

Splitboard simulation and design example

Full bamboo core

Bamboo density: 700kg/m³

Bamboo Y modulus 15000

Core thickness profile: 2.5-6.5-2.5 mm

board length 1590mm

effective length 1400mm

tip width 320mm

tail width 300mm

waist width 265mm

5mm sidewalls ABS

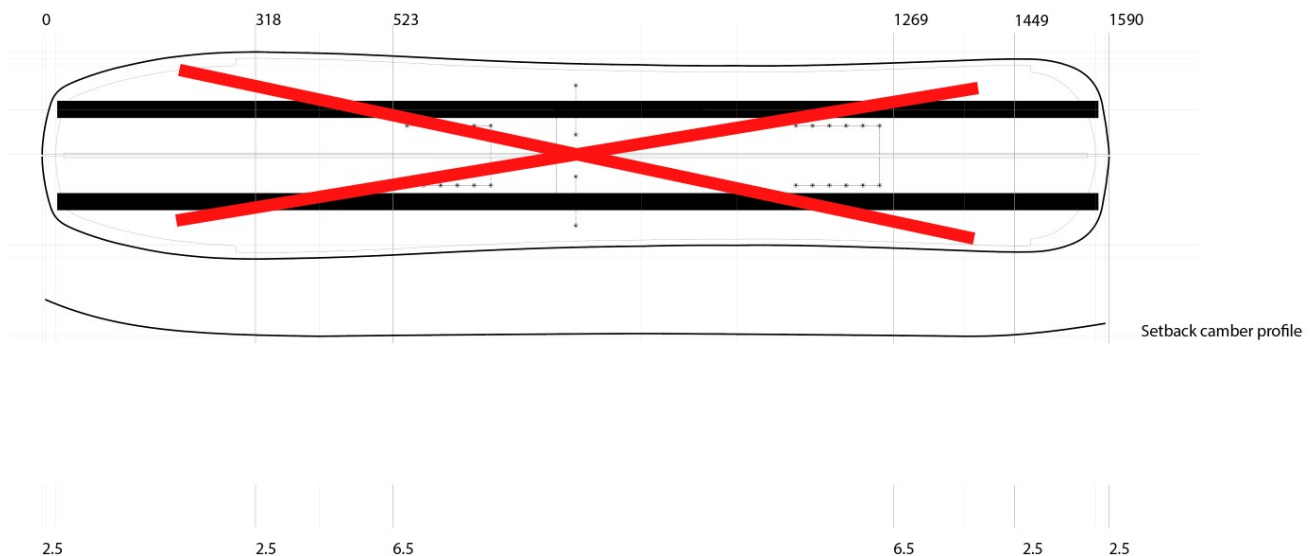
1.2mm edges, 2mm wide

Layup:

- Triaxial glass fabric: 0 ply: 288g, 1200 tex, +/-45 ply: 217g, 300tex

- 2 x 25mm UD carbon stringers 130gms (top and bottom) (black in picture)

- Carbon X stringer (+/-45 degrees) top and bottom for torsional stiffness 2x 50mm 130gms carbon (top and bottom)(red)

