

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

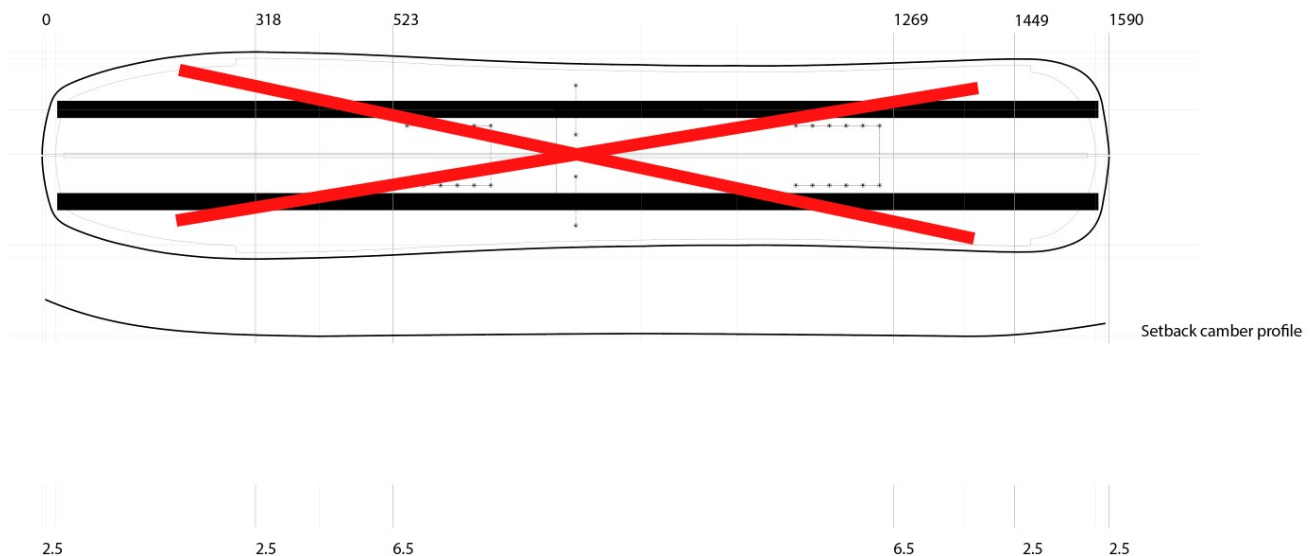
1.2mm edges, 2mm wide

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)

