surface for each of it.

The search of a solution follows two successive steps:

1 – Input of the existing concrete stair

- Input of the existing concrete stairwell
- Input of the step dimensions

2 – Parameters and optimization

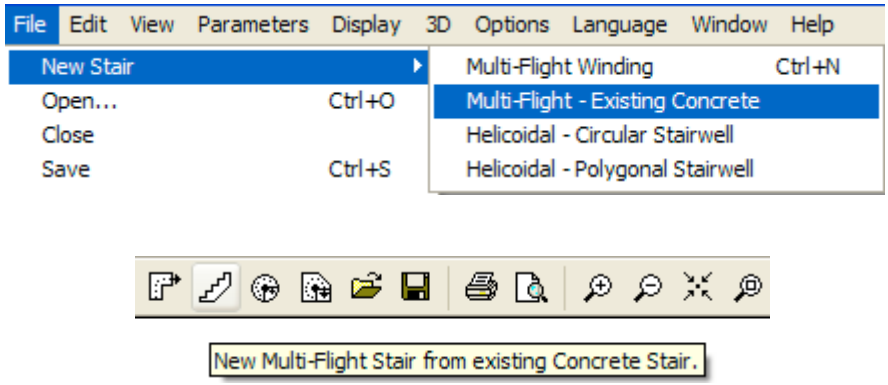
- Parameters of the finished stair
- Optimization parameters
- Execution of the optimization

After its calculations, **StairDesigner** automatically finds an optimized solution that you can change manually. Afterwards you can see the effect of this change on the final result in regard to the surface that has to be loaded or broken.

X. 1 INPUT OF THE EXISTING CONCRETE STAIR

You can access to the window "Existing concrete" via:

- The menu File/ New stair/ Multi flight- Existing concrete, or
- A double-click on the second item from the left: 

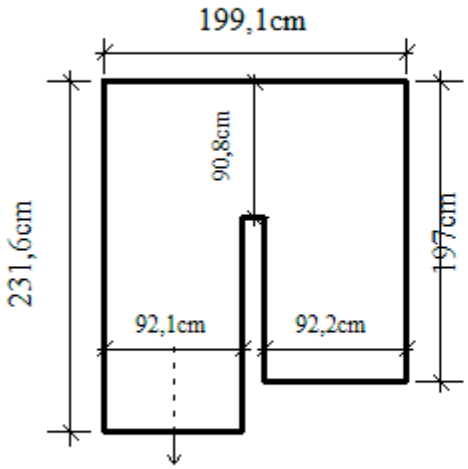


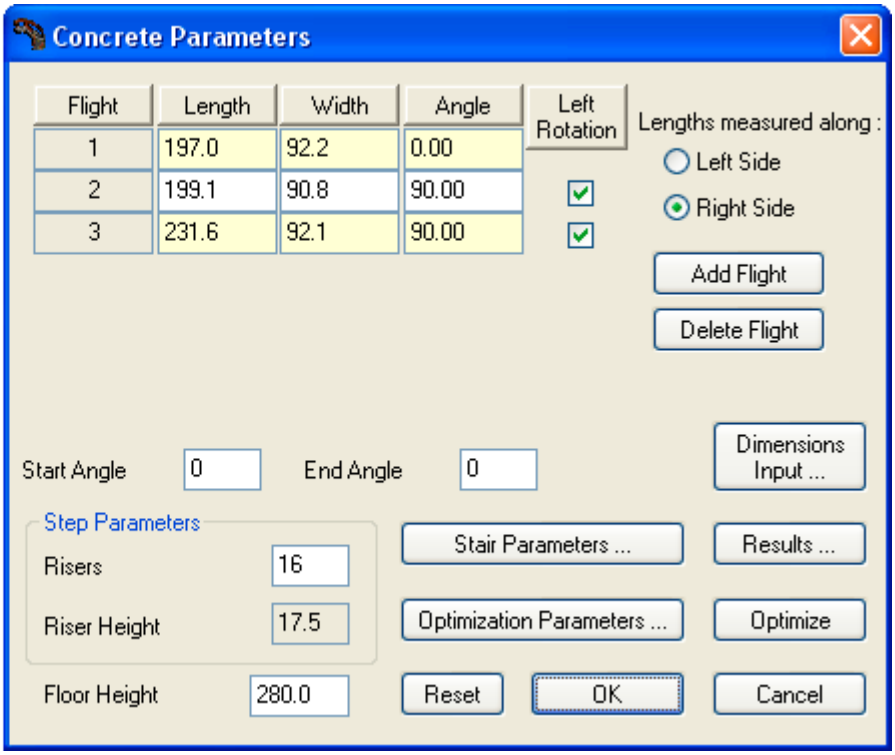
Each of these two ways opens the window "Concrete parameters" below.

Input of the Existing Concrete Stair

To input the existing concrete stair, you have to begin with the stairwell using a similar method as with the stairwell of a finished stair.

You first create the number of flights *(2 for L-shaped stairs, 3 for U- or S-shaped stairs, etc.)* by clicking on the button "Add flight", then inputting the dimensions of each flight, specifying whether their lengths are measured along the left or the right side.





Concrete stairwell *(measured)*

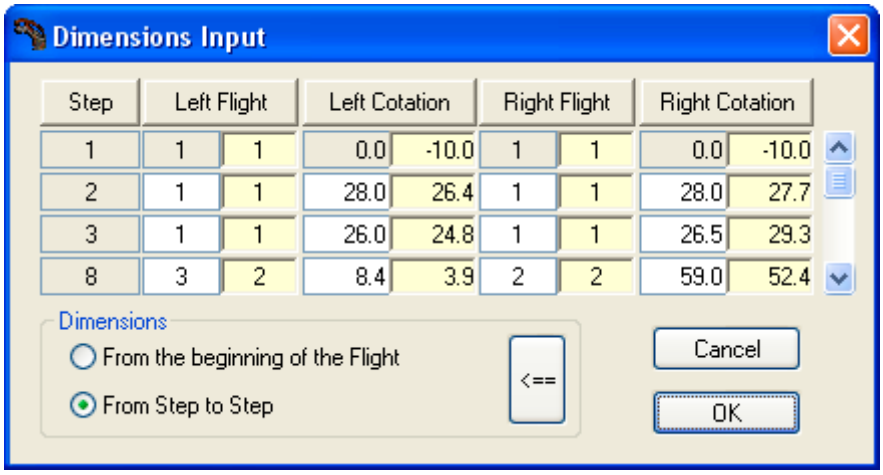
Concrete parameter window

Input of the Step Dimensions

Once the stairwell input finished, a click on the button "Dimensions input" opens the window below where you can input the steps one by one.

Both columns "Dimensions left" and "Dimensions right" are sub-divided into two further columns:

- The sub-columns on the right *(highlighted in yellow)* correspond to the dimensions of the theoretical stair. They are calculated automatically.
- The sub-columns on the left *(white background)* correspond to the existing concrete stair.



For each step *(identified by its number)* and for each of their sides *(left and right)*, you have to indicate:

- The number of the flight and
- The measured position.

The dimensions may be from nosing to nosing or from the beginning of the flight.

