# The Need of Elastic Material Component between Rock Pressure Load and Metallic Structure Way of Receiving it in Order to Obtain a Uniform Load

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*Abstract*

*In galleries digged for different type of uses, but mostly for extracting coal, hydrotechnical adduction galleries but also for tunnels, after the dislocation of the rocks is done, the tenssions in the rock changes massively. We take for example a metallic structure used as provisory structure until the rock pressure stabilize and used in Petroșani Romania, coal mines. The galleries are digged with explosives and the shockwave gives excessive cracks and disturb the rock pressure and its characteristics. The space between the metallic structure, rock walls and bolt is filled with wood, but this article suggests a rubber band material so the rock pressure to be distributed uniformly and not concentrated in the contact points between the wood and metal profile.*

**Keywords:** *galleries, dislocation, rocks, tenssion*

**Introduction**

In Romania the most common profiles used as temporary or definitive maintenance are TH and I profiles. The TH profile can be used in an elastic construction, but the I or doubled I profiles can only be used in rigid constructions. The elastic constructions have the advantage of interacting with the rock pressure. It allows the rock pressure to relax but not to change the geometrical profile.The characteristics of TH profiles and doubled I profils are shown in table 1.

**Replacing the wood bars with rubber bands as filling materials between the rock walls, bolt and the metallic structure**

The rubber band proposed to be used as filling material between metallic structure and the excavated profile can be made from recycled material in different shapes and mechanical characteristic as experimental material. We can also use broken rubber bands from the broken machines that need to be replaced or repaired. This space is usualy filled with wood but this filling up material share out the tensions around the metallic structure concentrated in contact points and not uniform around the structure.

The metallic structure that is designed to recive the rock pressure is presented in figure 1.

**Comparative study between TH and I profiles considering the rock pressure and the rock proprieties**

The distance between the profiles is given by their capacity of taking over the rock pressure of each profile. If we note with *L* the distance between the frameworks the calculation of it is given by the formula:

$$L = \frac{q}{P_M}[m]$$

where $q$ is the capacity of taking over the rock pressure and $P_M$ is the rock pressure.

For different values of the rock pressure the results are: for THN-21, in shale:

$$L^m_{THN21} = \frac{13,3}{18,4} = 0,73m$$

for double I-12 in shale:

$$L^m_{I12.dublu} = \frac{9,73}{18,4} = 0,59m$$

for THN-21, in sandstone:

$$L^g_{THN21} = \frac{13,3}{11,6} = 1,14m$$

for double I-12 , in sandstone:

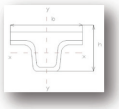
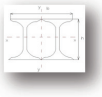
$$L^g_{I12.dublu} = \frac{9,73}{11,6} = 0,83m$$

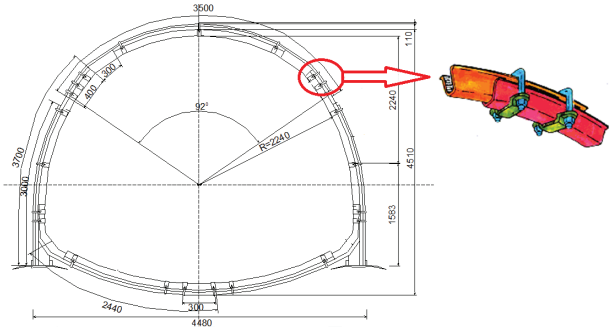
The results show that if the underground construction is made in rocks like shale, the distance between the frameworks is 0,73 meters and the I profiles needs 0,6 meters between the frameworks. For sandstone the TH profiles need one meter between the frameworks, and The I profiles need 0,8 meters. From this we can conclude that the TH profiles fits for rocks like shale but for rocks like sand stone the I profiles fits.