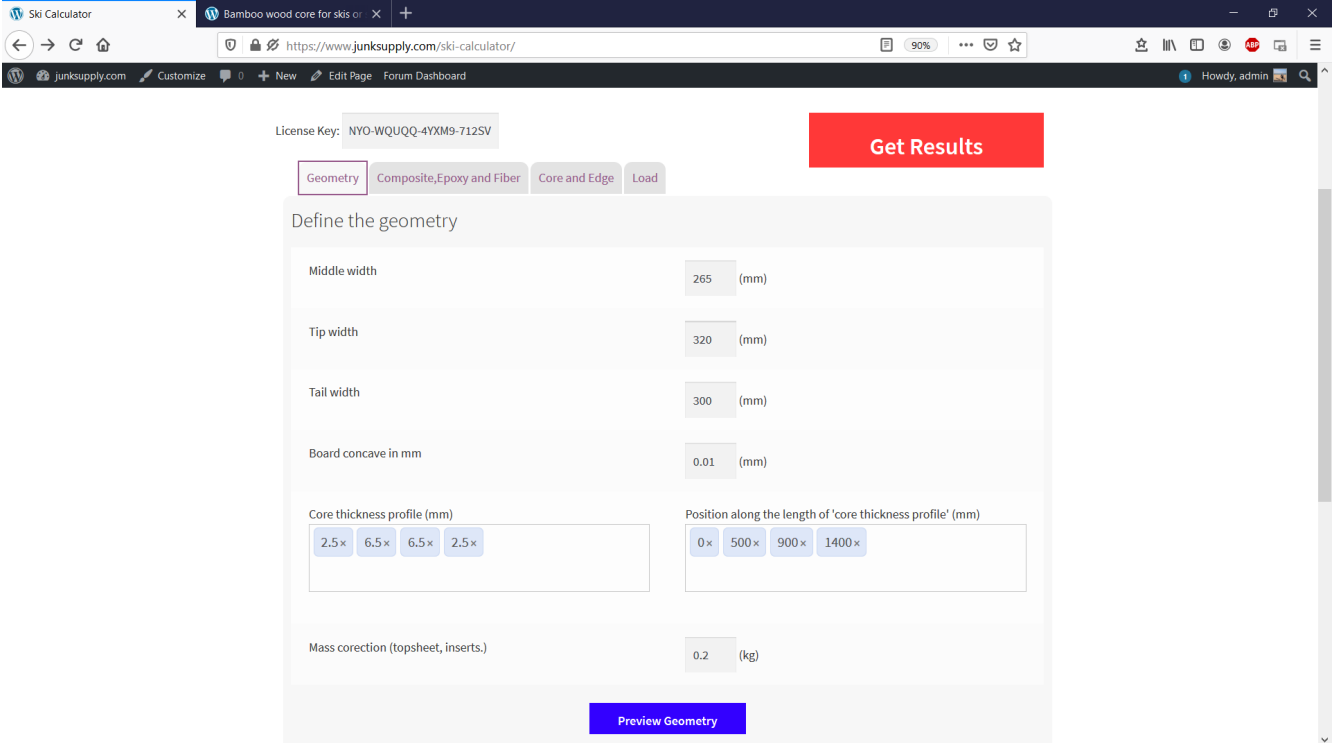


Reason why we add X carbon stringers is because glass is a bit damp and 'boaring' so we would like to improve the torsional stiffness and responsiveness of the board.

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 the 'Ski Calculator' web application interface. The browser address bar displays 'https://www.junksupply.com/ski-calculator/'. The page features a navigation menu with 'Geometry', 'Composite, Epoxy and Fiber', 'Core and Edge', and 'Load' tabs. A 'License Key' field contains 'NYO-WQUQQ-4YXM9-7125V'. A prominent red 'Get Results' button is located in the top right. The 'Define the geometry' section includes input fields for 'Middle width' (265 mm), 'Tip width' (320 mm), 'Tail width' (300 mm), and 'Board concave in mm' (0.01 mm). Below these are two rows of buttons for 'Core thickness profile (mm)' (2.5x, 6.5x, 6.5x, 2.5x) and 'Position along the length of 'core thickness profile' (mm)' (0x, 500x, 900x, 1400x). A 'Mass correction (topsheet, inserts.)' field is set to 0.2 (kg). A blue 'Preview Geometry' button is at the bottom.

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

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)	