@ **PLEASE NOTE :** In case the flight changes between two steps, the position given is from the beginning of the new flight.

The position of step No.1 is always "0".

The position of the last step is calculated automatically.

Dimension Transfer

The button below transfers the dimensions of the theoretical stair and overwrites the input dimensions. It should only be used for simulations.



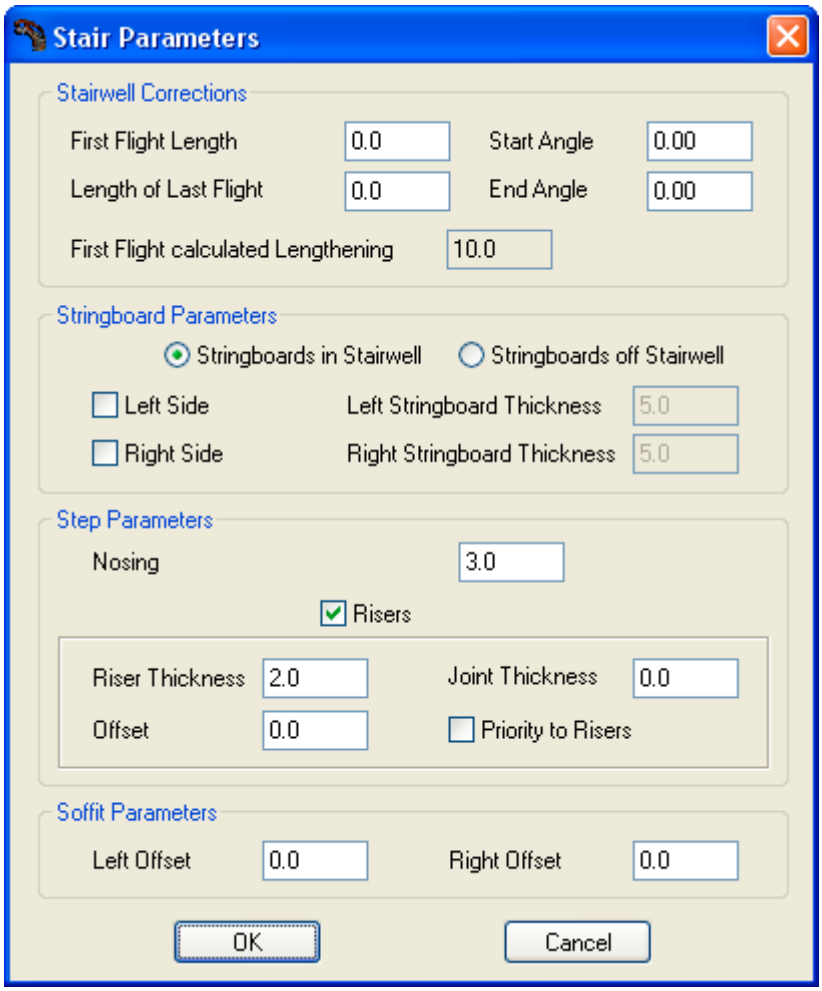
X. 2 PARAMETERS AND OPTIMIZATION

The parameters necessary for the optimisation can be divided into two groups:

- **The parameters of the finished stair** enable you to impose modifications of the concrete stairwell and to specify the characteristics of the finished stair.
- **The optimization parameters** determine the search depth, e.g. for the winding, the automatic lengthening of the flight, the repositioning of the tread line, etc.

Parameters of the Finished Stair

A click on the button "Stair parameters" opens the following window:



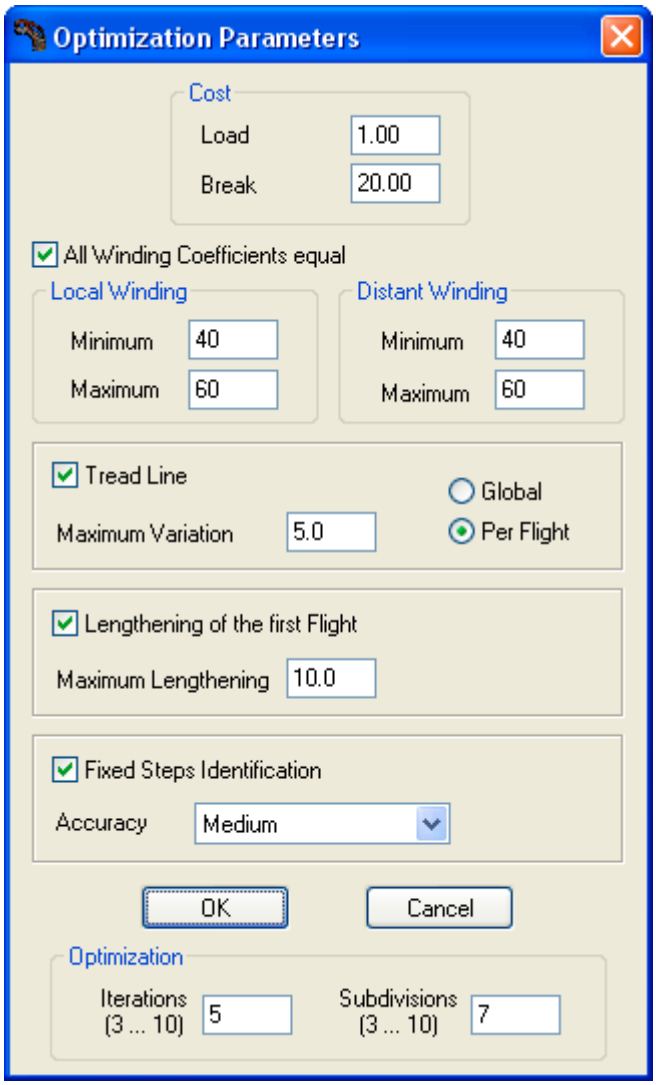
The parameters of the stairwell correction enable you to modify the concrete stairwell of the existing concrete into the finished stair you wish to obtain. To this purpose you may lengthen *(or shorten)* a flight by increasing *(or decreasing)* a start or end angle.

The parameter "First flight calculated lengthening" corresponds to a lengthening automatically calculated by **StairDesigner**, that adds to the total length of the first concrete flight.

The other parameters allow you to specify the dimensions *(thickness, recess, etc.)* that make the difference between the concrete and the finished stair.

Optimization Parameters

A click on the button "Optimization parameters" will open the following window:



StairDesigner takes into account the difference in price of loading and breaking of the concrete when searching a solution.

The winding parameters specify the minimum and maximum values of the winding coefficients applied to the finished stair *(local and distant winding coefficients).*

The variation of the tread line determines the maximum authorized value of its repositioning *(to the right or left)* and whether the repositioning is global or varies from one flight to another.

The lengthening of the first flight is automatically calculated during the optimization in the upper limit specified. It adds to the possible correction of the stairwell.

The parameter "Fixed steps identification" specifies whether **StairDesigner** should automatically identify fixed or straight steps, as well as the level of accuracy.