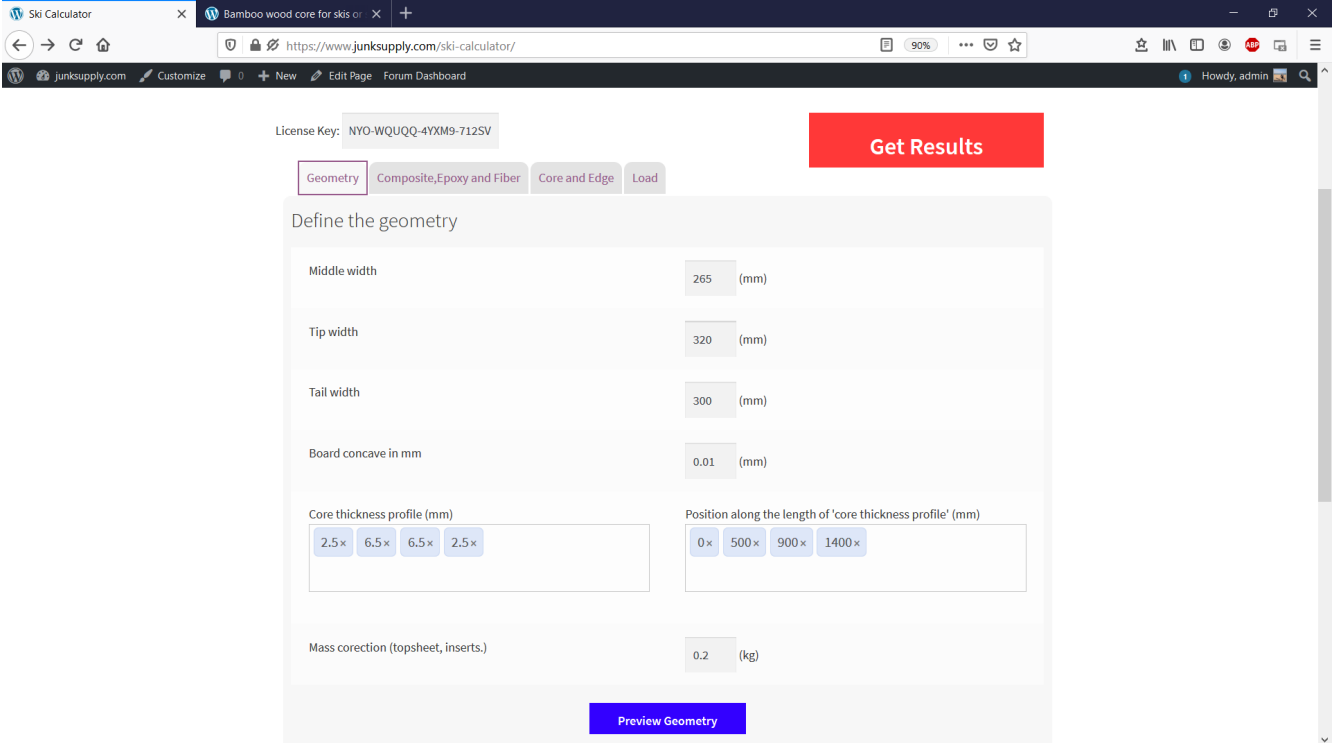


Reason why we add X carbon stringers is because glass is a bit damp and 'boaring' so we would like to improve the torsional stiffness and responsiveness of the board.

In following simulations we assume that the UD stringers are placed directly on the core. This way we use same core thickness for all simulations. If you however place the UD stringers on the outside of triax glass, which is about 0.7mm thick, make sure you add $2 \times 0.7\text{mm} = 1,4\text{mm}$ to your simulated core thickness for these simulations!!!

Now simulator will always assume that the top and bottom layup is identical.

Geometry definition



The screenshot shows a web browser window with the URL <https://www.junksupply.com/ski-calculator/>. The page title is "Ski Calculator" and the license key is "NYO-WQUQQ-4YXM9-712SV". The "Geometry" tab is selected, and the "Get Results" button is visible. The "Define the geometry" section contains the following input fields:

Parameter	Value	Unit
Middle width	265	(mm)
Tip width	320	(mm)
Tail width	300	(mm)
Board concave in mm	0.01	(mm)
Core thickness profile (mm)	2.5 x 6.5 x 6.5 x 2.5 x	
Position along the length of 'core thickness profile' (mm)	0 x 500 x 900 x 1400 x	
Mass correction (topsheet, inserts.)	0.2	(kg)

A "Preview Geometry" button is located at the bottom of the form.

We will simulate this task in 3 parts:

0) Core only

- 1) first we will just simulate the impact of ud stringers in length on this core
- 2) secondly we will simulate the impact of UD stringers in X (torsion) on this core
- 3) we will simulate the effect of glass fabric on the core
- 4) Finally we will combine all of them.

