

第三节 提高梁弯曲强度的措施

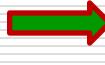


§ 7-3 提高梁弯曲强度的措施

在不减小外载荷、不增加材料的前提下，提高梁的强度就是想办法降低梁的**最大工作应力**。如何降低呢？？

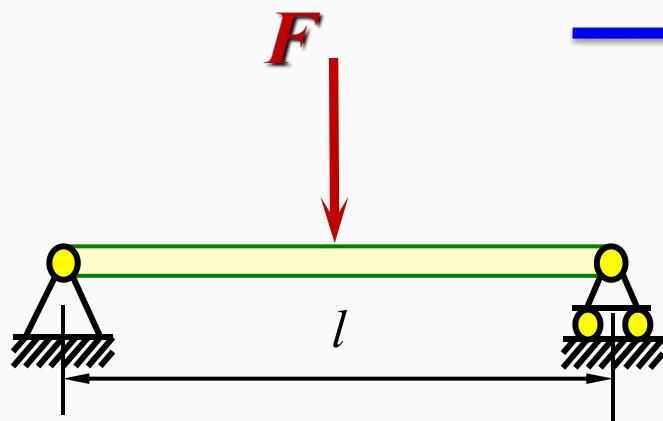
$$\sigma_{\max} = \frac{M_{\max}}{W_z} \leq [\sigma]$$

1、降低 M_{\max}  1)合理布置梁的荷载
2)合理安排支座位置

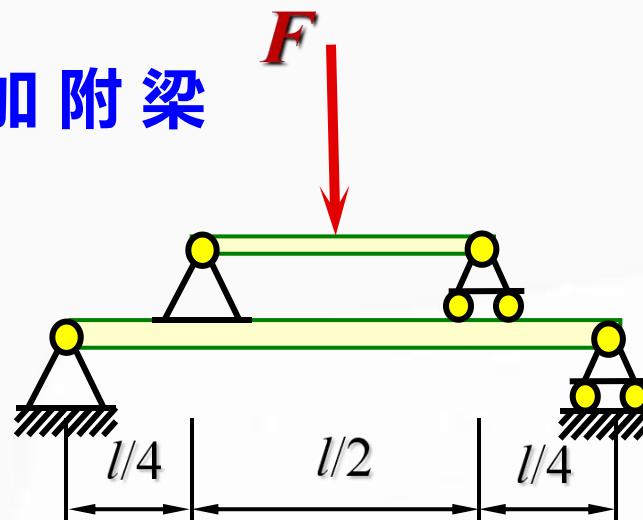
2、增大 W_z  1)合理设计截面
2)合理放置截面

一、降低梁的最大弯矩值

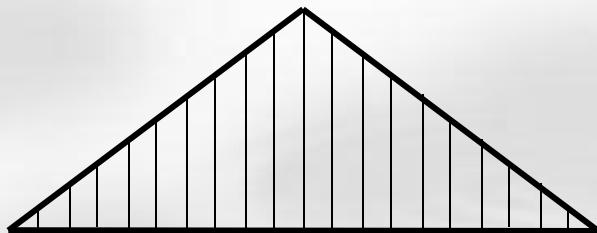
1. 合理地布置梁的荷载



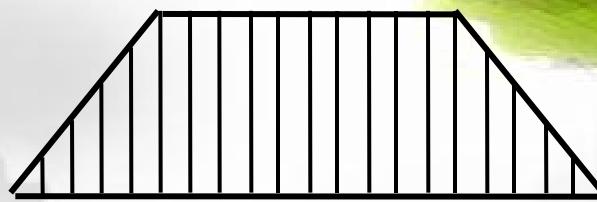
→ 加附梁



$$Fl/4$$

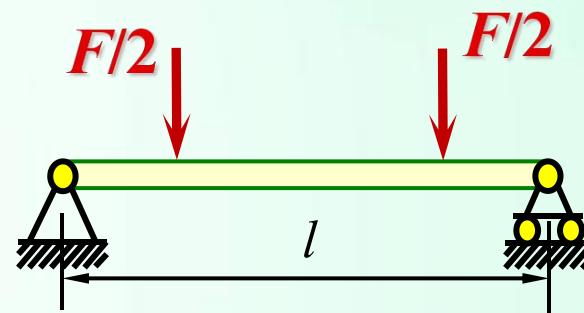
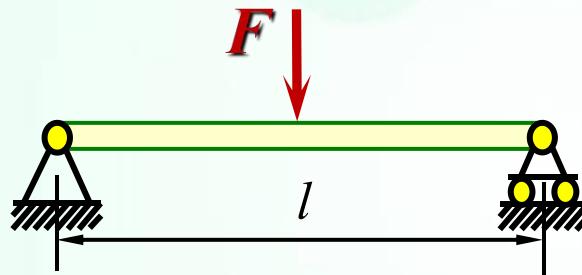