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

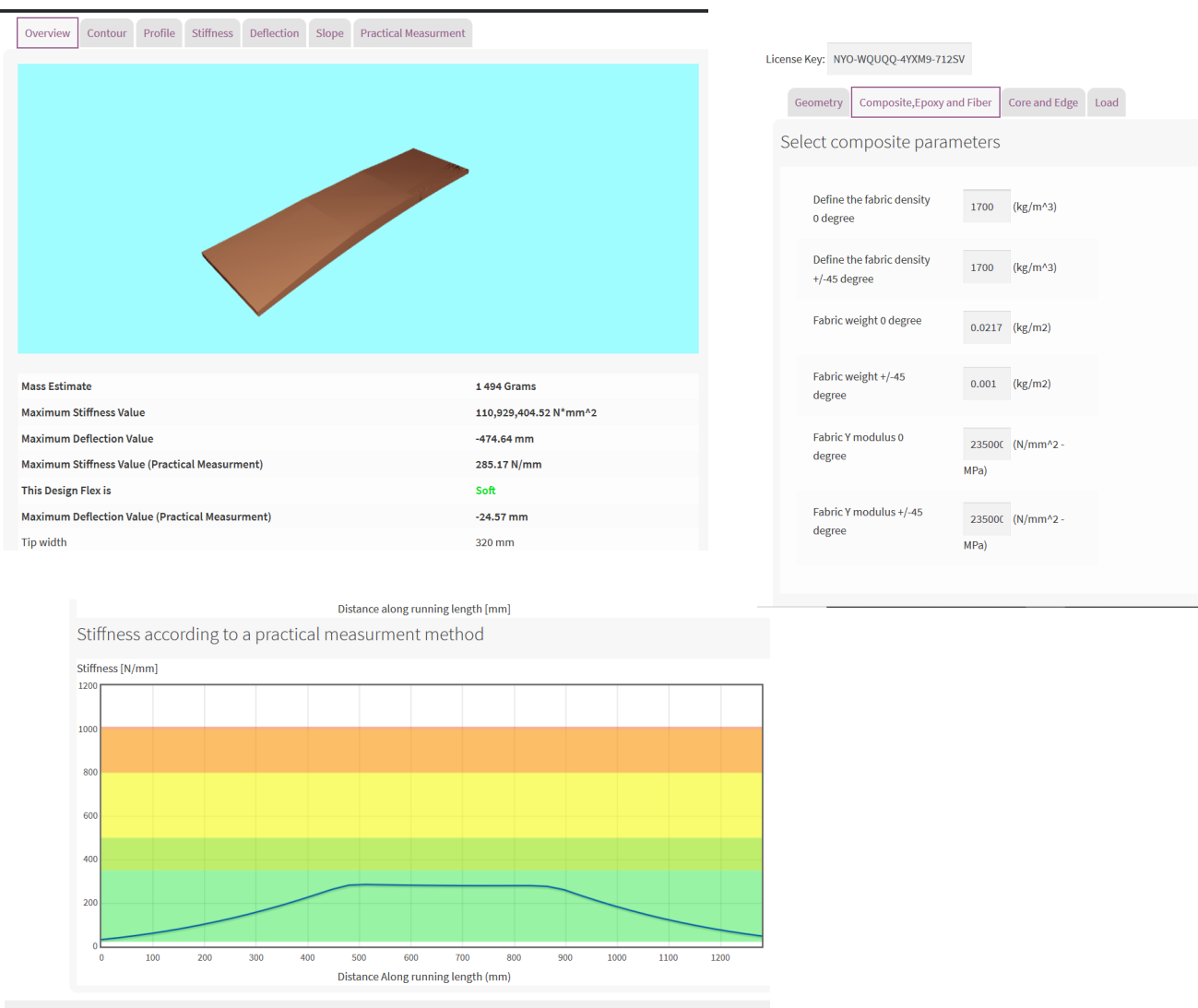
Now we add 2x2.5mm UD carbon stringers of 130gms. This is equal to 1x50mm carbon stringer. Since simulator assumes that the fabric we use is spread evenly over the entire board, we cant just input 130gms into the 0 direction field. This would be wrong since the simulator would calculate as if there was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