0. Core only

The screenshot shows the 'Ski Calculator' web application with the 'Composite, Epoxy and Fiber' tab selected. The license key is NYO-WQUQQ-4YXM9-7125V. A red 'Get Results' button is visible. The 'Select composite parameters' section includes input fields for fabric density (0 degree and +/-45 degree), fabric weight (0 degree and +/-45 degree), and fabric Y modulus (0 degree and +/-45 degree). On the right, material properties for Glass, Carbon, and Basalt are listed.

License Key: NYO-WQUQQ-4YXM9-7125V

Get Results

Geometry Composite, Epoxy and Fiber Core and Edge Load

Select composite parameters

Define the fabric density 0 degree	1700	(kg/m ³)	Glass Density = 2600 Y modulus = 75000
Define the fabric density +/-45 degree	1700	(kg/m ³)	Carbon Density = 1700 Y modulus = 235000
Fabric weight 0 degree	0.001	(kg/m ²)	Basalt Density = 2700 Y modulus = 88000
Fabric weight +/-45 degree	0.001	(kg/m ²)	
Fabric Y modulus 0 degree	235000	(N/mm ² - MPa)	
Fabric Y modulus +/-45 degree	235000	(N/mm ² - MPa)	

The screenshot shows the 'Ski Calculator' web application with the 'Core and Edge' tab selected. The license key is NYO-WQUQQ-4YXM9-7125V. A red 'Get Results' button is visible. The 'Select Core parameter' section includes input fields for core density and core young modulus. The 'Select edge parameters' section includes input fields for steel edge thickness and steel edge width. The 'Select sidewall parameters' section includes an input field for sidewall width. On the right, material properties for Paulownia, Poplar, and Birch are listed.

License Key: NYO-WQUQQ-4YXM9-7125V

Get Results

Geometry Composite, Epoxy and Fiber Core and Edge Load

Select Core parameter

Core density	700	(kg/m ³)	Paulownia Density = 300 Y modulus = 5000
Core young modulus Mpa	15000	(N/mm ²)	Poplar Density = 350-500 Y modulus = 8800

Select edge parameters

Steel edge thickness	0.01	(mm)	Birch Density = 610 Y modulus = 14000
Steel edge width	0.01	(mm)	

Select sidewall parameters

Sidewall width			
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Overview	
Mass Estimate	1 465 Grams
Maximum Stiffness Value	94,221,611.03 N*mm^2
Maximum Deflection Value	-573.57 mm
Maximum Stiffness Value (Practical Measurement)	242.73 N/mm
This Design Flex is	Soft
Maximum Deflection Value (Practical Measurement)	-35.12 mm
Tip width	320 mm
Tail width	300 mm
Board Concave	0.01 mm
Height	2 5 6 5 6 5 2 5

