

## Shoring Load Calculations

### Scope

When deciding what type and size of shore to build, the load to be supported must be estimated. In the event that engineering support is available this will provide more accurate figures, however some 'fireground' calculations may give the order of magnitude of the load.

### Calculations Using Density

If the type of material is known, an approximation of the volume of the debris can be made and the load worked out by multiplying the volume by the density. Some common densities are listed below.

### Density of materials

Material	(Kg/m <sup>3</sup> )
Concrete or masonry rubble	2000
Earth	2000
Granite	2700
Limestone	2300
Masonry	2000
Mud	1750
Reinforced concrete	2400
Sandstone	2600
Slate	1500
Snow – compacted	480
Snow – freshly fallen	160
Steel	7850
Timber	560

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## Calculations Using Weights

In addition, the weights of some elements of construction, building contents, etc. can be estimated by multiplying the following figures by the appropriate factor.

## Reference Weights

Material	Metric (Kg/m <sup>2</sup> )
Reinforced Concrete	2.4 per mm depth
Steel beam with concrete filled metal deck	250 – 350
Timber floor	50 – 125
Rubble	2 per mm depth
Stud walls	50-75 per floor
Furniture/contents	50 per floor
Rescuers	50-100 (lower figure for large slabs which will spread the load)

### Example 1

A structure composed of a collapsed reinforced concrete floor measuring 10 metres by 10 metres and 300mm thick, with furniture and contents plus an average of 0.2 metres of rubble on top, with rescuers working on it, will weigh:		
Concrete floor	= 10m x 10m x (2.4 x 300) kg/m <sup>2</sup>	= 72,000 kg
Furniture	= 10m x 10m x 50 kg/m <sup>2</sup>	= 5,000 kg
Rubble	= 10m x 10m x 200mm x 2kg/m <sup>2</sup> /mm	= 40,000 kg
Rescuers	= 10m x 10m x 50kg/m <sup>2</sup>	= 5,000 kg
	<b>Total</b>	<b>= 122,000 kg = 122 tonnes</b>
The capacity of a single laced post shore is 10 tonnes. If the whole floor had to be supported by laced-post shores, it would require 13.		

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## Example 2

A 5 metre x 6 metre roof composed of steel beams and concrete filled deck, with one metre of compacted snow on top will weigh:		
Roof	= 5m x 6m x 350 kg/m <sup>2</sup>	= 10,500 kg
Snow	= 5m x 6m x 1m x 480 kg/m <sup>3</sup>	= 14,400 kg
	<b>Total</b>	<b>= 24,900 kg = 25 tonnes (approx)</b>
The capacity of a single laced post shore is 10 tonnes. If the whole floor had to be supported by laced-post shores, it would require 3.		

The total load of a structure can be relatively easily calculated, but it can be difficult to determine individual load concentrations. This is why a shoring system which will give warning of overload is desirable.

A decision has to be made on whether to include the weight of damaged but currently stable floors, and what allowance has to be made for wind or other external forces.

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