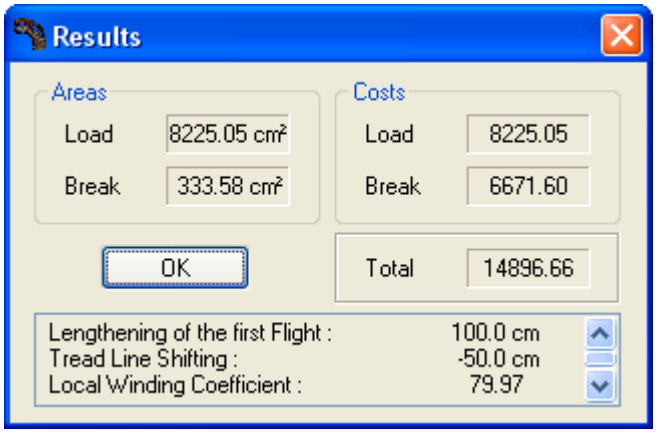
The parameters for the optimization calculation determine the accuracy of the calculations and the direct influence on their duration *(advice: maintain the default values above).*

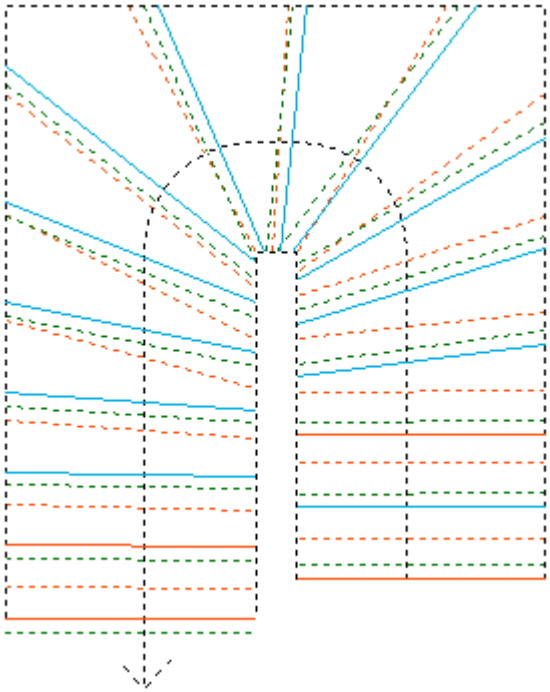
Optimization Results

Once the input finished, you just have to click on the button "Optimize" in the "Concrete parameter" window to launch the search for a solution.

The duration of the calculations depend on the number of flights and the optimization parameters. It can vary from several seconds to several minutes.

When the calculations are finished, the following result window *(left)* opens automatically and shows you the results.





When you close the windows, the screen shows the finished stair and its soffit *(in green)*, as well as the measured concrete *(in red)* so that you can see the existing and the finished stair at the same time.

	Left Side						Right Side					
Step	Measured		Corrected		Correction		Measured		Corrected		Correction	
1	1	0.0	1	-10.0	Load	10.0	1	0.0	1	-10.0	Load	10.0
2	1	28.0	1	27.7	Load	10.3	1	28.0	1	27.7	Load	10.3
3	1	26.0	1	25.3	Load	10.9	1	26.5	1	30.1	Load	6.7
9	3	0.1	3	3.9	Break	3.9	2	59.0	2	52.2	Load	9.2
10	3	13.5	3	4.5	Load	5.1	3	32.0	3	22.3	Load	9.7

Using the parameter "Concrete correction" in the folder printing options, you can print out the above document that specifies from step to step how the concrete must be corrected.

On the basis of this first automatic result, you can freely change the results and see the impact by re-opening the result window.

XI. RESULT PRINTOUTS

StairDesigner can print out the results in two modes:

- The "Project" mode for small-scale printouts,
- The "Template" mode for 1:1 printouts.

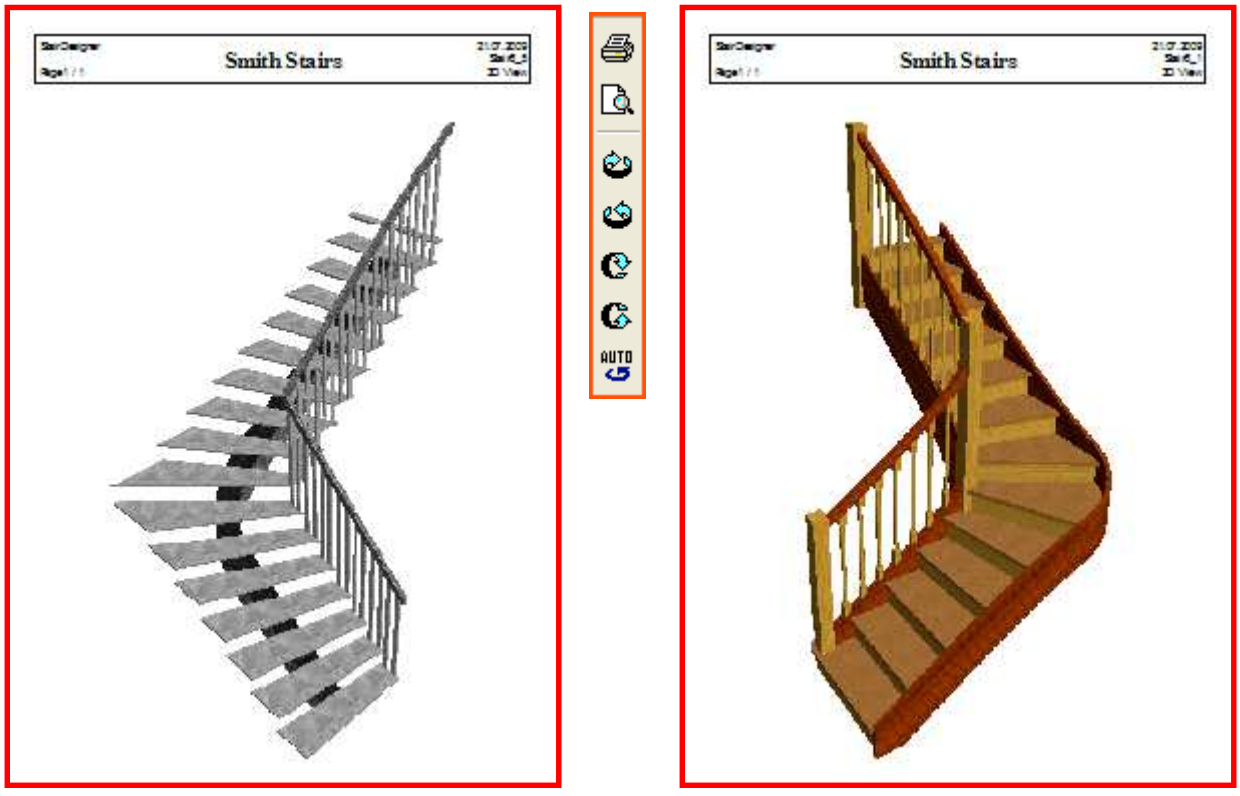
XI. 1 PROJECT MODE PRINTOUT

In the project mode you can print a 3D view of the stair, a 2D view of each of its elements, the cutting list and the summary.

In the "Standard" version, only the "automatic scale" is available.

3D Printout

The magnifying glass icon in the 3D toolbar launches the 3D preview of the stair. The printer icon launches the print.