Max stiffness for practical measurement is 243N/mm

1. simulating wood core and UD carbon in length direction only

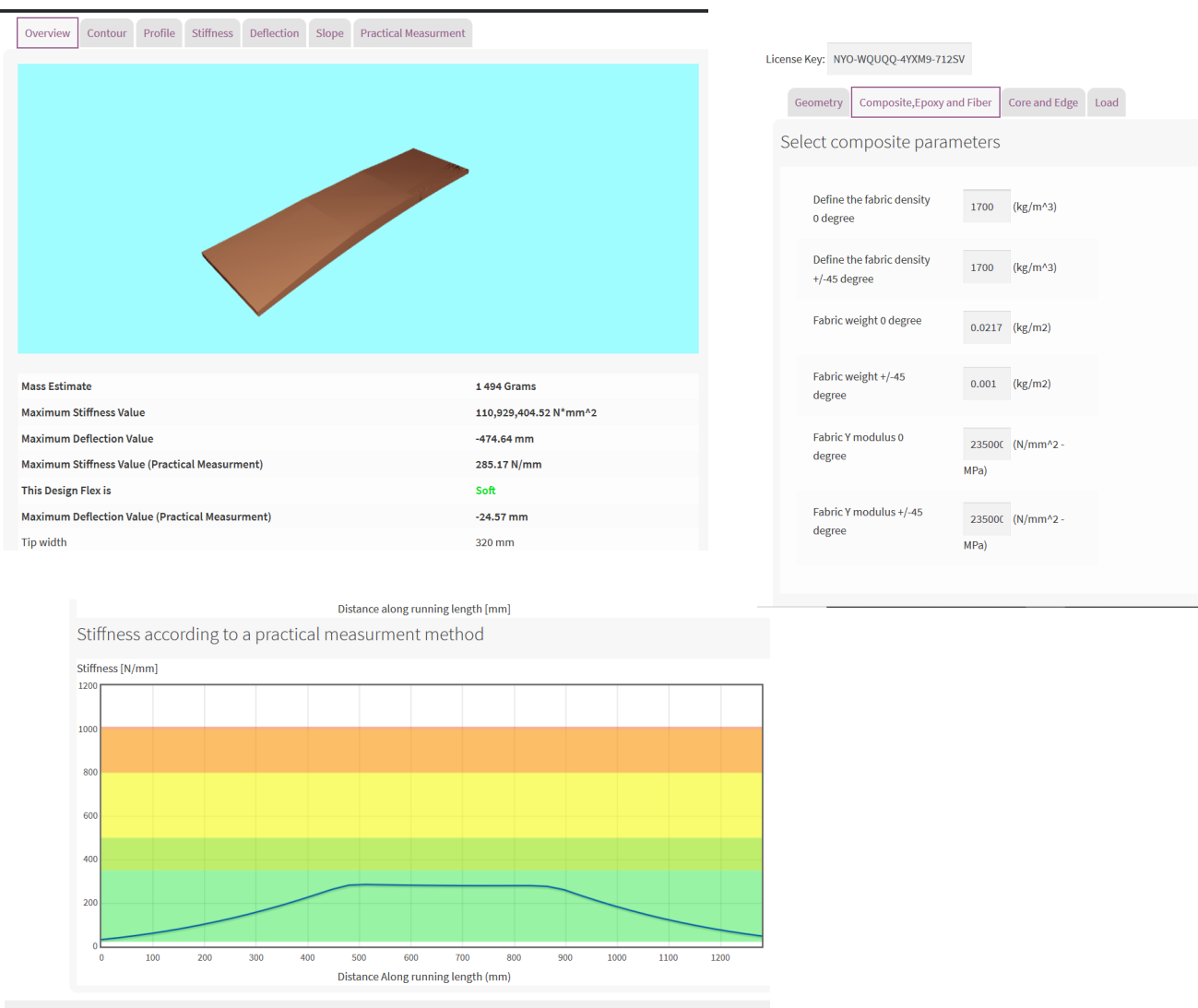
Now we add 2x2.5mm UD carbon stringers of 130gms. This is equal to 1x50mm carbon stringer. Since simulator assumes that the fabric we use is spread evenly over the entire board, we cant just input 130gms into the 0 direction field. This would be wrong since the simulator would calculate as if there was a end to end fabric of this weight covering out board. So we will calculate equivalent fabric weight:

Equivalent fabric weight = Stringer weight * stringer width / board average width

Equivalent fabric weight = 130gms * 50mm / 300mm = 21,7gms.

So we will use 21,7gms for our simulation.

Here are the results: maximum stiffness is now 285 N/mm, **increase of 50 N/mm!**



2. Simulation the UD carbon in X/diagonal direction only

Now we will simulate only 2 x 50mm diagonal carbon UD stringers, 130gms.

We can do this by splitting the diagonal +/-45 degree weight contribution into a 0 degree contribution and a 90 degree contribution.

90 degree contribution we can ignore as it will make the board more stiff and responsive in width, but it wont impact our longitudinal stiffness. So to see the impact of longitudinal stiffness by these X stringers we calculate:

0 degree weight contribution = +/-45 degree equivalent weight * cosine(45 degrees)

0 degree weight contribution = (130gms*50/300) * 0,7 = 15gms

So we can now simulate this contribution and here are results: max stiffness is 271N/mm, **increase of about 30N/mm**

The screenshot shows a simulation software interface. At the top, there are tabs for 'Overview', 'Contour', 'Profile', 'Stiffness', 'Deflection', 'Slope', and 'Practical Measurement'. The main area displays a 3D model of a brown, tapered rectangular board. To the right, there is a 'Get Results' button and a 'Select composite parameters' section. Below the 3D model, a table lists simulation results:

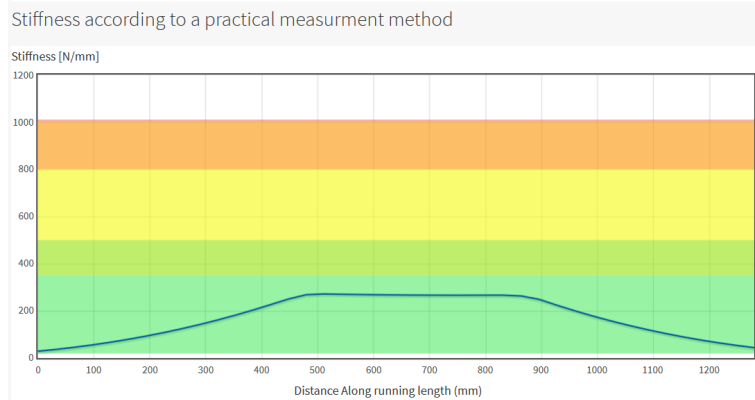
Mass Estimate	1 485 Grams
Maximum Stiffness Value	105,496,752.74 N*mm^2
Maximum Deflection Value	-502.73 mm
Maximum Stiffness Value (Practical Measurement)	271.38 N/mm
This Design Flex is	Soft
Maximum Deflection Value (Practical Measurement)	-27.24 mm
Tip width	320 mm

The 'Select composite parameters' section includes the following settings:

- Define the fabric density 0 degree: 1700 (kg/m^3)
- Define the fabric density +/-45 degree: 1700 (kg/m^3)
- Fabric weight 0 degree: 0.015 (kg/m^2)
- Fabric weight +/-45 degree: 0.301 (kg/m^2)
- Fabric Y modulus 0 degree: 235000 (N/mm^2 - MPa)
- Fabric Y modulus +/-45 degree: 235000 (N/mm^2 - MPa)

Material properties listed on the right:

- Glass: Density = 2800, Y modulus = 75000
- Carbon: Density = 1700, Y modulus = 235000
- Basalt: Density = 2700, Y modulus = 88000



3.Simulation of the triax glass only

The screenshot shows a web browser window with the URL <https://www.junksupply.com/ski-calculator/>. The page features a navigation bar with tabs for "Geometry", "Composite, Epoxy and Fiber", "Core and Edge", and "Load". The "Composite, Epoxy and Fiber" tab is active. A "License Key" field contains the text "NYO-WQUQQ-4YXM9-712SV". A prominent red "Get Results" button is located in the top right corner. Below the navigation tabs, a section titled "Select composite parameters" contains several input fields for defining material properties. On the right side of this section, a list of material properties is displayed for "Glass", "Carbon", and "Basalt".