$$Fl/8$$

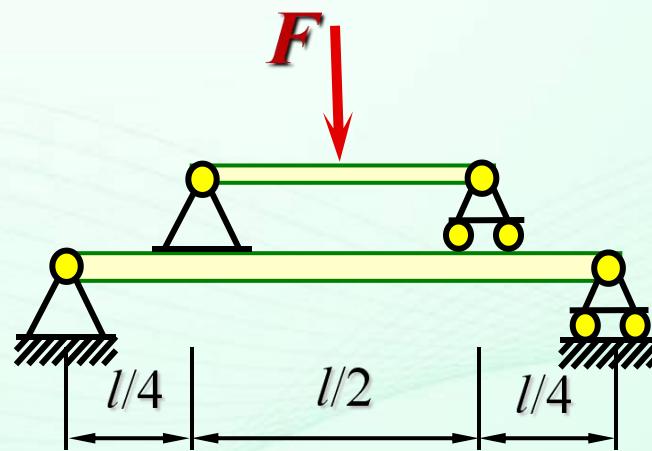


一、降低梁的最大弯矩值

1. 合理地布置梁的荷载



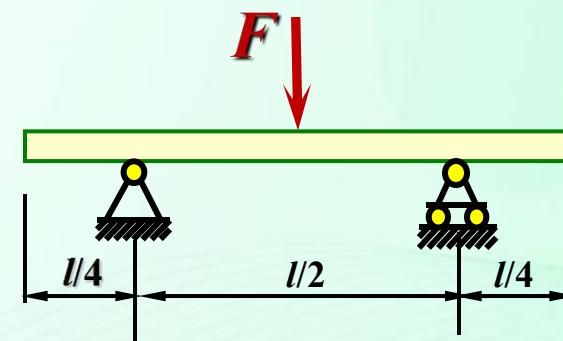
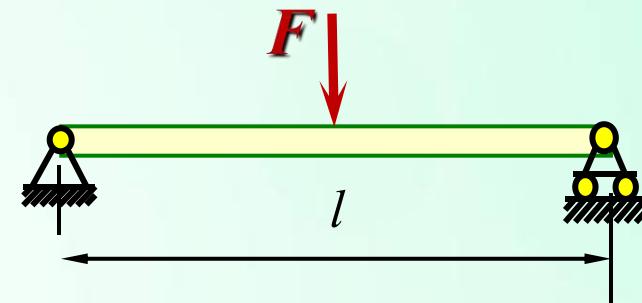
加附助梁



2.合理地设置支座位置



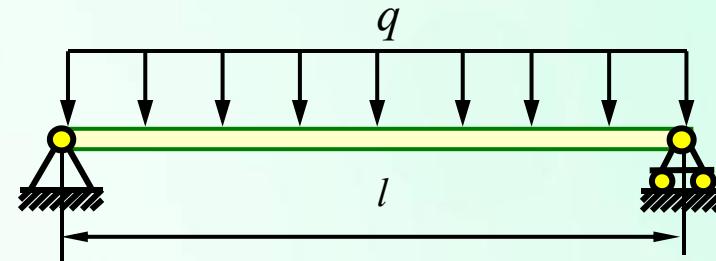
龙门吊



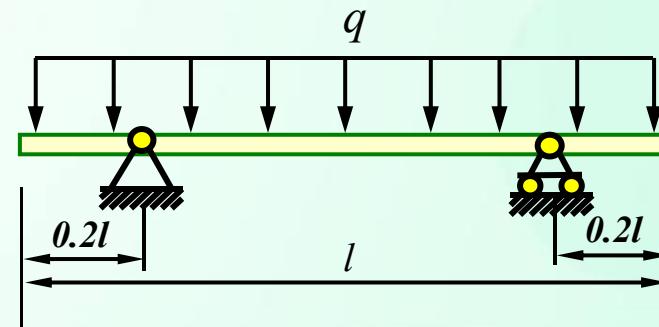
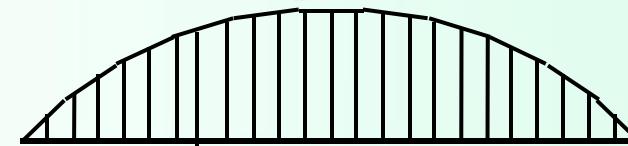
2.合理地设置支座位置



