

Sections

Shear forces and bending moments aren't difficult, as long as you got an easy method to calculate them. In this chapter I just explain a method. Use it if you find it handy, and otherwise just use the method you're used to.

1 The convention

The most important thing is the convention we're using. First we'll discuss the normal force convention. But you probably already know that. Tension is positive and compression is negative.

The shear force sign convention is not that difficult either. There are 2 kinds of shear forces. The first one (which I'll call Z) has a downward force on the left, and an upward force on the right. The other one (which I'll call S) is exactly the opposite. The convention is: the Z-type shear force is positive and the S-type is negative. In diagrams, positive is drawn above the x-axis.

We also have a convention for bending moments. Suppose a bar bents in such a way that it is shaped as a hill, then it is negative. If it bents in the shape of a valley, then it is positive. To keep things simple, we still draw positive bending moments upward in diagrams.

2 Normal forces

Suppose we want to know the normal force in a point B . The most simple way to calculate a normal force in a point B , is to look at all the horizontal forces acting on the object on one side of point B . Add them up, while taking forces pointing away from B (thus tensing the object) positive, and forces pointing towards B negative.

When there is a structure which is not a straight line, things can get a little bit more complicated. Just draw a line tangential to the structure at point B . When calculating the shear force, only the forces parallel to that line should be added up. (This does mean you might have to dissect some forces.)

3 Shear forces

Shear forces aren't difficult to calculate either. When calculating a shear force in a point B , simply look at all the vertical forces on one side of point B . If we look at the left side, we can simply add up all the forces, which gives our shear force directly (note that negative forces automatically should get subtracted). If we look at the right side, we should take upward forces negative and downward forces positive to get the shear force. In the end, a positive shear force indicates a Z-type shear force, and a negative shear force indicates an S-type shear force, as discussed in the previous paragraph.

When there is a structure which is not a straight line, things can get a little bit more complicated. Just draw a line perpendicular to the structure at point B . When calculating the shear force, only the forces parallel to that line should be added up.

4 Bending moments

Calculating bending moments isn't very difficult either. When calculating a bending moment in a point B , we look at all the forces and torques acting on the object on one side of it. The bending moment can then be easily calculated by adding up all the external torques on one side, and the torques caused by the forces on that side. One very important rule here, is that upward forces cause positive torques and downward forces cause negative torque. This implies for both the left and the right side of point B . (To be exact, when you're looking to forces on the left, clockwise counts as positive, and when you're

looking on the right, counter-clockwise counts as positive.) A positive bending moment number indicates a valley-type bending moment, while a negative bending moment indicates a hill-type bending moment.