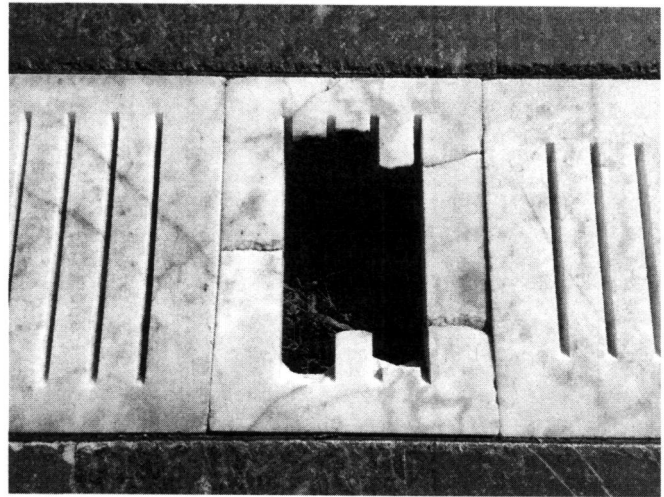


You may use your books and notes. Your signature shows that you agree with the answers. No discussions are allowed between the different teams. Each team returns one signed copy to Prof. Burleigh.

Name	signature
	Solutions

The photograph shows the marble drain covers in the main square of Mugla University. The approximate dimensions of the marble sections are 4x4x30 cm.

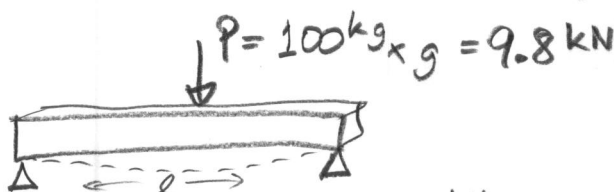


1) Why did the marble sections break?

They broke due to poor design. The sections were too thin and too narrow to take the loading of a person's weight. Marble is brittle and can not take bending tension.

2) What can be done in future drain covers to prevent this from happening?

The drain covers must be redesigned to have a larger cross-section and larger moment of inertia, I .



$$M_{\max} = \frac{Pl}{4} = \frac{9.8 \text{ kN} \times 0.3 \text{ m}}{4}$$

$$M_{\max} = 0.735 \text{ kN}\cdot\text{m}$$

$$I = \frac{bh^3}{12}$$

$$I = \frac{4 \times 4^3}{12} = 21.3 \text{ cm}^4$$

$$\sigma = \frac{Mc}{I}$$

$$\sigma = \frac{(0.735 \text{ kN}\cdot\text{m})(2 \text{ cm})}{(21.3 \text{ cm}^4)}$$

$$\sigma = 69 \text{ MPa} \leftarrow \text{too large for marble}$$