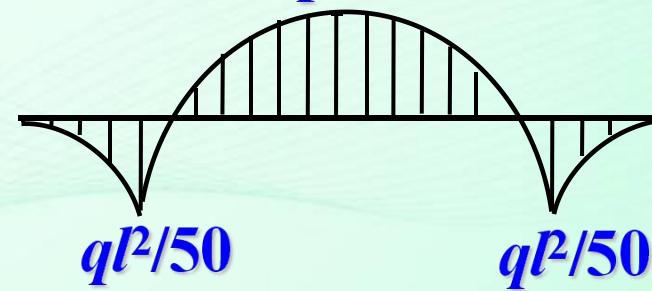
油罐车



$$ql^2/8$$



$$ql^2/40$$



$$ql^2/50$$

$$ql^2/50$$

$$\sigma_{\max} = \frac{M_{\max}}{W_z} \leq [\sigma]$$

2、增大 W_z 

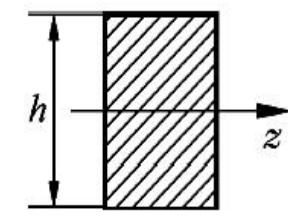
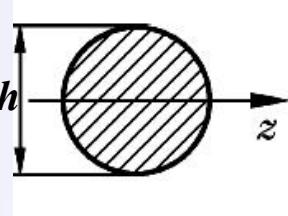
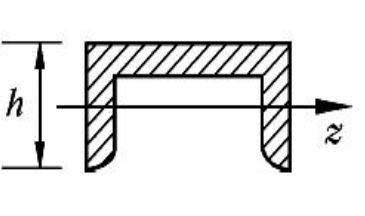
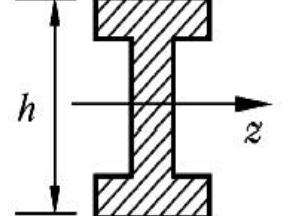
- 1) 合理设计截面
- 2) 合理放置截面