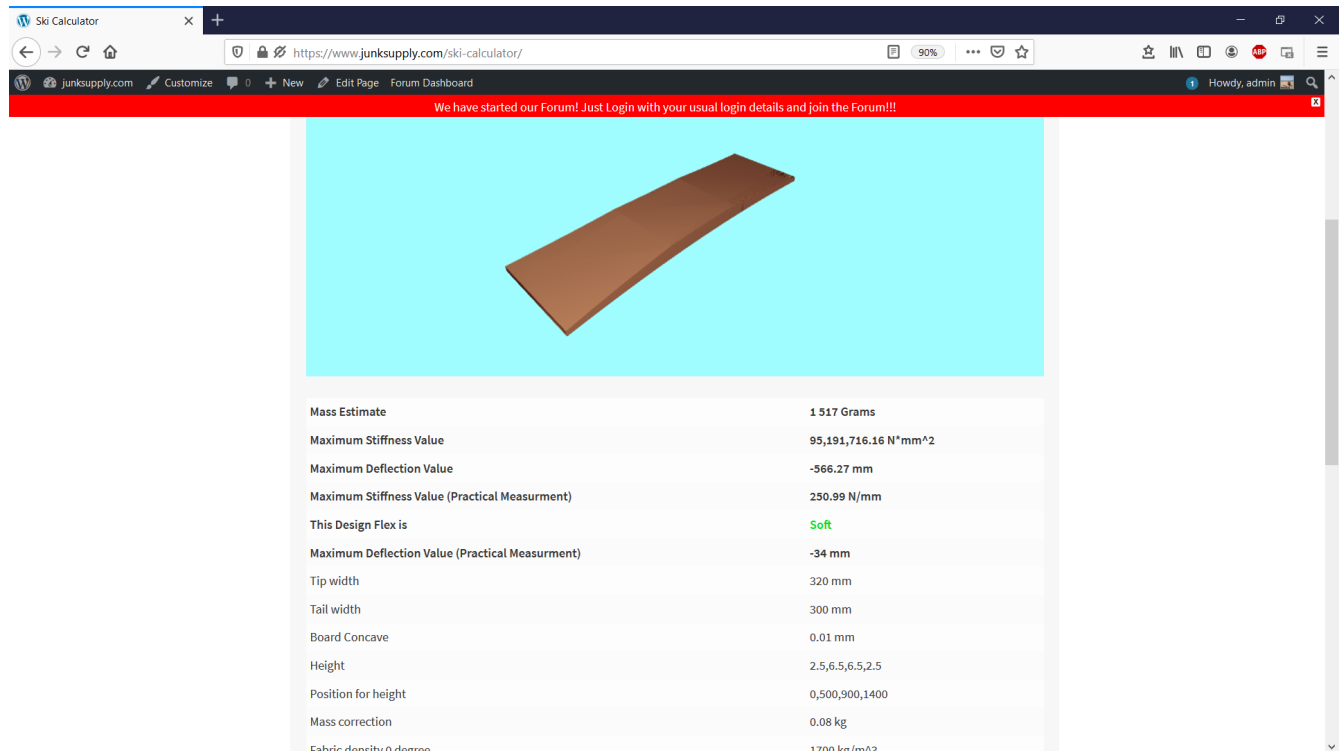


2. Simulation the UD carbon in X/diagonal direction only

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

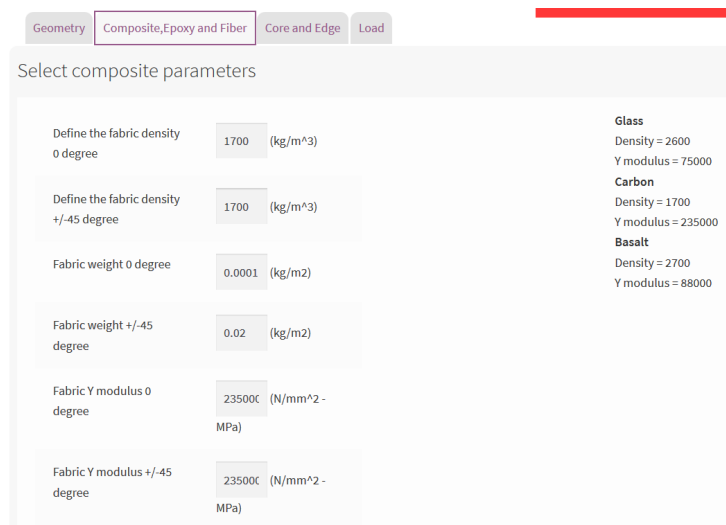
Since we position it +/-45 degrees, we can just put the 0 direction to 0.001 and +/-45 direction to
Equivalent fabric weight = 130gms * 50mm / 300mm = 21,7gms.

