

Materials in Skiing

- Public awareness and participation in winter sports is on the increase
- Earliest downhill skis were derived from cross country skis
 - >230cm
 - very stiff
- First competitions in Switzerland 1911
 - Attempts made to make shorter/more flexible
- Designs refined in the 1930s and 1940s

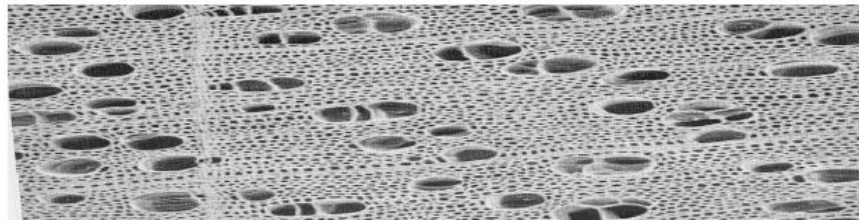


12.8 1936 US Olympic ski team.

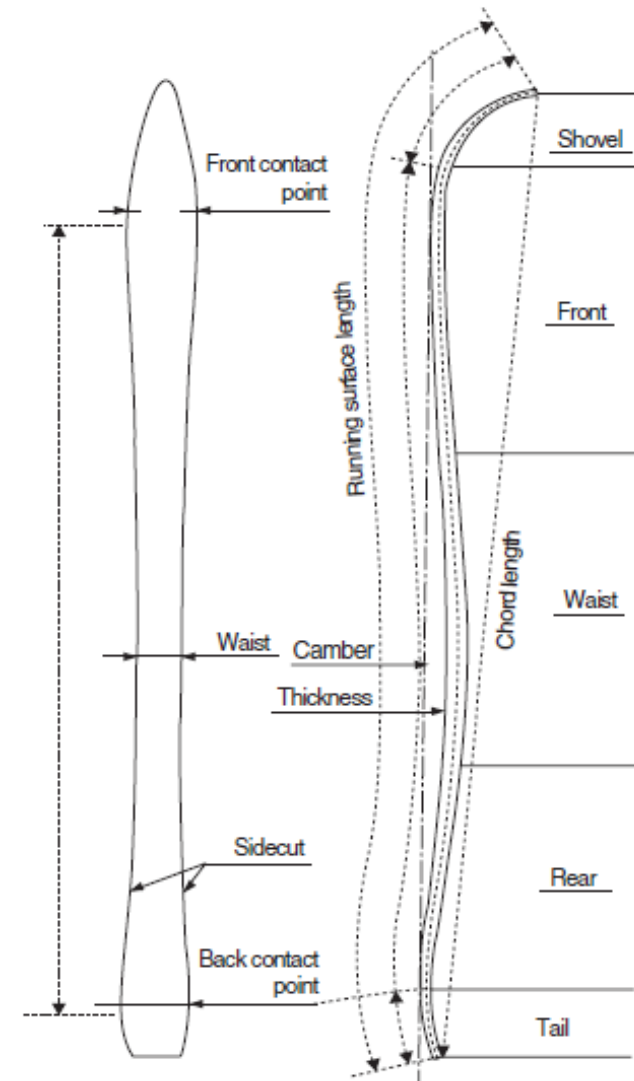
Materials in Skiing



- Wood was initially used – e.g. hickory
 - Monolithic
 - Highly anisotropic
 - Poor strength in torsion
 - Sensitive to humidity
 - Absorbs moisture
 - Warps/distorts
- Heavy
- Difficult to manoeuvre
- Warping and structural failures were common