二、增大 W_z 值

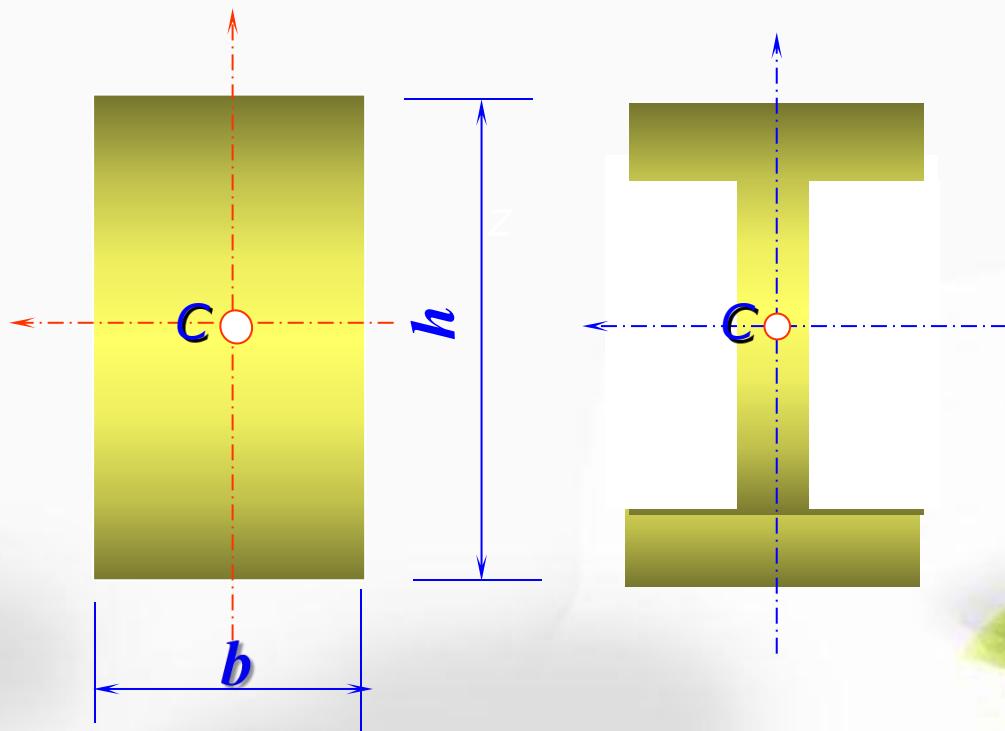
1、合理设计截面

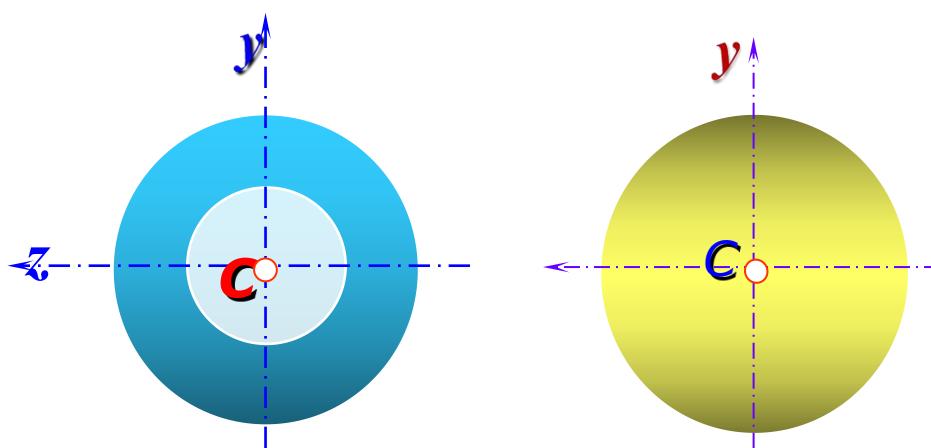
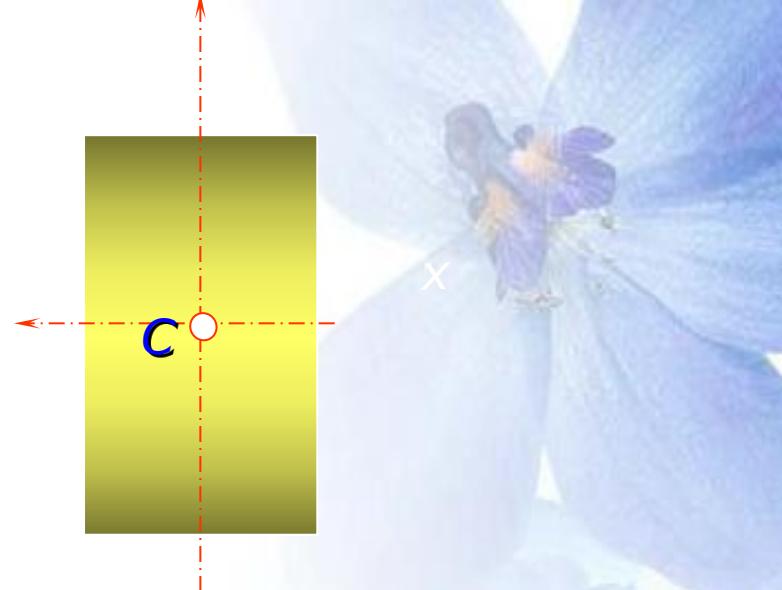
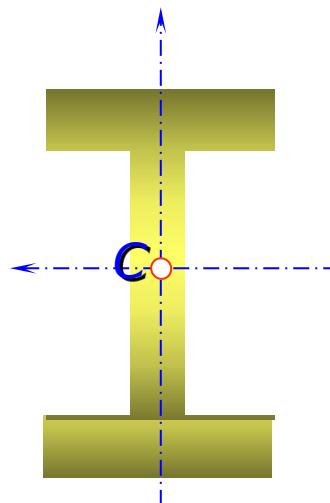
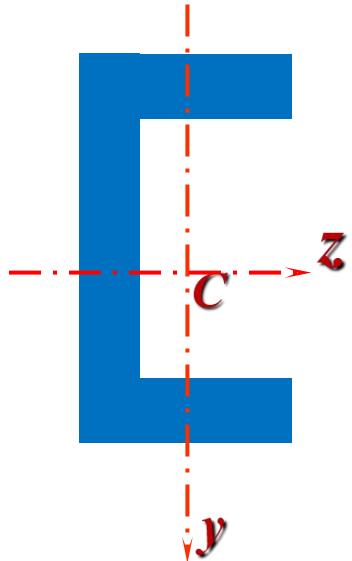