License Key: NYO-WQUQQ-4YXM9-712SV

Get Results

Geometry Composite, Epoxy and Fiber Core and Edge Load

Select composite parameters

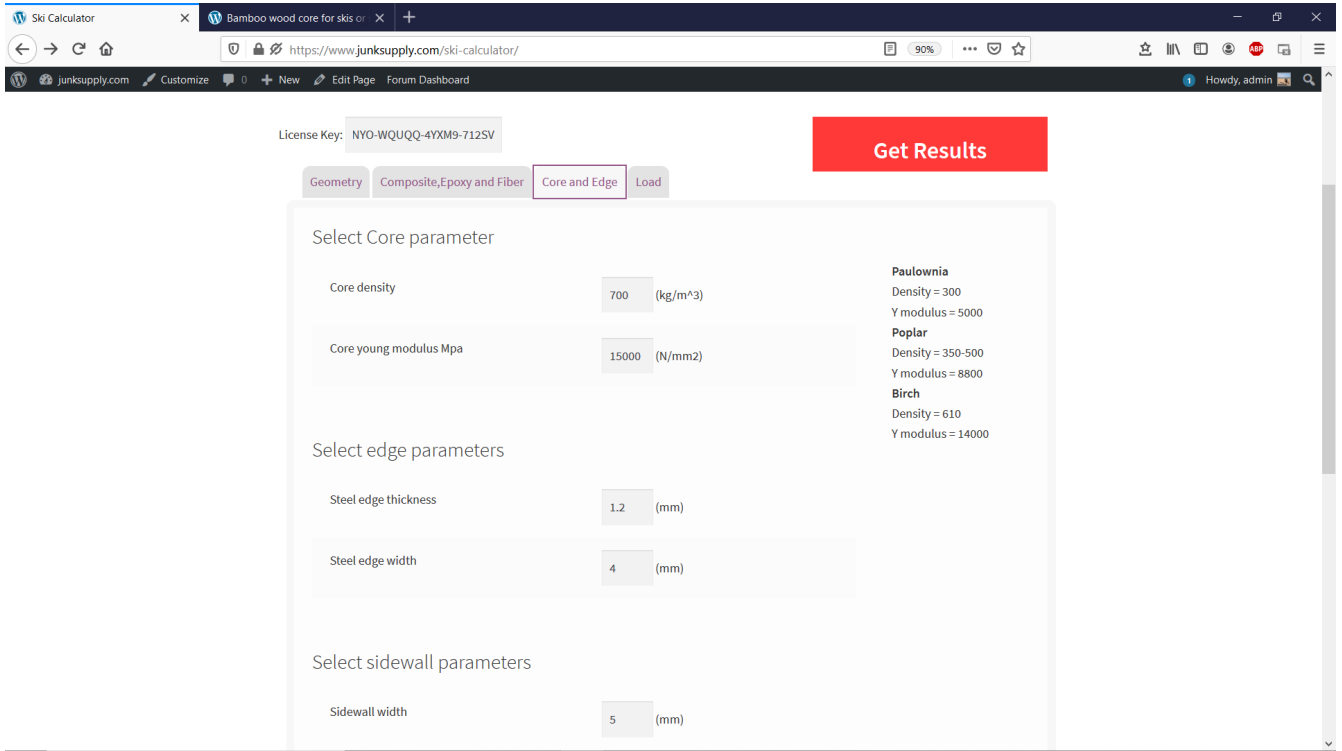
Define the fabric density 0 degree	2600	(kg/m ³)
Define the fabric density +/-45 degree	2600	(kg/m ³)
Fabric weight 0 degree	0.288	(kg/m ²)
Fabric weight +/-45 degree	0.217	(kg/m ²)
Fabric Y modulus 0 degree	75000	(N/mm ² - MPa)
Fabric Y modulus +/-45 degree	75000	(N/mm ² - MPa)

Glass
Density = 2600
Y modulus = 75000

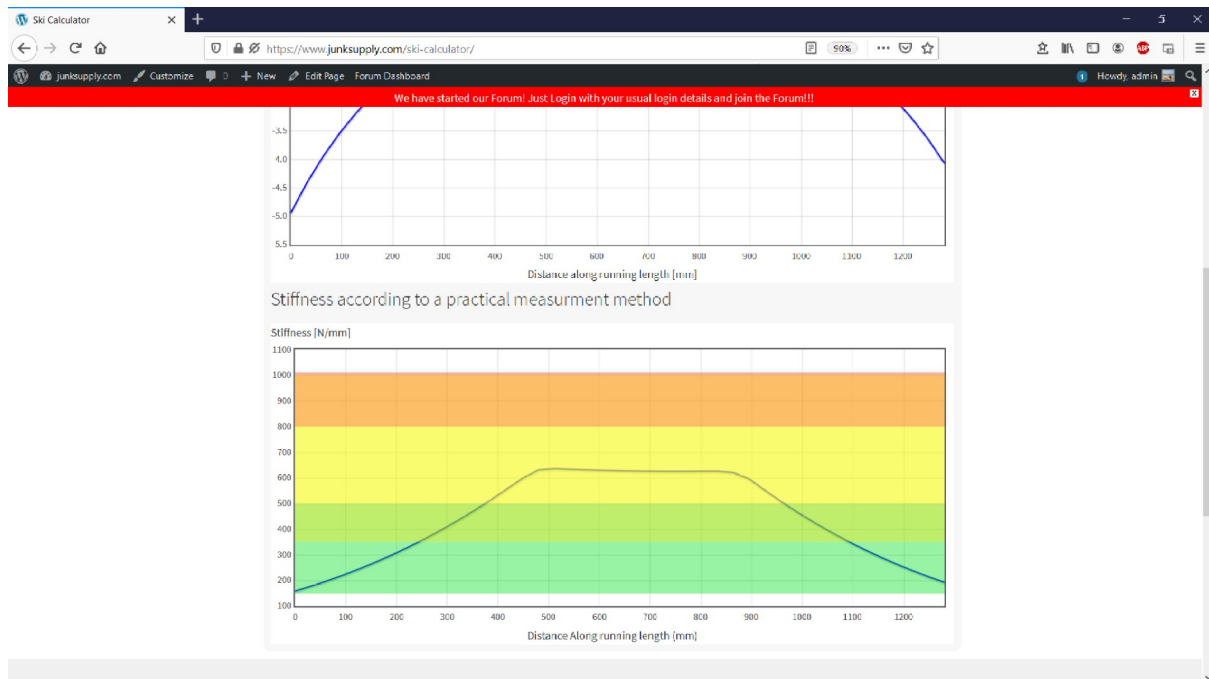
Carbon
Density = 1700
Y modulus = 235000