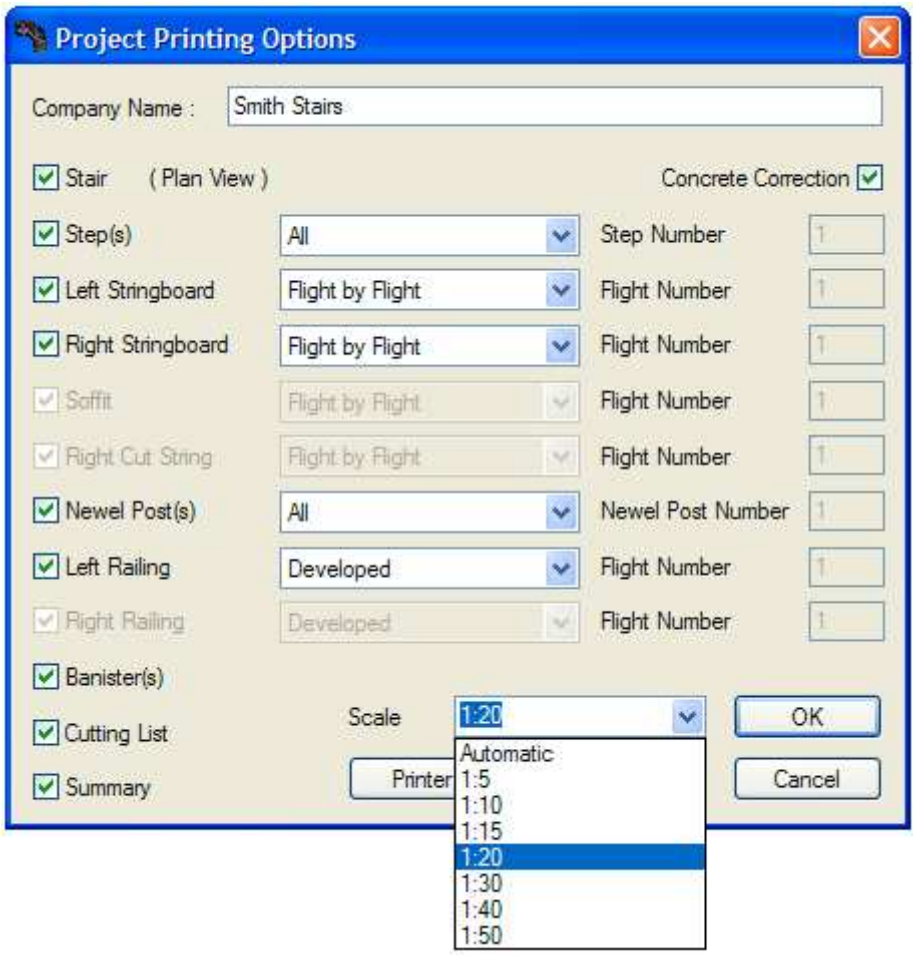


The stair is printed in the perspective that you use for the screen, taking into account the size of the software's main window.

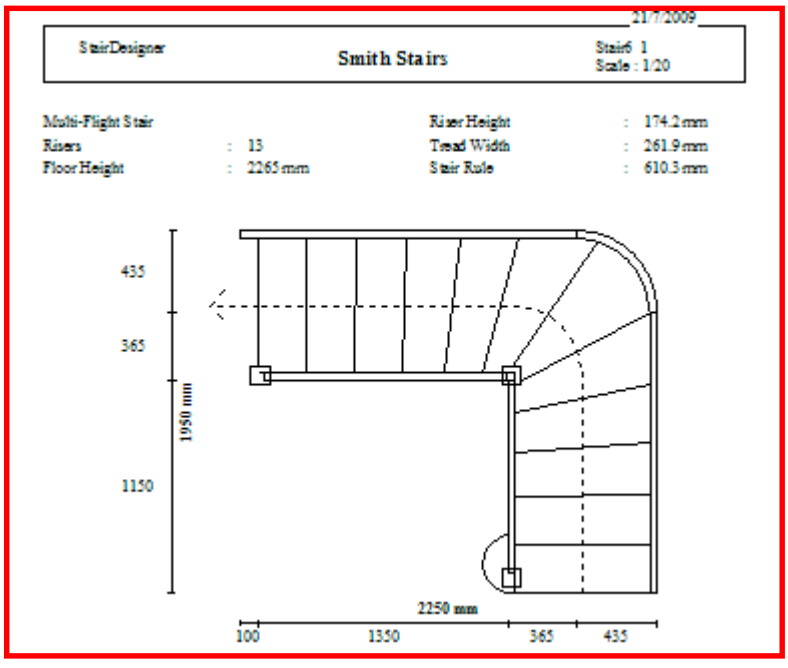
In order to optimize the positioning of the stair on the page, you may have to modify the size of the **StairDesigner** window in height or width or print in "landscape" format *(instead of "portrait" format).*

2D-Project Printout and Summaries

The command "Project printing options" of the "File" menu opens the window below where you can select the elements you want to print as well as their composition:

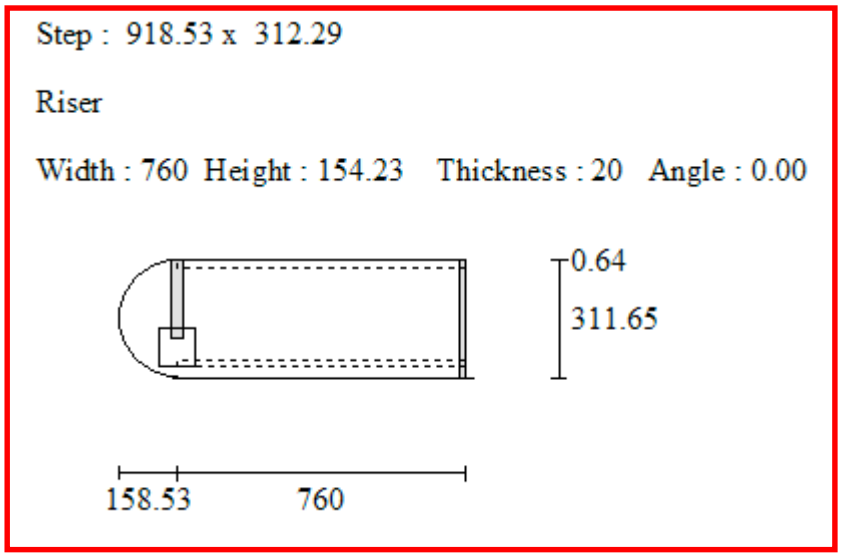


2D plan view



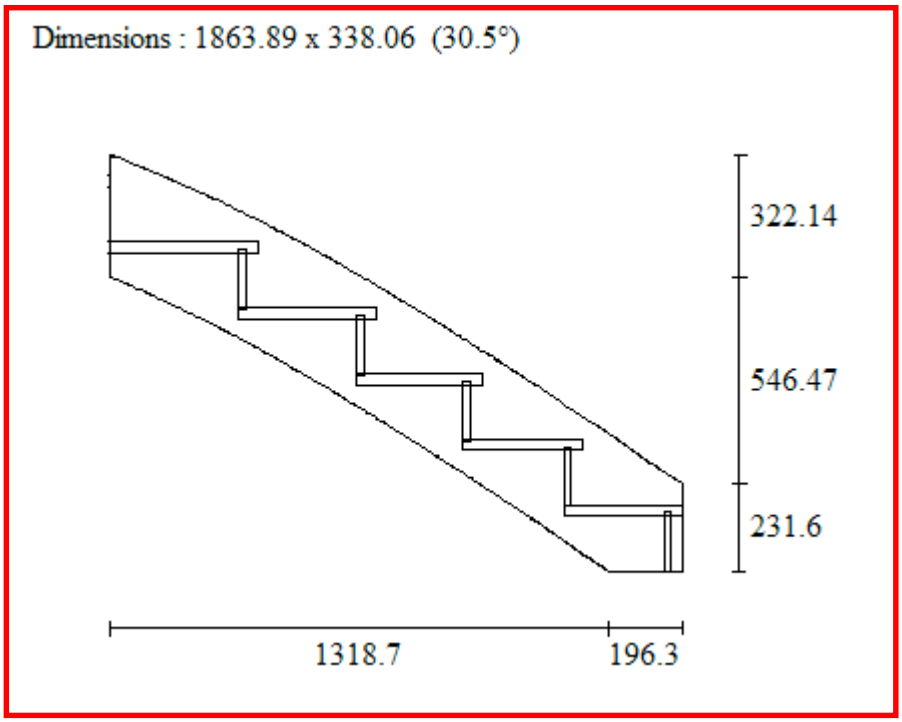
Step Printout

StairDesigner prints a scheme of the step and gives its cutting, main dimensions and the characteristics of the riser below.



Stringboard Printout

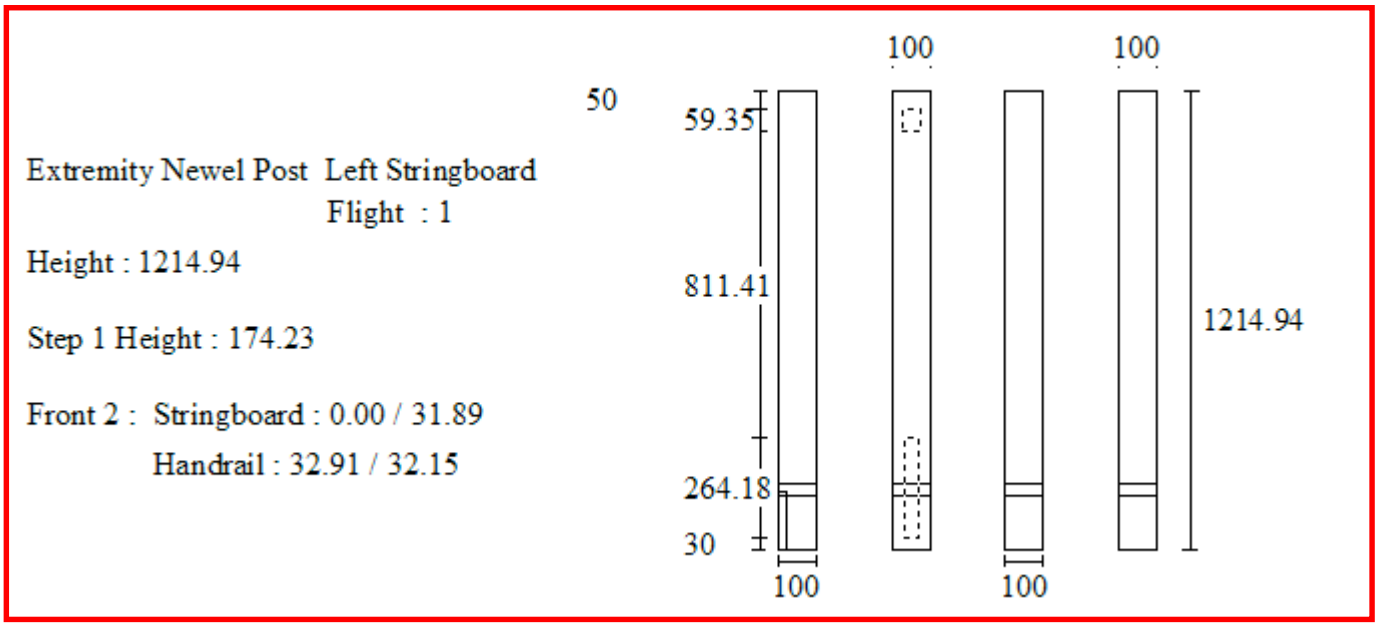
StairDesigner shows the cutting of the stringboard, its main dimensions and the position of the steps and risers that fit into it.



When the stringboards penetrate the newel post, the position of the newel post and the offset of the stringboard are shown as well.

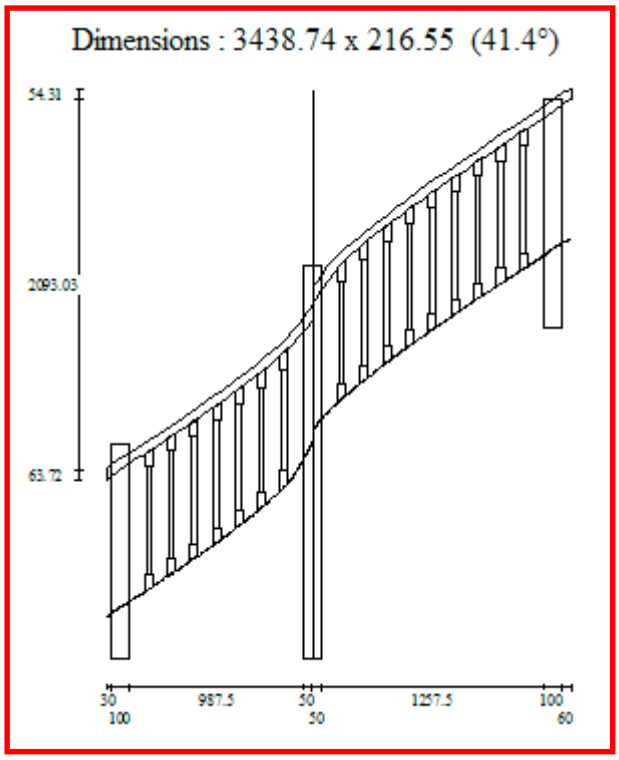
Newel Post Printout

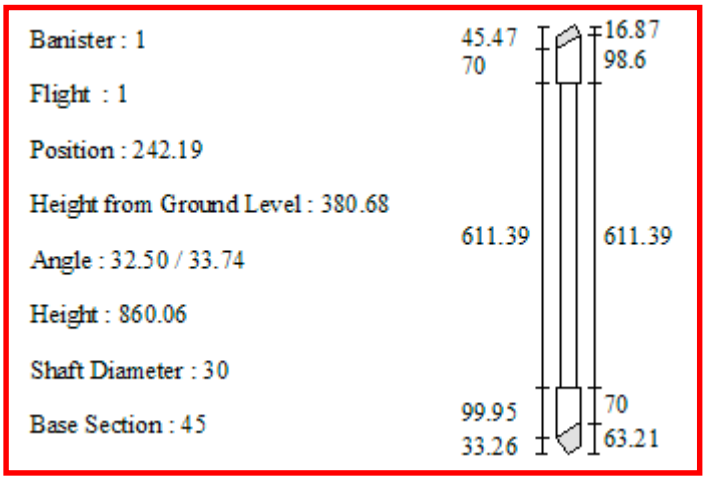
StairDesigner shows the positions of the steps, the risers and the handrail.