W_z/A 的比值是衡量截面是否合理的尺度,
 W_z/A 的比值越大，截面越趋于合理。

表7-1 几种常见截面的 W_z/A 值

截面形状				
W_z/A	$0.167h$	$0.125h$	$(0.27\sim0.31)h$	$(0.29\sim0.31)h$

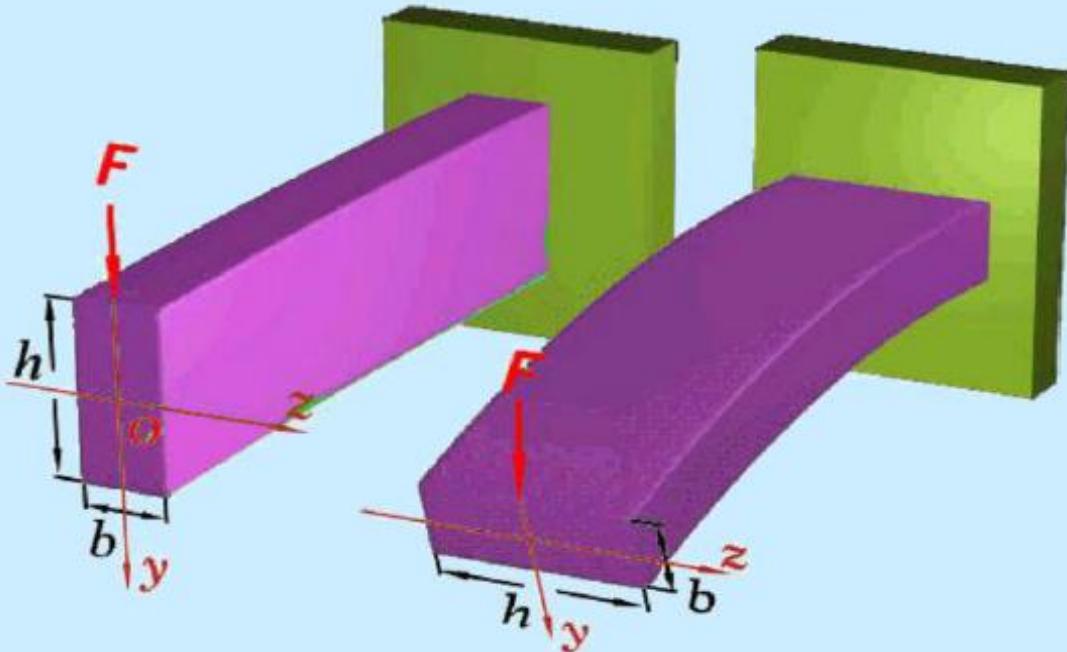
所以，在实际工程中，我们将中性轴附近不能充分发挥作用的材料移置到离中性轴较远处，使它们得到充分利用，形成“合理截面”。