So we can now simulate this contribution and here are results: max stiffness is 252N/mm, **increase of about 10N/mm.**



The screenshot shows a web browser window with the URL <https://www.junksupply.com/ski-calculator/>. The page features a 3D model of a brown ski on a light blue background. Below the model is a table of simulation results:

Mass Estimate	1 517 Grams
Maximum Stiffness Value	95,191,716.16 N*mm^2
Maximum Deflection Value	-566.27 mm
Maximum Stiffness Value (Practical Measurement)	250.99 N/mm
This Design Flex is	Soft
Maximum Deflection Value (Practical Measurement)	-34 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	0.08 kg
Fabric density 0 degree	1700 kg/m^3



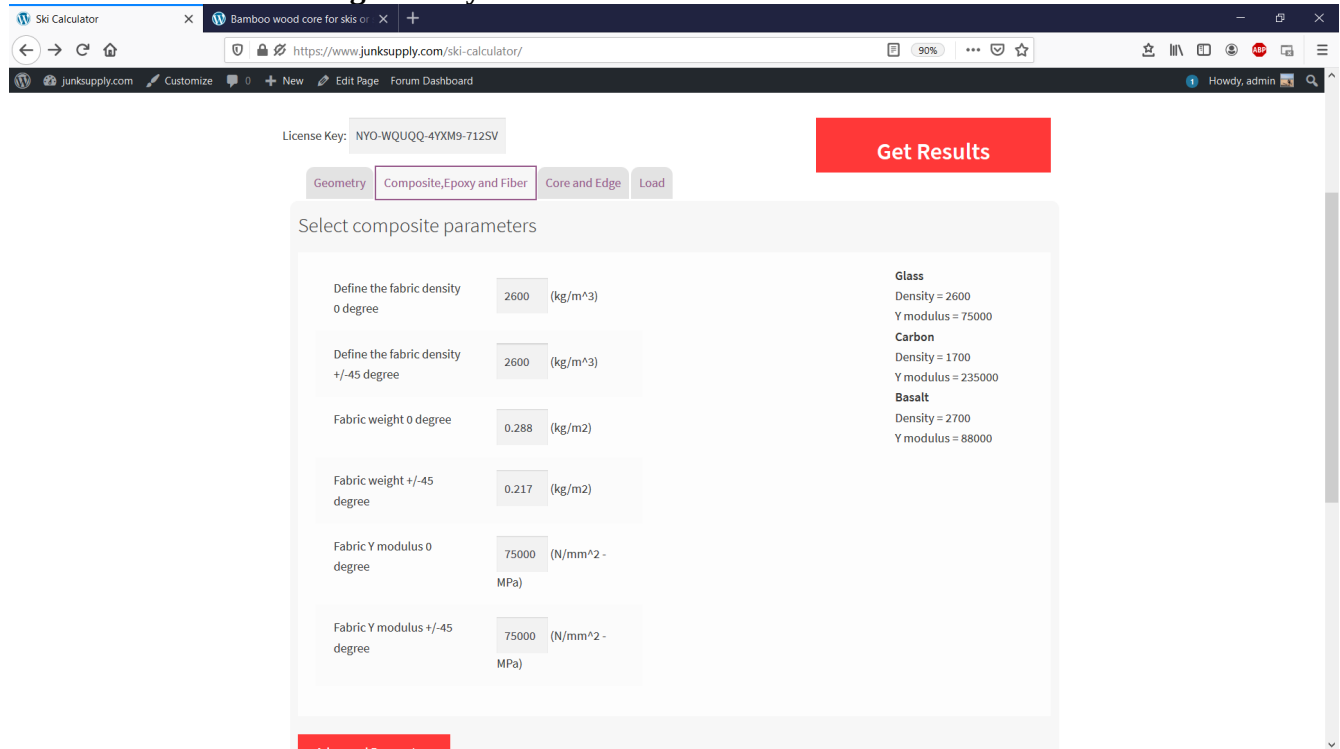
The screenshot shows the 'Composite, Epoxy and Fiber' tab selected in the Ski Calculator interface. The page is titled 'Select composite parameters' and contains several input fields for defining material properties:

- Define the fabric density 0 degree: 1700 (kg/m^3)
- Define the fabric density +/-45 degree: 1700 (kg/m^3)
- Fabric weight 0 degree: 0.0001 (kg/m2)
- Fabric weight +/-45 degree: 0.02 (kg/m2)
- Fabric Y modulus 0 degree: 23500 (N/mm^2 - MPa)
- Fabric Y modulus +/-45 degree: 23500 (N/mm^2 - MPa)

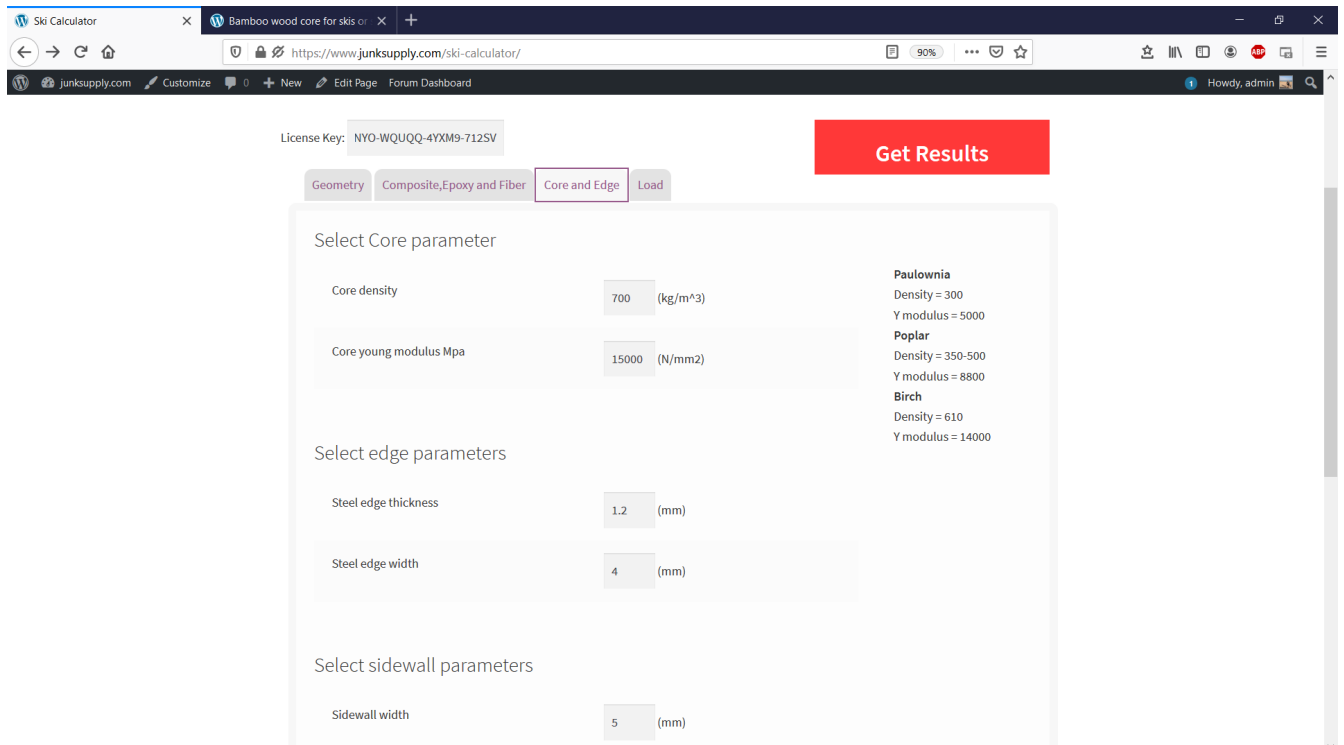
On the right side, there are three material options listed:

- Glass**: Density = 2600, Y modulus = 75000
- Carbon**: Density = 1700, Y modulus = 235000
- Basalt**: Density = 2700, Y modulus = 88000