Handrail and Banister Printouts

StairDesigner prints the developed handrail with its newel posts and banisters as well as the details concerning every individual banister.





Cutting List

StairDesigner calculates the real volume of every element of the stair, as well as the cutting that is equal or higher than the form of the element.

Piece	Dimensions	Cutting List Volume	Real Volume
Step 1	918.53 x 312.29 x 30	8.61 dm³	8.28 dm³
Step 2	760.27 x 316.81 x 30	7.23 dm³	7.11 dm³
Step 3	764.61 x 332.73 x 30	7.63 dm³	7.11 dm³
Riser 1	760 x 154.23 x 20	2.34 dm³	2.34 dm³
Riser 2	760.02 x 159.23 x 20	2.42 dm³	2.42 dm³
Riser 3	760.34 x 159.23 x 20	2.42 dm³	2.42 dm³
Right Stringboard 1	1863.89 x 338.06 x 35	22.05 dm³	18.04 dm³
Right Stringboard Join 1	817.51 x 322.06 x 35	9.22 dm³	7.29 dm³
Right Stringboard 2	2260.27 x 350.14 x 35	27.70 dm³	22.06 dm³
Left Stringboard 1	1481.54 x 363.53 x 35	18.85 dm³	13.51 dm³
Left Stringboard 2	1928.92 x 427.63 x 35	28.87 dm³	17.95 dm³
Left Handrail 1	1306.46 x 100.94 x 50	6.59 dm³	3.22 dm³
Left Handrail 2	1630.9 x 112.33 x 50	9.16 dm³	4.01 dm³
Newel Post 1	100 x 100 x 1214.94	12.15 dm³	12.15 dm³
Newel Post 2	100 x 100 x 2222.55	22.23 dm³	22.23 dm³
Newel Post 3	100 x 100 x 1297.17	12.97 dm³	12.97 dm³
Banister 1	45 x 45 x 860.06	1.74 dm³	0.89 dm³
Banister 2	45 x 45 x 859.86	1.74 dm³	0.89 dm³
Banister 3	45 x 45 x 858.91	1.74 dm³	0.89 dm³

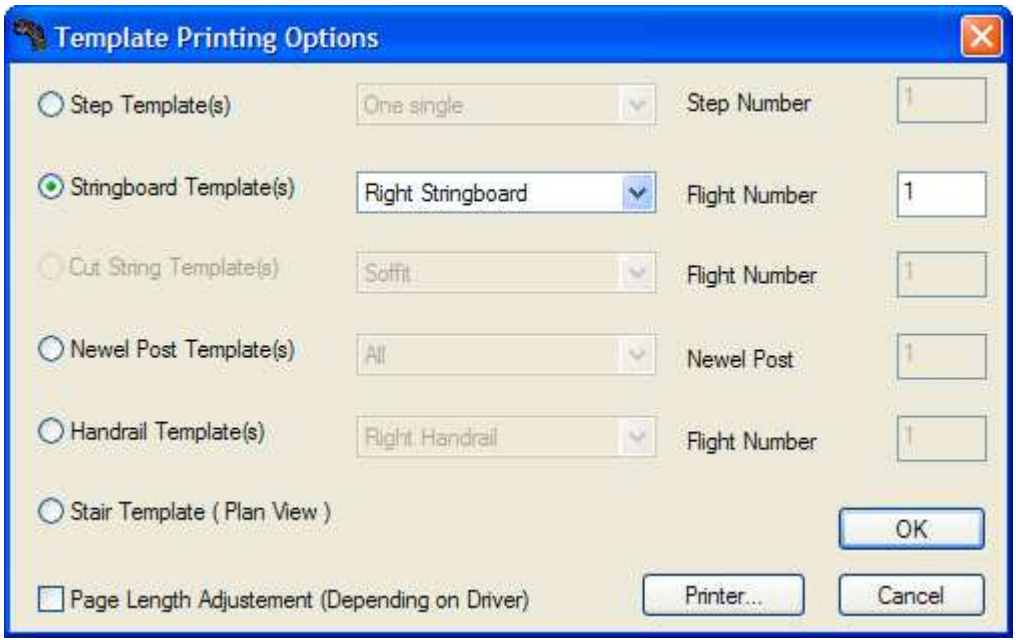
Summary

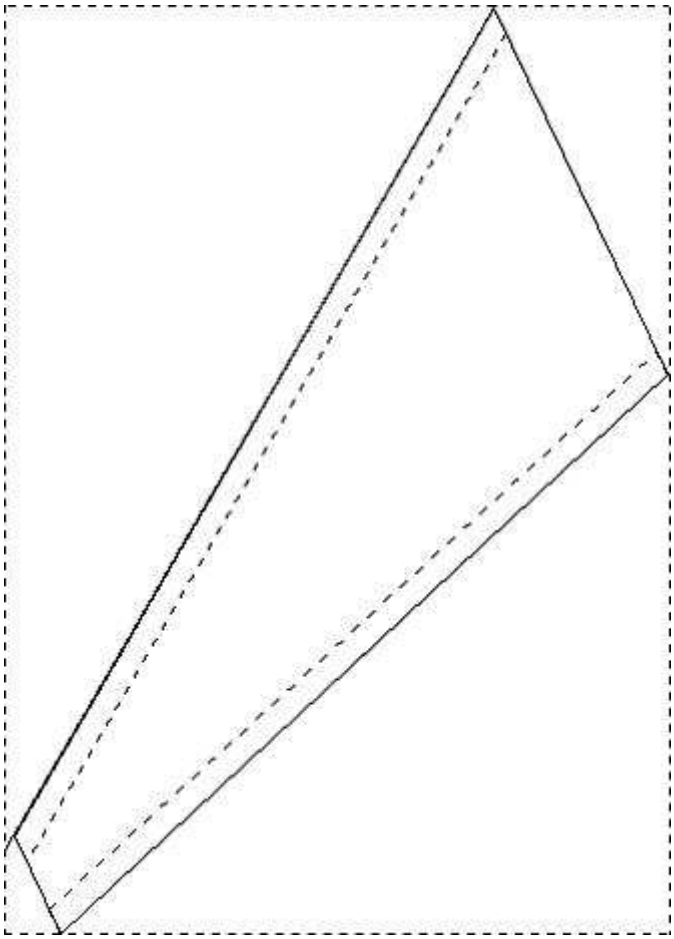
The summary groups volumes, weight and cost by the element category, then calculates the sum of each of these data.