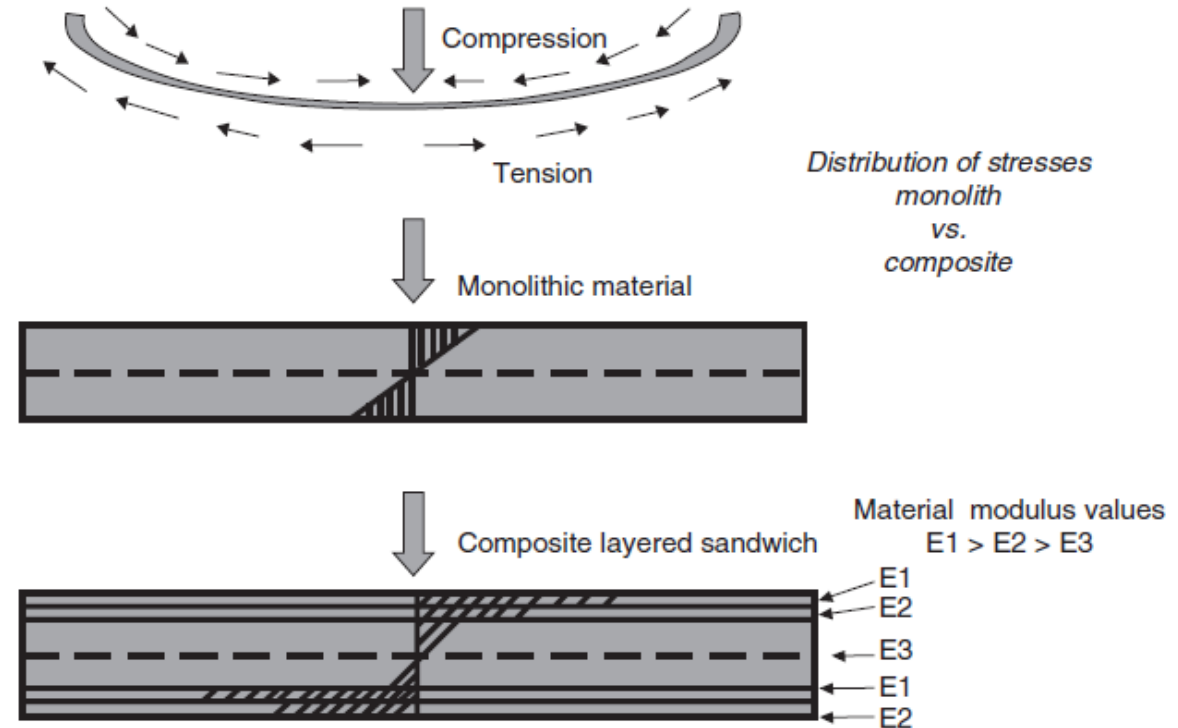


12.3 Macrostructure of wood.



Materials in Skiing

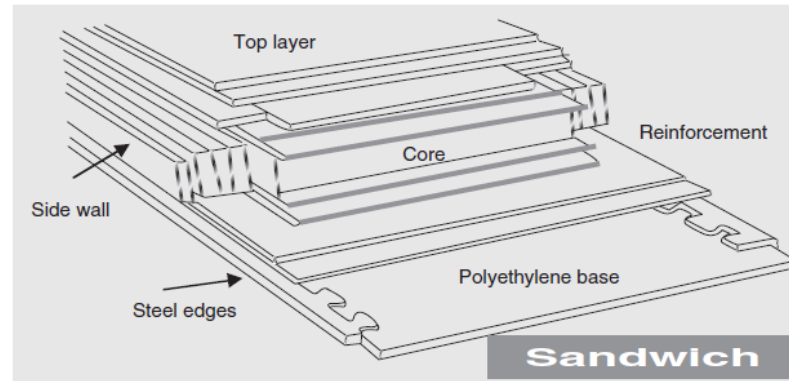
$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$



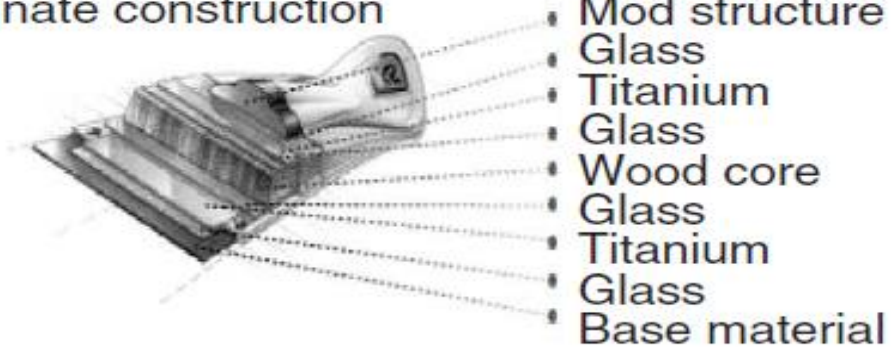
12.5 (Two-dimensional) stress distribution in simple monolith, versus multilayer dissimilar material lay-up.

