Looking at the “stacked” planks in (a) it can be seen that if they are individually place and NOT attached to each other, slippage will occur between them.

Each plank is bending individually;
  C in top fibers
  T in bottom fibers

If an adhesive is applied that bonds the planks together, then the planks will bend as one beam;
  $C_{\text{max}}$ in top fibers of top plank
  $T_{\text{max}}$ in bottom fibers of bottom blank

The adhesive will then be resisting the “shearing stress” that occurs in those planes due to vertical loading.
• The equation for horizontal shear can be calculated from an equation:

    “General Shear Formula”  \( S_s = \frac{VQ}{I_b} \)

• Where ever an internal vertical shear force \( V \) exists in a beam, internal resisting shear stresses are developed.

• To satisfy laws of equilibrium, it goes that the sum of the shear stresses over a cross sectional area must be equal and opposite to total shear force \( V \) at the segment of the beam.

• So it goes for any infinitesimal element in the beam:

• Therefore, in a loaded beam, both vertical and horizontal shear stress are developed at any given point.
• “General Shear Formula”  \( S_s = \frac{VQ}{Ib} \)

Where:
- \( V \) is computed vertical shear force at cross section being considered
- \( Q \) is the statical moment about the neutral axis of the area outside the horizontal plane being evaluated
- \( I \) is moment of inertia
- \( b \) is the width of the cross section in the horizontal plane where the shear stress is being calculated

How to find “Q”:
Since the flange shear stress will be very small compared to that of the shear stress in the web:

- It is conventional to consider ALL the shear in a girder or I-shape to be resisted by the web.
- So, for girders/I-shapes:

\[ S_s (Average \ Web \ Shear) = \frac{V}{dt_w} \]

- \( V \) is vertical shear force
- \( d \) is full depth of the beam
- \( t_w \) is the thickness of the web
It is generally the maximum shear stress that we are seeking when investigating shear stress in beams.

There are a few simplified equations that can be used for common/simple shapes.