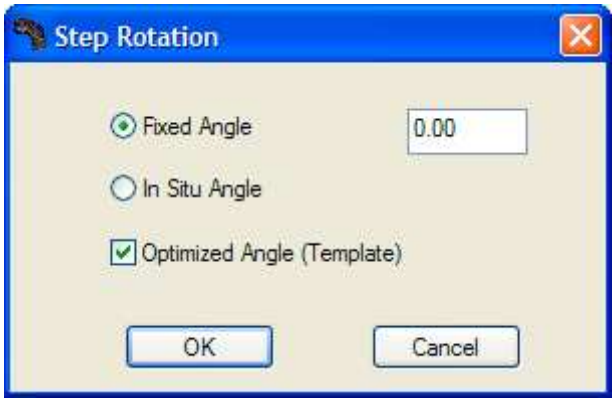
Piece	Cutting List Volume	Real Volume	Weight	Cost
Steps	111.85 dm³	91.71 dm³	82.54 kg	89.48 €
Risers	32.42 dm³	32.32 dm³	22.62 kg	19.45 €
Stringboards	106.69 dm³	78.84 dm³	70.96 kg	85.35 €
Handrails	15.75 dm³	7.23 dm³	7.95 kg	14.18 €
Newel Posts	47.35 dm³	47.35 dm³	52.08 kg	42.61 €
Banisters	27.77 dm³	14.32 dm³	15.75 kg	24.99 €
Total	**341.83 dm³**	**271.76 dm³**	**251.90 kg**	**276.07 €**

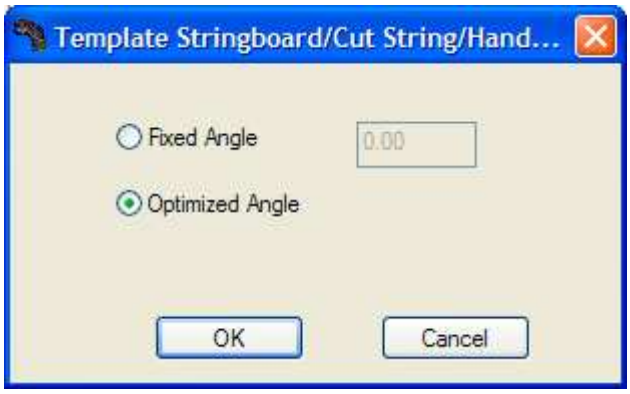
XI. 2 TEMPLATE MODE PRINTOUT

In the template mode you can print the plan view of the stair and its elements in a scale of 1:1, adjusting to your printer or plotter.

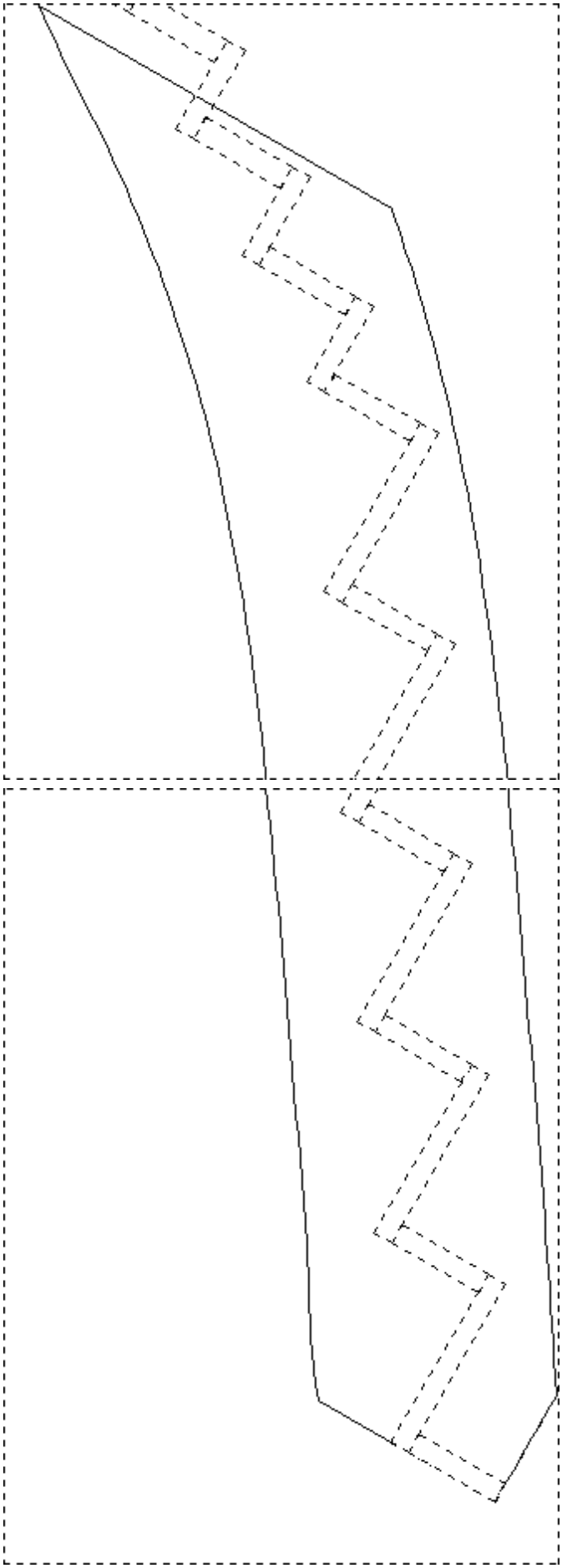








The option "Optimized angle" orients the object so as to reduce the length of the printed paper



P53

XI. 3 DATA LISTS

If you do not want to print out templates in a scale of 1:1, you can print or export data lists with the stringboard and cut string *(or soffit)* dimensions.

The window "Data list options" of the "File" menu enables you to select the category of element as well as the number of the printed *(or exported)* points per step.



The data list shows the coordinates along the developed element and the top and bottom positions to its vertical.

The angle coordinates *(in bold print)* indicate flight changes.