**工字形、槽形截面比
矩形截面合理，矩形
截面比圆形截面合理**

2、合理放置截面



$$W_{z\text{左}} = \frac{bh^2}{6}$$

$$W_{z\text{右}} = \frac{hb^2}{6}$$

结论：竖放比平放合理

2、合理放置截面

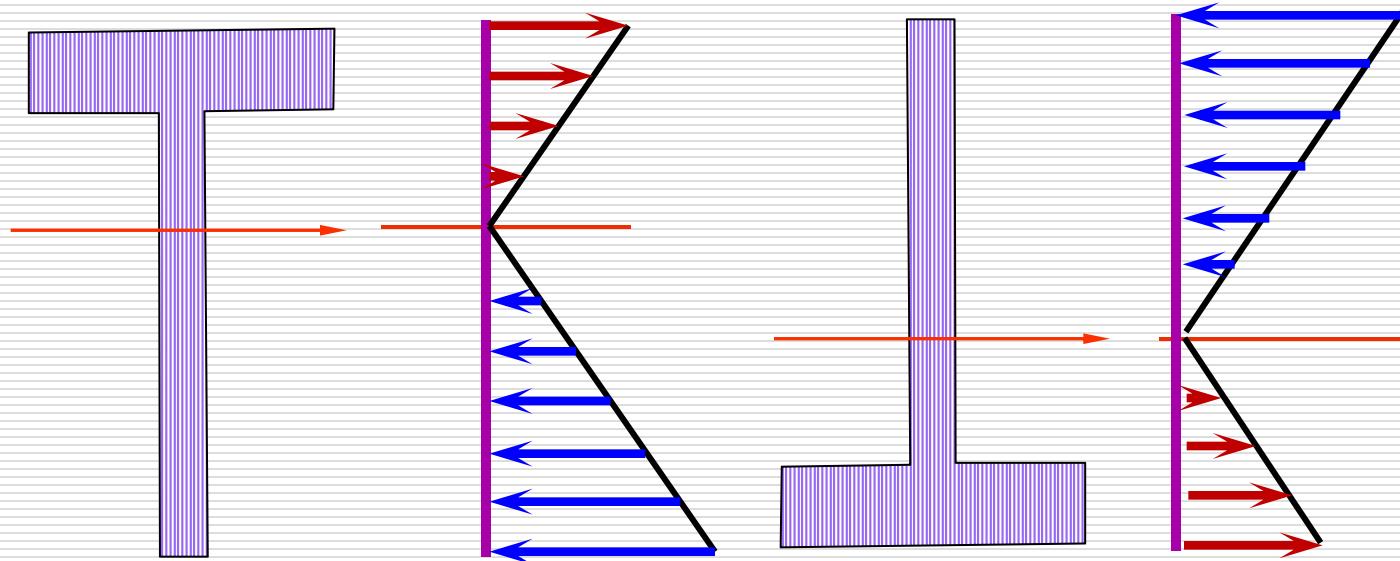
房屋建筑



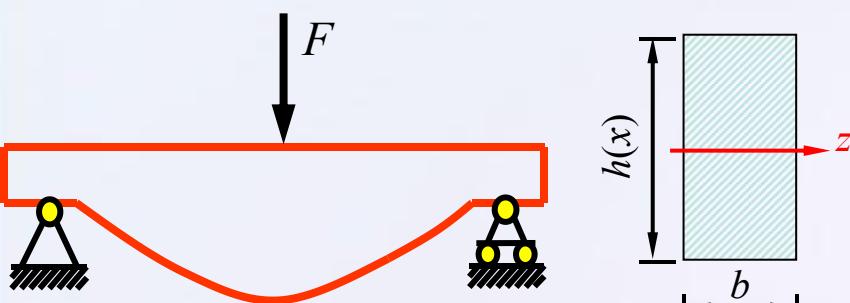
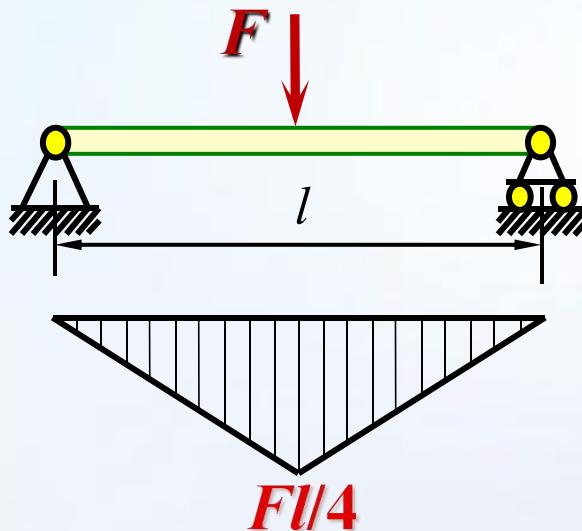
工程实例

