Pressure and Forces

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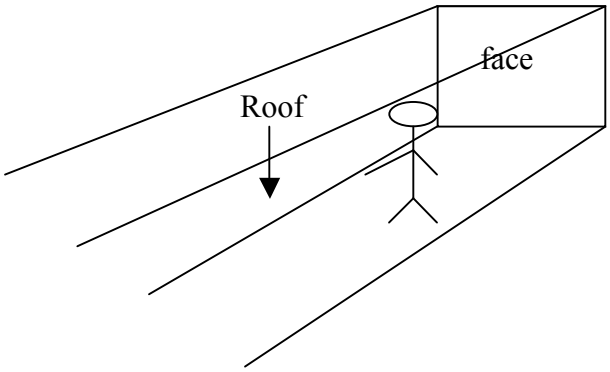
About the Author:

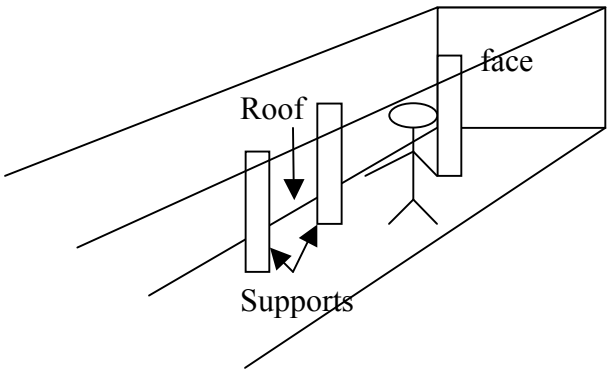
Asogan Moodaly received his Bachelor of Science degree (with honours) in Mechanical Engineering from the University of Natal, Durban in South Africa. For his final year design project he worked on a 3-axis filament winding machine for composite (Glass re-enforced plastic in this case) piping.
He worked in Vereeniging, Gauteng at Mine Support Products (a subsidiary of Dorbyl Heavy Engineering) as the design engineer once he graduated.
He currently lives in the Vaal Triangle area and is working for Sasol Technology Engineering as a mechanical engineer, ensuring the safety and integrity of equipment installed during projects.

Pressure and Forces:

In the mining industry, the roof (hangingwall) tends to drop as the face of the tunnel (stope) is excavated for rock containing gold.



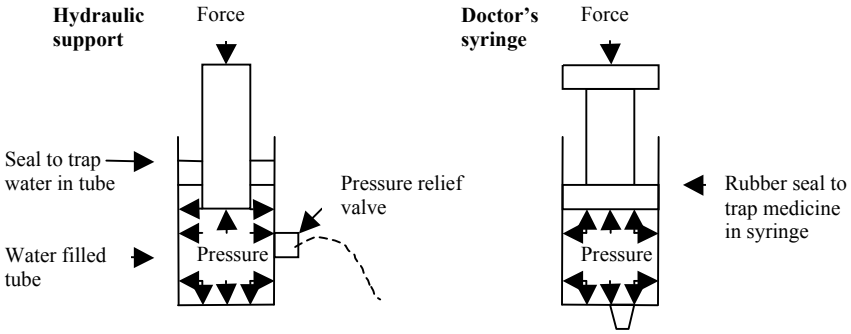
As one can imagine, a roof falling on one's head is not a nice prospect! Therefore the roof needs to be supported.



The roof is not one big uniform chunk of rock. Rather it is broken up into smaller chunks. It is assumed that the biggest chunk of rock in the roof has a mass of less than 20 000 kgs

therefore each support has to be designed to resist a force related to that mass. The strength of the material (either wood or steel) making up the support is taken into account when working out the minimum required size and thickness of the parts to withstand the force of the roof.

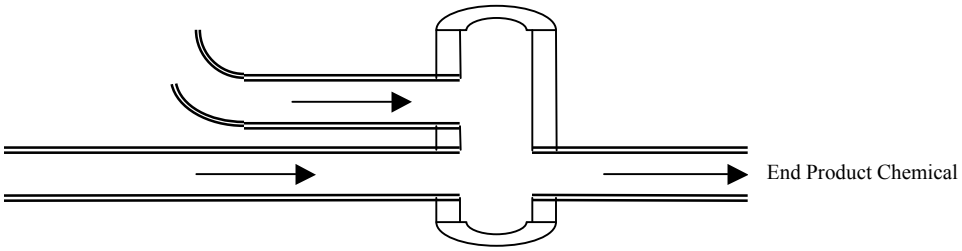
Sometimes the design of the support is such that the support needs to withstand the rock mass without the force breaking the roof…..



Therefore 'hydraulic supports' (hydro = water) use the principles of force and pressure such that as a force is exerted on the support, the water pressure increases. A pressure relief valve then squirts out water when the pressure (and thus the force) gets too large. Imagine a very large, modified doctor's syringe.

In the petrochemical industry, there are many vessels and pipes that are under high pressures. A vessel is a containment unit (Imagine a pot without handles, that has the lid welded to the pot – that would be a small vessel) where chemicals mix and react to form other chemicals, amongst other uses.

The end product chemicals are sold to companies that use these chemicals to make shampoo, dishwashing liquid, plastic containers, fertilizer, etc.
Anyway, some of these chemical reactions require high temperatures and pressures in order to work.



These pressures result in forces being applied to the insides of the vessels and pipes. Therefore the minimum thickness of the pipe and vessels walls must be determined using calculations, to withstand these forces. These calculations take into account the strength of the material (typically steel, plastic or composite), the diameter and of course the pressure inside the equipment.
Let's examine the concepts of force and pressure in further detail….