21/7/2009

StairDesigner
Right Stringboard

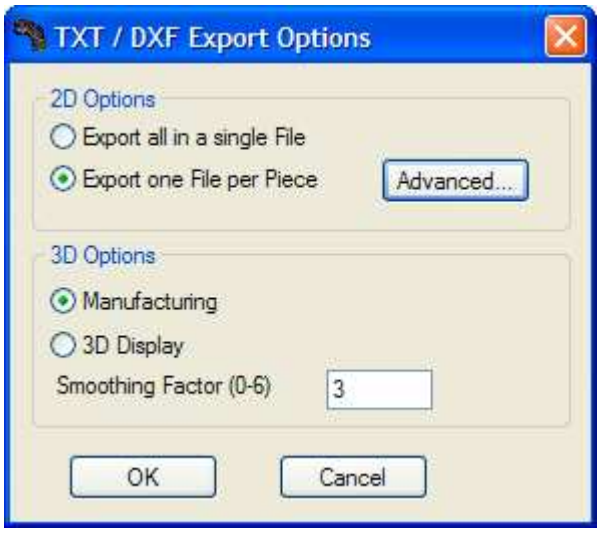
Smith Stairs

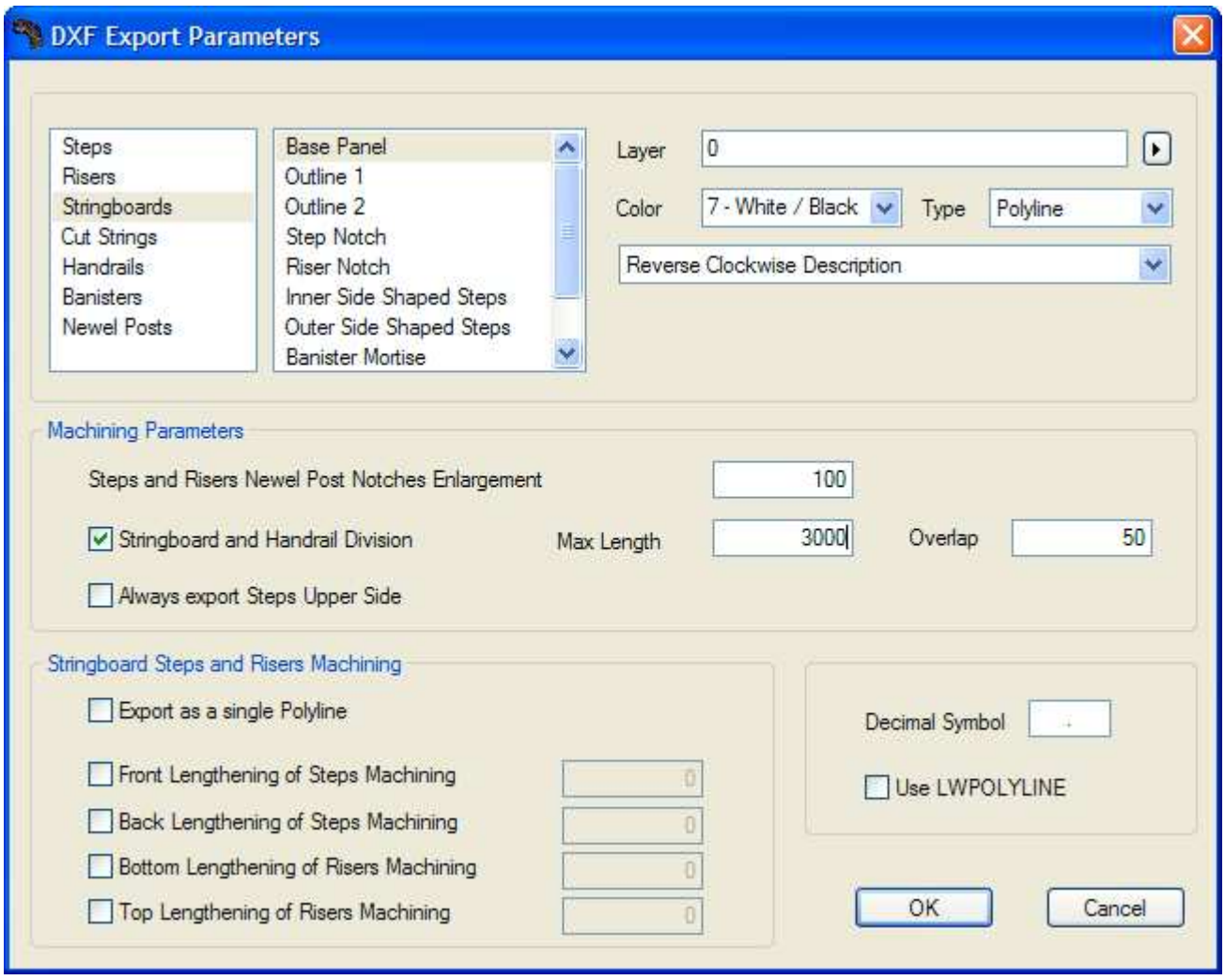
Stair6_1

Step	Abscissa	Ordinate	Stringboard Top	Stringboard Bottom
1	0	174.23	0	231.6
	131.13		0	318.36
2	262.25	348.46	43.92	408.34
	395.56		136.9	495.97
3	528.87	522.69	224.65	581.93
	669.79		316.03	670.47
4	810.7	696.92	404.88	754.89
	966.73		498.61	844.93
5	1122.75	871.15	588.46	926.99
	1317.12		688.36	1019.49
6	1511.5	1045.38	776.62	1098.89
	1515	**1045.38**	**778.07**	**1100.2**
	1769.43		870.88	1185.9
7	2027.36	1219.62	954.39	1272.93
	2143.32	**1219.62**	**995.97**	**1316.44**
	2240.02		1032.22	1354.66
8	2452.68	1393.85	1118.78	1449.29
	2610.37		1192.93	1535.53
9	2768.07	1568.08	1280.08	1625.73
	2914.11		1363.64	1711.53

XII. DXF EXPORTS

The 2D DXF export function exports all the stair elements, either all in a single file or in one file per piece according to the options below *(the button "Advanced" of the first window gives you access to the advanced parameters of the second window)*:

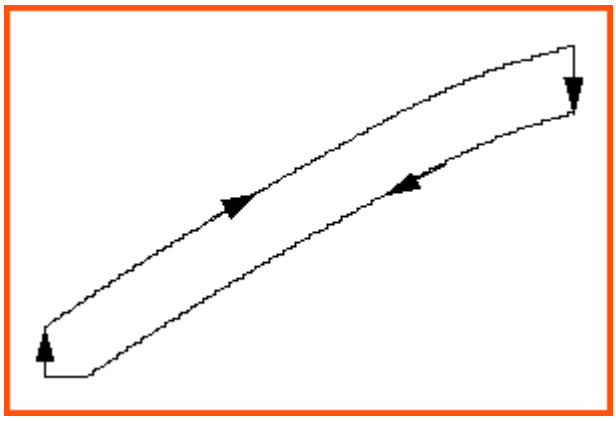


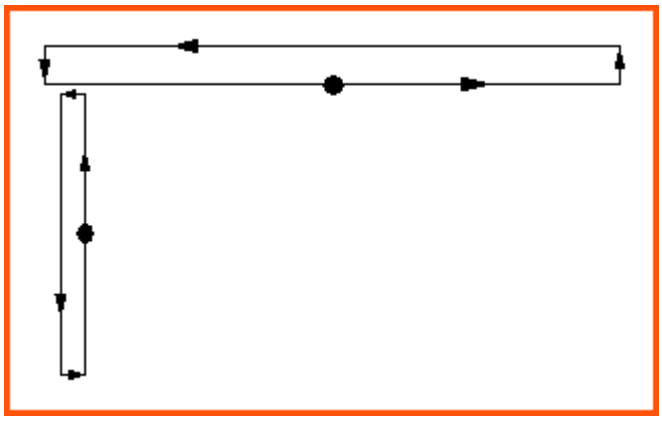


Sense of Progression of DXF Forms

In **StairDesigner**, you can choose the sense of progression of the exported DXF elements.

The stringboard below *(left)* is described clockwise whereas the step and riser *(right)* is described anti-clockwise.





3D DXF Export

The 3D DXF export function exports the whole stair in the DXF "3D_Side" that is compatible with the most CAD software *(AutoCad, DesignCad, VectorWorks, etc.).*



Example of a stair exported in DXF 3D to VectorWorks