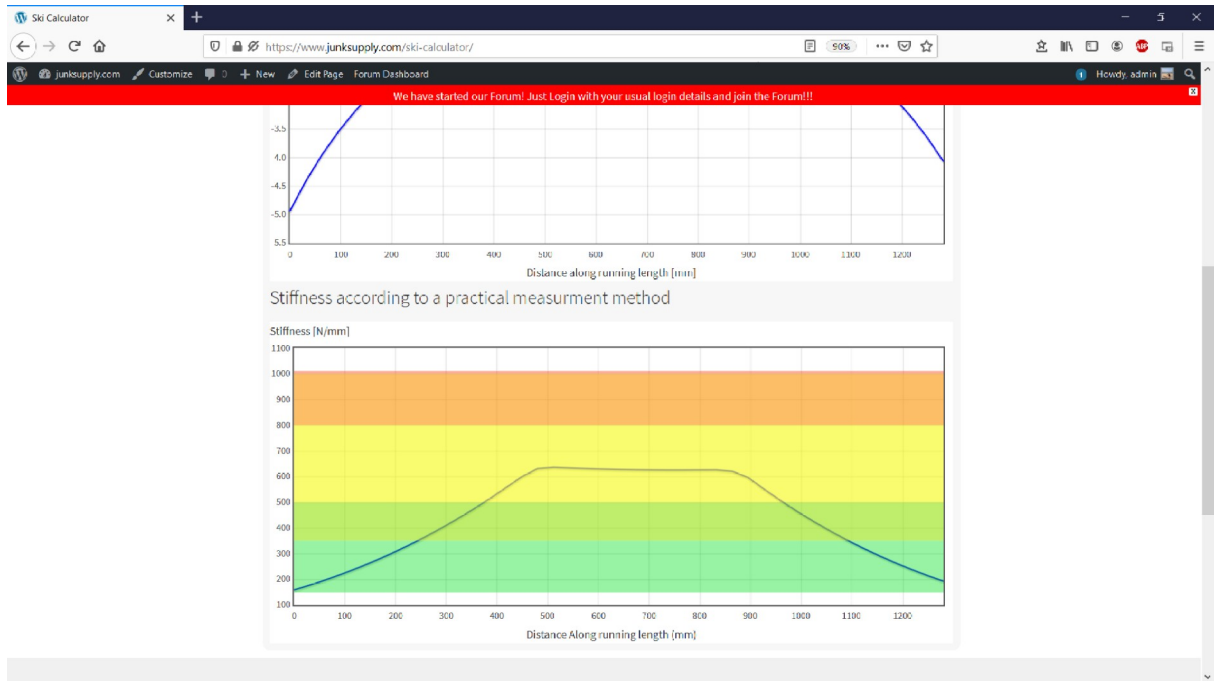
3.Simulation of the triax glass only



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).

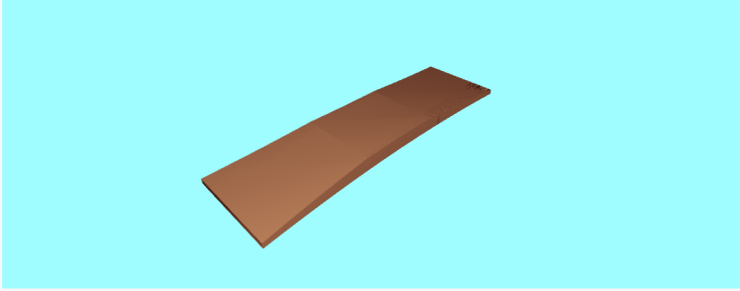


Here are results:



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 10N/mm. This gives total of about 700N/mm, which is an increase of about 10%, however more importantly the board will feel more responsive due to added carbon stringers.

X – diagonal stringers only increase the stiffness few percent, but contribute well to the torsional stiffness.

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.

For a comparison, running a simulation with stringers on the outside of the triaxial fabric (0,7mm + 0.7mm additional thicknes) with this core dimensions, gives following increase:

- For 2x25mm UD carbon stringers: increase of 60N/mm
- for X-diagonal UD stringers: increase of 20N/mm

A total increase of about 13%.