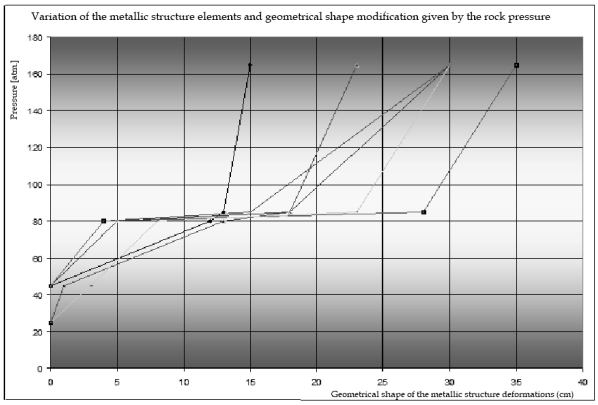
For evaluating the distance between the frameworks by considering the proprieties of the rocks and the dimension of the underground construction the formula is:

$$L = \frac{q \cdot f}{4 \cdot \gamma \cdot r^2 \cdot k_0}[m]$$

where $f$ is the Protodiakonov clasification strenght coefficient, γ is the rock weight, $r$ is the radius of the gallery and $k_0$ is the rock uniformity coefficient. For values given to the formula the results are:

| Name of the profile | Shape and dimmension of the profile | | | Weight G kg/m | Transversal section F, $cm^2$ | Momentum | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Shape | h, mm | b, mm | | | x-x $W_x$ $cm^3$ | y-y $W_y$ $cm^3$ | $\frac{W_y}{W_x}$ $\frac{cm^3}{cm^3}$ | $\frac{W_x}{1kg/m}$ | $\frac{W_y}{1kg/m}$ |
| TH |  | 85 | 98 | 12,9 | 16,4 | 32,0 | 30,6 | 0,96 | 2,5 | 2,4 |
| | | 98 | 112 | 21,0 | 26,8 | 57,8 | 63,0 | 1,09 | 2,8 | 3,0 |
| | | 119 | 149 | 29,0 | 37,0 | 99,6 | 107 | 1,11 | 3,4 | 3,7 |
| | | 144 | 147 | 43,6 | 55,6 | 179,0 | 179 | 1,00 | 4,1 | 4,1 |
| Double I |  | 100 | 100 | 16,6 | 21,2 | 68,4 | 31,4 | 0,46 | 4,1 | 1,9 |




for shale:

$$L^m_{THN21} = \frac{13,3 \cdot 4}{4 \cdot 2,69 \cdot 2^2 \cdot 1.3} = 0,95m$$

for sandstone:

$$L^g_{THN21} = \frac{13,3 \cdot 6}{4 \cdot 2,73 \cdot 2^2 \cdot 1.3} = 1,4m$$

for shale:

$$L^m_{I12dublu} = \frac{9,73 \cdot 4}{4 \cdot 2,69 \cdot 2^2 \cdot 1.3} = 0,72m$$

for sandstone:

$$L^g_{I12dublu} = \frac{9,73 \cdot 6}{4 \cdot 2,73 \cdot 2^2 \cdot 1.3} = 1,08m$$

As the results shows, the TH profile as well as the I profile can be used, but the decision for choosing the right profile depends on financial reasons. A bigger distance between the frameworks needs less frameworks so the price of the construction is smaller.

**Rock pressure limits for the metallic structure to recive by keeping the geometricsal shape unmodify**

The rock pressure values are variable and depends by the mechanical rock characteristics, the profile characteristics and geometrical shape of the gallery. The values obtained at University of Petroşani, Mine Faculty, Minning Constructions laboratory, are given in the graphic from figure 2.

**Conclusions**

The dependence between the elastic behavior of the metallic structure and rock pressure was showen above. From the manifestation of the metallic structure it can by seen that an elastic material is needed to fill the place between the steel profile and rock wall so the pressure to be distribuited uniform. In that case the graphic is expectd to by more like a sine function.

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## *Zastosowanie połączenia elastycznego pomiędzy wyrobiskiem a konstrukcją metalową w celu uzyskania jednolitego obciążenia*

*W wyrobiskach wybranych do różnego rodzaju zastosowań, głównie do wydobycia węgla, budowli hydrotechnicznych, tuneli, po zakończeniu wydobycia skal napięcie w skale zmienia się ogromnie. Jako przykład pokazano stabilizowanie się ciśnienia w wyrobiskach w kopalni węgla Petroșani w Rumunii Eksploatacja jest prowadzona za pomocą materiałów wybuchowych, fala uderzeniowa powoduje nadmierne pęknięcia i zaburza ciśnienie w skałach. Przestrzeń między obudowa a górotworem metalową jest wypełniona drewnem, ale w tym artykule przedstawiono zastosowanie gumy dla uzyskania równomiernego nacisku skały,*

***Słowa kluczowe:*** *wyrobiska, górotwór , przemieszczenia, naprężenie*