2、合理放置截面

对于铸铁等抗拉、抗压不相同的脆性材料，最好选用关于中性轴不对称的截面（如T字形）并使中性轴偏于受拉的一侧。



三、采用等强度梁



厂房建筑中常用的**鱼腹梁**

$$\sigma_{\max} = \frac{M_{(x)}}{W_{(x)}} = [\sigma]$$

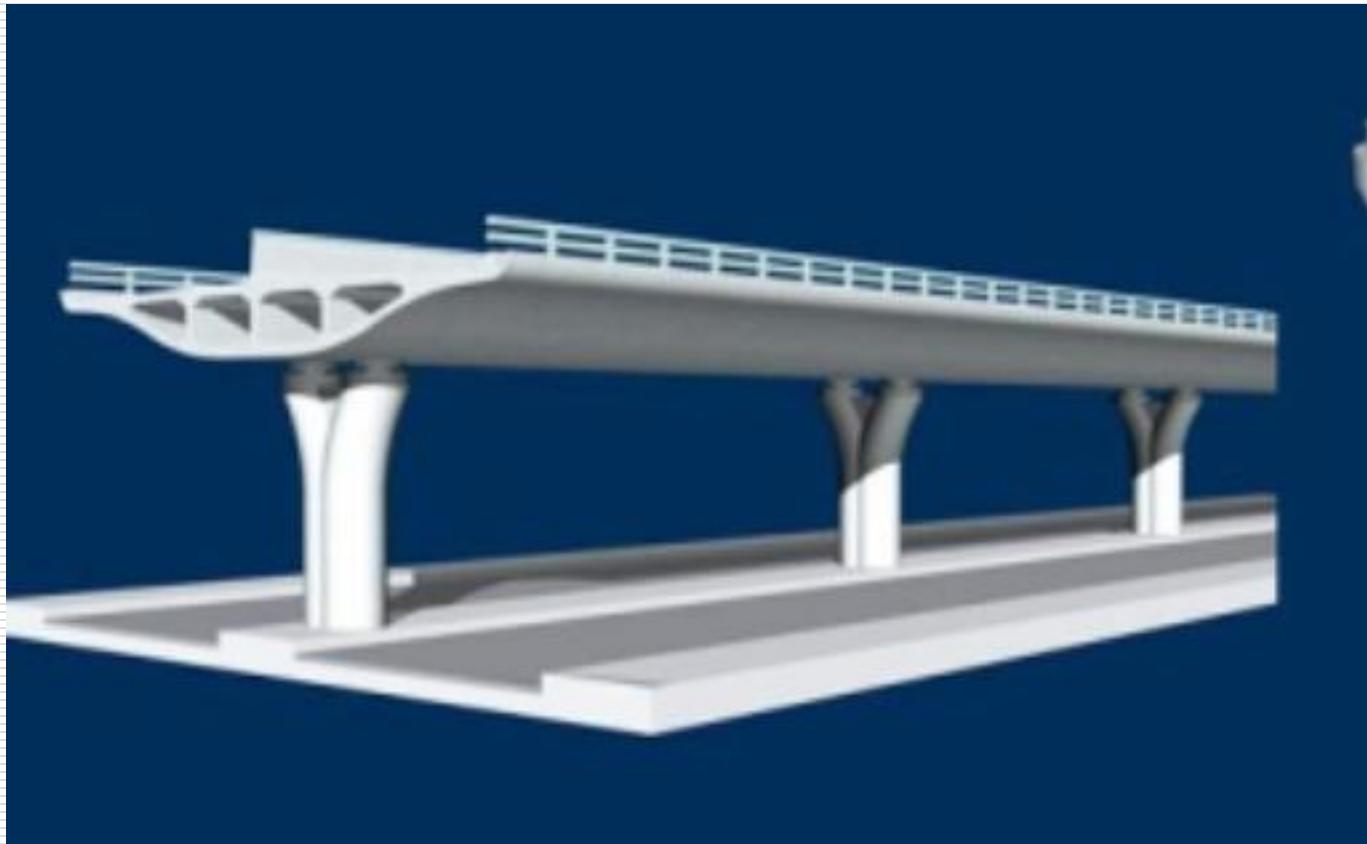
$$W_{(x)} = \frac{M_{(x)}}{[\sigma]}$$

从节约材料或减轻自重考虑，在弯矩较大的梁段采用较大的截面，在弯矩较小的梁段采用较小的截面。这种横截面尺寸沿梁轴线变化的梁称为**变截面梁**。

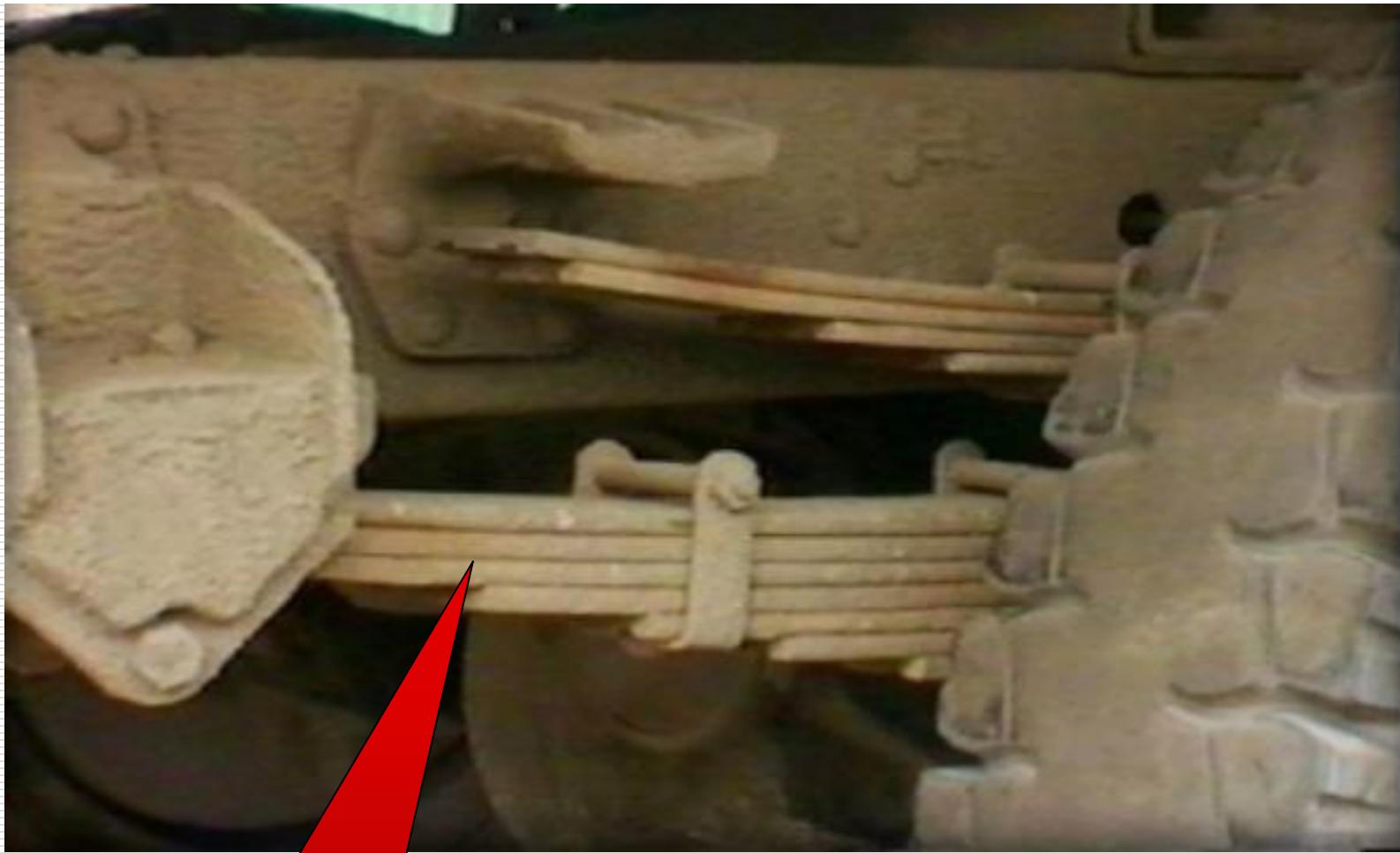
如果梁各个截面上的最大正应力都相等，且均达到材料的许用应力，这种变截面梁是最理想的形式，被称为**等强度梁**。



