

Optimization Results

Polypropylene Plate

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Fuction					
<i>m</i>	mass of plate	1.45E+00	kg		
Design Variables					
<i>a</i>	length of plate	0.156	m	0.001	0.4
Calculations					
<i>h</i>	heigth of plate	0.041631	m	0.001	0.05
<i>I</i>	second moment area (plate)	1.49E-06	m ⁴		
Parameters					
<i>L</i>	Half length of snowboard	0.52	m		
<i>d</i>	distance between screws	0.04	m		
<i>E_b</i>	Youngs Modulus (board)	9.48E+09	Pa		
<i>J</i>	second moment area (board)	2.83E-08	m ⁴		
<i>b</i>	width of board	0.248	m		
<i>p</i>	density (plate)	9.00E+02	kg/m ³		
<i>E</i>	Youngs Modulus (plate)	2.00E+09	Pa		

Wood Plate

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Fuction					
<i>m</i>	mass of plate	4.70E-01	kg		
Design Variables					
<i>a</i>	length of plate	0.156	m	0.001	0.4
Calculations					
<i>h</i>	heigth of plate	0.024346	m	0.001	0.05
<i>I</i>	second moment area (plate)	2.98E-07	m ⁴		
Parameters					
<i>L</i>	Half length of snowboard	0.52	m		
<i>d</i>	distance between screws	0.04	m		
<i>E_b</i>	Youngs Modulus (board)	9.48E+09	Pa		
<i>J</i>	second moment area (board)	2.83E-08	m ⁴		
<i>b</i>	width of board	0.248	m		
<i>p</i>	density (plate)	5.00E+02	kg/m ³		
<i>E</i>	Youngs Modulus (plate)	1.00E+10	Pa		

Aluminium Plate

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Function					
m	mass of plate	1.33E+00	kg		
Design Variables					
a	length of plate	0.156	m	0.001	0.4
Calculations					
h	height of plate	0.0127271	m	0.001	0.05
I	second moment area (plate)	4.26E-08	m ⁴		
Parameters					
L	Half length of snowboard	0.52	m		
d	distance between screws	0.04	m		
E_b	Youngs Modulus (board)	9.48E+09	Pa		
J	second moment area (board)	2.83E-08	m ⁴		
b	width of board	0.248	m		
p	density (plate)	2.70E+03	kg/m ³		
E	Youngs Modulus (plate)	7.00E+10	Pa		

Plate Results Conclusion

Material	Mass [kg]	Plate Length [cm]	Plate Height [cm]
Polypropylene	1.45	15.6	4.2
Wood	0.47	15.6	2.4
Aluminium	1.33	15.6	1.3

Polypropylene Tubes

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Fuction					
<i>m</i>	mass of two tubes	7.58E-01	kg		
Design Variables					
<i>Do</i>	Outer tube diameter	0.055	m	0.001	0.055
<i>a</i>	length of tube	0.239	m	0.001	0.4
Calculations					
<i>Di</i>	Inner tube diameter	0.0279609	m	0.001	0.055
<i>I</i>	second moment area (both tubes)	8.38E-07	m ⁴		
Parameters					
<i>L</i>	Half length of snowboard	0.52	m		
<i>d</i>	distance between screws	0.04	m		
<i>Eb</i>	Youngs Modulus (board)	9.48E+09	Pa		
<i>J</i>	second moment area (board)	2.83E-08	m ⁴		
<i>b</i>	width of board	0.248	m		
<i>p</i>	density (tube)	9.00E+02	kg/m ³		
<i>E</i>	Youngs Modulus (tube)	2.00E+09	Pa		

Wood Tubes

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Fuction					
<i>m</i>	mass of two tubes	5.31E-02	kg		
Design Variables					
<i>Do</i>	Outer tube diameter	0.055	m	0.001	0.055
<i>a</i>	length of tube	0.204	m	0.001	0.4
Calculations					
<i>Di</i>	Inner tube diameter	0.051897	m	0.001	0.055
<i>I</i>	second moment area (both tubes)	1.86E-07	m ⁴		
Parameters					
<i>L</i>	Half length of snowboard	0.52	m		
<i>d</i>	distance between screws	0.04	m		
<i>Eb</i>	Youngs Modulus (board)	9.48E+09	Pa		
<i>J</i>	second moment area (board)	2.83E-08	m ⁴		
<i>b</i>	width of board	0.248	m		
<i>p</i>	density (tube)	5.00E+02	kg/m ³		

E	Youngs Modulus (tube)	1.00E+10	Pa	
-----	-----------------------	----------	----	--

Aluminium Tubes

Var	Description	Value	Unit	Lower Bound	Upper Bound
Objective Fuction					
m	mass of two tubes	3.90E-02	kg		
Design Variables					
Do	Outer tube diameter	0.055	m	0.001	0.055
a	length of tube	0.201	m	0.001	0.4
Calculations					
Di	Inner tube diameter	0.0545833	m	0.001	0.055
I	second moment area (both tubes)	2.69E-08	m ⁴		
Parameters					
L	Half length of snowboard	0.52	m		
d	distance between screws	0.04	m		
Eb	Youngs Modulus (board)	9.48E+09	Pa		
J	second moment area (board)	2.83E-08	m ⁴		
b	width of board	0.248	m		
p	density (tube)	2.70E+03	kg/m ³		
E	Youngs Modulus (tube)	7.00E+10	Pa		

Tubes Results Conclusion

Material	Mass [kg]	Tube Length [cm]	Outer Diameter [cm]	Inner Diameter [cm]
Polypropylene	0.758	23.9	5.50	2.80
Wood	0.053	20.4	5.50	5.19
Aluminium	0.039	20.1	5.50	5.46

Minimum outer diameter for a tube length of 24 cm, for which inner diameter is approaching 0

Material	Minimum Outer Diameter [cm]
Polypropylene	5.5
Wood	3.7
Aluminium	2.2