FactSheet
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Meyer TIMBER

TO E, OR NOT TO E?

That is the question… But what is E?

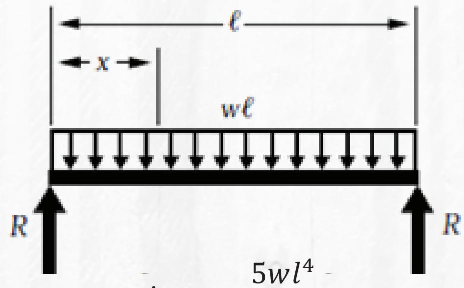
Let's first start with the technical side. "E" is the scientific symbol for the material property called Modulus of Elasticity (or MoE). The MoE is a number that measures a materials resistance to being deformed elastically (non-permanently) when a load is applied to it. All materials have a MoE, and the higher the MoE the stiffer the material. The table below shows examples of MoE of some timber grades as well as other materials. Note that MoE is not directly related to how strong a material is or how brittle it is; MoE is all about stiffness.

Material	Modulus of Elasticity (MPa)
Rubber	500
Nylon	3,000
MGP10 timber	**10,000**
LVL (hySPAN)	**13,200**
F17 timber	**14,000**
Concrete	30,000
Aluminium	69,000
Steel	210,000
Diamond	1,100,000

MODULUS OF ELASTICITY OF COMMON MATERIALS

So what is all the fuss about? When designing a structural member there are two main calculations that occur, these being for strength and stiffness. The majority of timber designs that are done turn out to be limited by deflection which is based on stiffness. We don't want excessive deflections to crack plasterboard or to be able to see visible sag. Hence the focus on E. But E is not the only thing that affects the stiffness. If you look at the deflection equation above there is another letter in there which is "I", or the Second Moment of Area. This is dependent on the geometry of the beam, and for a rectangular section is $bd^3/12$. So the breadth (b) of the beam and the depth (d) are also a factor.

Therefore, if you want to reduce deflections you can either simply increase E, or you can look at the problem holistically and look at bd^3E. You will notice the depth (d) is cubed so any change in depth is magnified. A 10% increase in breadth will reduce deflections by around 9%, but a 10% increase in depth will reduce deflections by 1.1^3=25%



$$\Delta_{max} = \frac{5wl^4}{384EI}$$

DEFLECTION OF SINGLE SPAN BEAM UNDER UNIFORM LOAD

Let's look at two examples which explain this a lot clearer:

1. A 190x45 E14 (F17) LVL is specified as a bearer to go into a 200 deep I-joist floor system. Why not look at a 200x45 hySPAN (E13.2) instead? If you work out bd^3E for each you will find the 200x45 hySPAN is actually 10% stiffer, and probably cheaper as well.

2. Let's say you have a 35mm E14 (F17) LVL specified but you have none in stock. Is it possible to use a 45mm hySPAN (E13.2)? If the depth is the same we are now looking at only bE, where the 45mm hySPAN will be 20% stiffer. In this case it will be dearer, but it gets you out of trouble quickly without re-specification (assuming all other properties are the same).

So it's not about who has the biggest E. The smart designer will consider the best combination of size and stiffness to come up with a fit for purpose specification which will give $ savings whilst still fulfilling all the other requirements. We all need to start sending this message out there. It may take a while to filter through but the end result will benefit both the construction industry and the engineered wood products manufacturing sector.

George

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