Basalt
Density = 2700
Y modulus = 88000

Since the splitboard has 1 x 2mm wide steel edge on each side, and also 2 in the middle (that is 2mm+2mm+2mm+2mm = 8mm in total), we will change the total steel edge width to 4mm (as simulator simulates with 1 steel edge on each side this will be 2x4mm = 8mm in total and matches the reality).

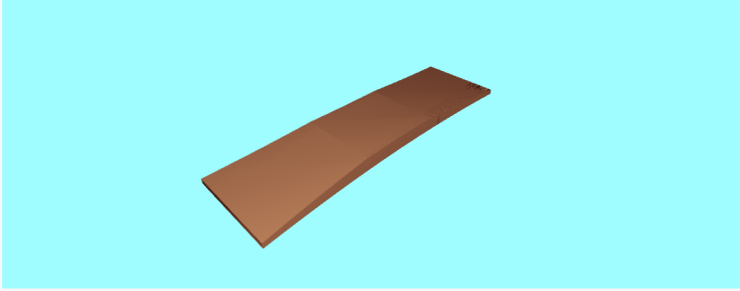


Here are results:



Ski Calculator

https://www.junksupply.com/ski-calculator/



Mass Estimate	3 160 Grams
Maximum Stiffness Value	228,506,874.67 N*mm^2
Maximum Deflection Value	-207.27 mm
Maximum Stiffness Value (Practical Measurement)	635.71 N/mm
This Design Flex is	Medium
Maximum Deflection Value (Practical Measurement)	-4.95 mm
Tip width	320 mm
Tail width	300 mm
Board Concave	0.01 mm
Height	2.5,6.5,6.5,2.5
Position for height	0,500,900,1400
Mass correction	0.2 kg

Max stiffness is 635N/mm for the glass fabric simulation. This is considered medium.

4. Combining the impact of all simulations

So the core with triaxial glass layup has a max stiffness of 635N/mm. By adding the UD stringers in length we increase this by about 50N/mm, and by placing the diagonal 45 degree X stringers we further increase the stiffness by about 30N/mm. This gives total of 715N/mm, which is an increase of about 13%, however more importantly the board will feel more responsive due to added carbon stringers.

Now simulator will always assume that the top and bottom layup is identical. If we however only wish to add a stringer on top or only on bottom, we can assume that the contribution at best will be half the simulated value, but probably less, since the composite have best benefit when used as sandwich construction, top and bottom.

NOTE: please consider that simulation does not take into account the splitboard buing split in half, this means that your final stiffness will be less then this since splitboard clips dont do perfect job of putting the 2 halves of splitboard together at every single point. So I suggest you increase thickness of your core by up to 1mm, or you add extra material to make the final stiffness even greater.