Materials in Skiing

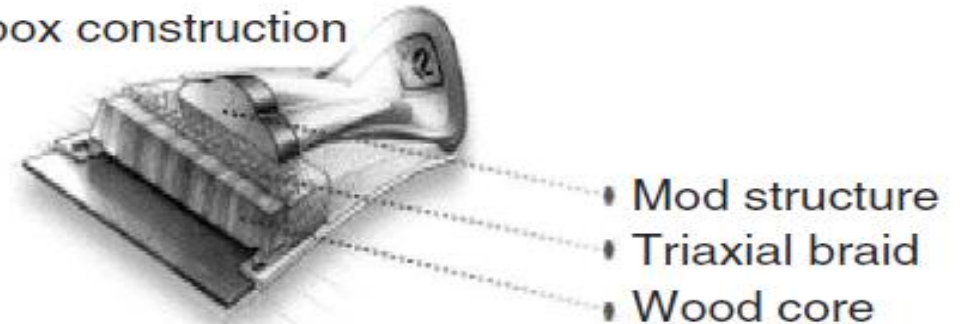
- Steel edges in 1930s
- 'Metal' ski introduced in 1950s
 - Howard Head
- Wood/Metal/fibreglass
- Bonding and joining issues
- 2001/2.....



Metal laminate construction



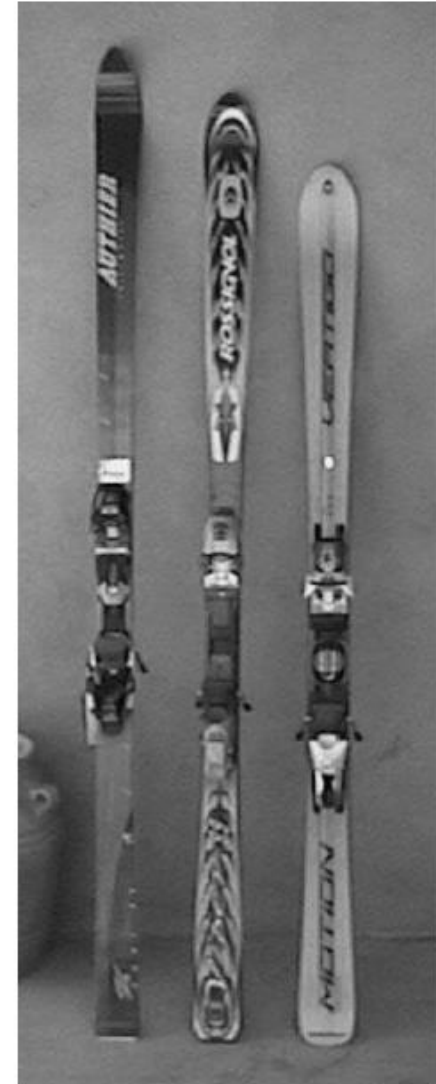
Torsion box construction



12.7 Product line examples illustrate the use of advanced materials and original designs.

Materials in Skiing

- Pre 1990 – ‘all mountain’ skis were 195 – 210 cm
- 1995 length reduced to < 198cm
- 2000 <180 cm
- 2002 Utah Games 155cm
- Modifications to the shape and contours
- Better use of engineering materials
 - Tailor strength, flex and stability



Materials in Skiing

- Carving with a traditional ski
 - Ski displaced well outside the skiers body
 - Only possible at high speed
 - Centrifugal force maintains balance



- 'Carving' ski
 - More ski-snow contact at lower edge angle
 - Lower velocities
- Advances due in part to materials to aid flex



Notes adapted from/further reading

- Materials in sports equipment, Mike Jenkins, 2003