等强度梁工程实例



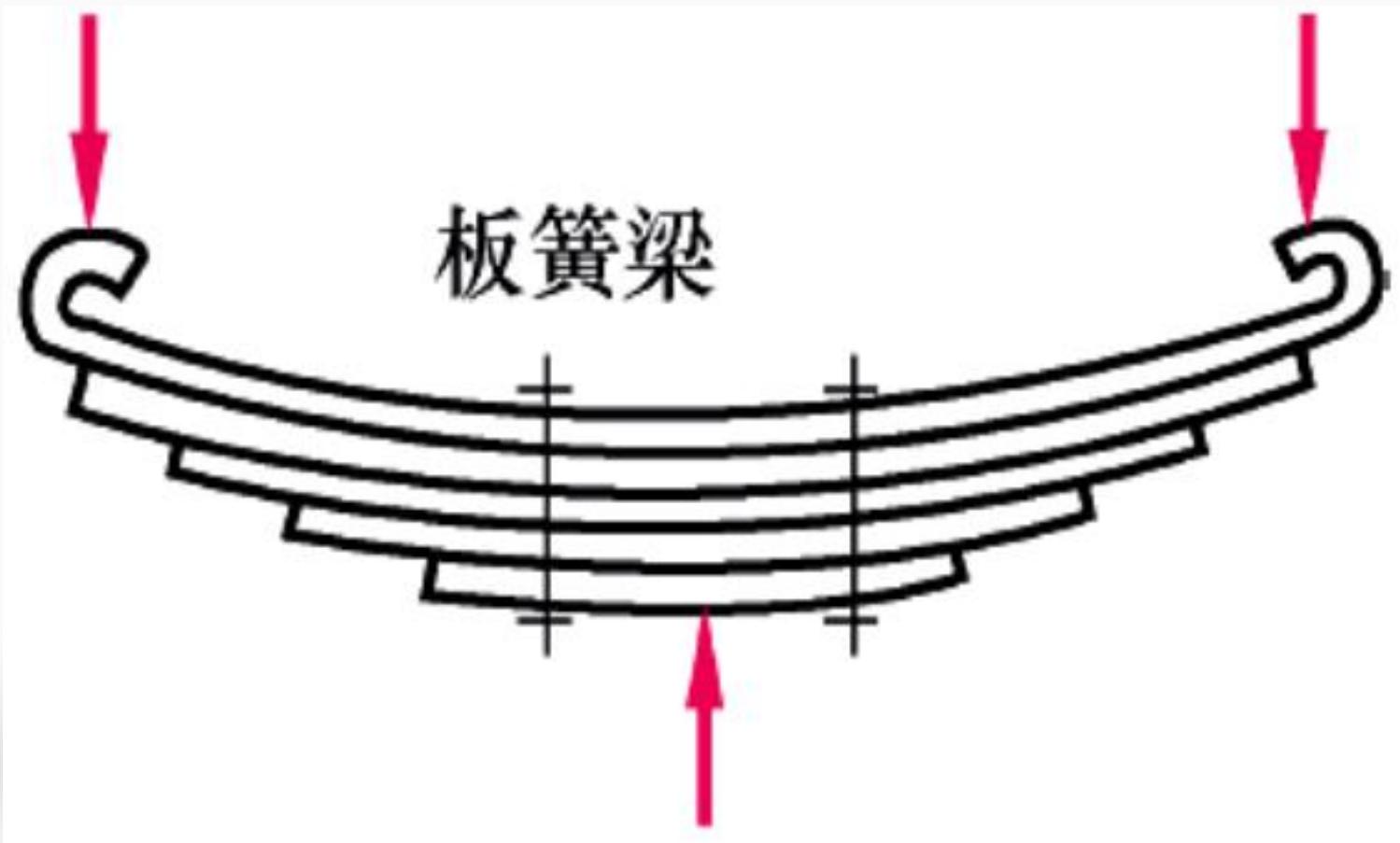
等强度梁工程实例



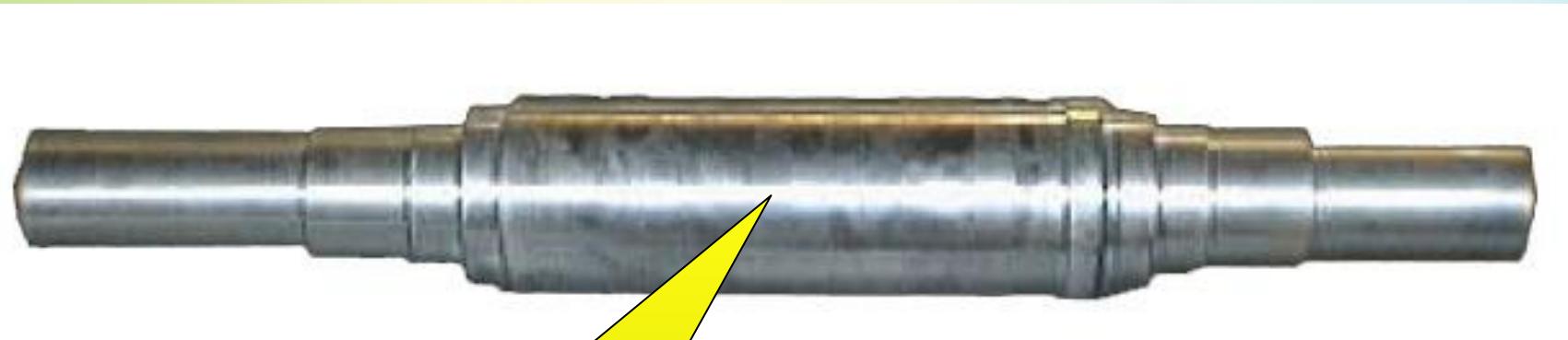
车辆底座下面
的板簧梁？

车辆底座下面叠板弹簧

等强度梁



车辆底座下面叠板弹簧



转轴为什么中
间部分要加粗？

受横向荷载作用的阶梯轴

本草綱東