THE STUDY OF ADAPTATION OF THE METALIC TOWER IN ORDER TO MAKE TWO EMBARKING RAMPS FOR THE TOURISTS AT THE UNIREA SHAFT FROM THE SLĂNIC PRAHOVA SALINE

IOSIF DUMITRESCU, *University of Petroşani, Petroşani, ROMANIA*
VILHELM ITU, *University of Petroşani, Petroşani, ROMANIA*

ABSTRACT: In this paper, we show the solution for the realisation of two ramps for embarking tourists starting from the construction of the cage with two storeys,wich doubles the transportation capacity for the Unirea shaft at the SlănicPrahova Saline, in order to enlarge the persons transportation flux on the shaft.

KEY WORDS: Saline, shaft, embarking ramps

1. INTRODUCTION

Romania is a country with numerous highly attractive touristic destinations, due to the existing natural potential. In this category we can also find salines, known especially for their therapeutical effects on people's health. The most well-known "salt palaces" are at SlănicPrahova, Turda, Praid, Cacica, Târgu Ocna and Ocnele Mari.

The town of SlănicPrahova is known for its salt lakes (also called "Baths"): BaiaBaciului, Baia Verde and BaiaRoșie, as well as for Salina Veche and Salina Nouă. In the Salina Nouă, salt is still being extracted, but Salina Nouă is opened to the public and is used as a recreation place..

a) b) c)

Figure 1 Touristic objectives in SlănicPrahova

Figure 2. Tourists waiting to enter the Unirea saline in Slănic

The Salt Mountain (figure 1a), one of its kind in the whole world, The Bride's Grotto (figure 1b), Baia Baciului and Unirea Saline are only a few of the resort's attractions. According to

documents, for more than 300 years, this was an important place for salt mining in the country. Unique in the country and in Europe due to its dimensions, the Unirea Saline from Slănic Prahova is visited daily by hundreds of tourists, and the peak is reached on weekends, when the number of tourists rises up to over 1.000 (figure 2).

2. THE TOWER OF THE EXTRACTION INSTALLATION OF THE UNIREA SHAFT FROM SLĂNIC PRAHOVA SALINE

In figure 3, we show the tower of the extraction installation from the Unirea shaft at SlănicPrahova. It is a mechanical construction made of the tower proper and the abutment. From the evidence kept at Slănic saline, it is supposed that the year of construction is 1930, which means it's over 80 years old.

Figure 3. The extraction installation tower from Unirea shaft

The construction materials from which the tower is made are laminated metallic profiles of the type L, U, I and thick plate, executed with the technical, mechanical and geometric characteristics corresponding to the year 1930. The joints of the composing elements are done with welding at the abutment and with rivets and screws at the tower. The tower's foundations are of monolith concrete and the pinning down of the tower and the abutment is done with metallic screws for the foundations.

3. THE ANALYSIS OF THE SHAFT TOWER UNIREA FROM SLĂNIC

In Figure 4, we show the sketch of the tower from the Unirea shaft at Slănic saline. The sketch was made based on existing documentation and by making measurements. This allowed us to determine the calculus model of the tower and of its solicitation loads.

Also, this allowed the determination of the dimension of 3560 mm between the floors of the two cabins of the cage with two storeys, which will double the flux of persons transportation on the shaft. In the case of the setting up of the second ramp for embarking at the level of the support platform of the abutment, by annulling the two stiffening braces of the tower and replacing them with another metallic construction that will be shown subsequently.

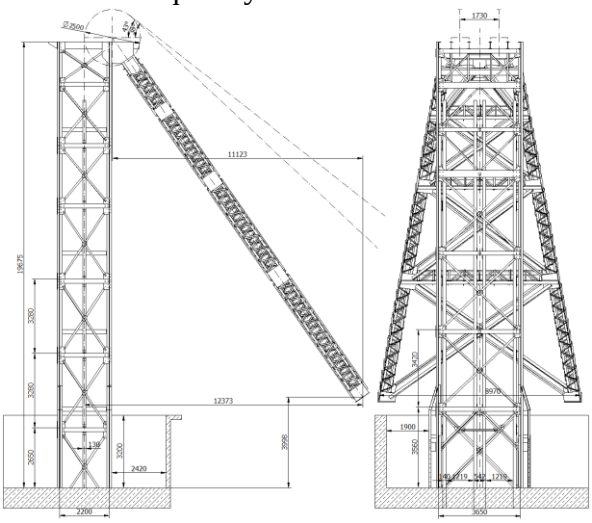

Figure 4. The tower's sketch with the dimensions necessary to the calculus model

The calculation abstract was made for a dynamic coefficient of the extraction installation of 1,6 and, based on the constructive geometry of the tower and on the geometrical characteristics of the sections of the composing elements (tower, platform, abutment), we made a geometric calculus model of the tower. The static undetermined system of the tower was solved using the Mohr-Maxwell unitary loading method and the Vereschagyn procedure, and we obtained

the bending moment and normal and cutting force diagrams, which are shown in figure 5.

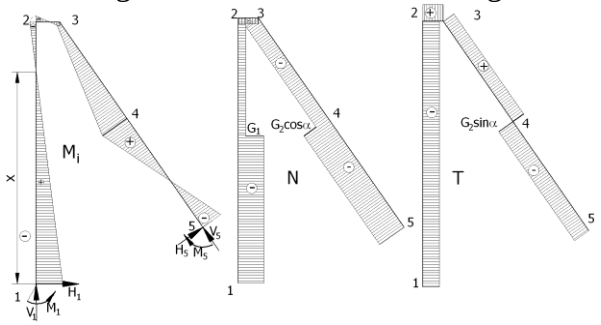

Figure 5. The bending moment and normal and cutting force diagrams

After analyzing the tower for the three solicitation cases: 1 – both cages are empty; 2 – a cage is loaded with persons and a cage is empty; 3 – both cages are loaded with persons, the following results were obtained:

- The maximum tension resulted from the calculation abstract in the area of the second section of the tower which is about to be modified was of 10,77 N/mm^2;
- The maximum tension resulted from the tensometrical measurements on the braces of the second section of the tower is of 23,1 N/mm^2, resulted at the safety braking on the cage with a mass of 2750 kg;
- In both cases, the safety coefficient for OL 37, with a flowing limit of 210 N/mm^2 has a value greater than 9;
- We can observe that, as a result of dismantling the braces that will be replaced, in the same loading conditions, we obtain small modifications of the tensions in the 12 measurement points;
- After realizing the metallic construction for realizing the second surface ramp and replacing the two braces, new measurements will be made for the same loading conditions;
- In the first phase, we will realize the metallic construction for replacing the two braces, in order to make the measurements and to get to the next stage of realization of the cage.

4. THE STUDYING OF THE NECESSARY MODIFICATIONS AT THE RAMP OF THE SHAFT AT THE SURFACE

Starting from the construction of the two storeys cage, which will double the transportation capacity on the shaft of Unirea Saline, we determined the height between the two embarking / debarking ramps from the cage of 3560 mm.

In figure 6, we show the 3D model of the new ramp from the surface of the shaft of Unirea Saline from Slănic, which was realized based on the tower's documentation and based on the measurements that were made. This is composed of: 1 – the existing ramp; 2 – the cage's guys; 3 – access stairs to the new ramp; 4 – braces that will be replaced; 5 – the closing doors of the new ramp; 6 – the new solution to replace the braces; 7 – the ramp's platform; 8 – support foot of the ramp.

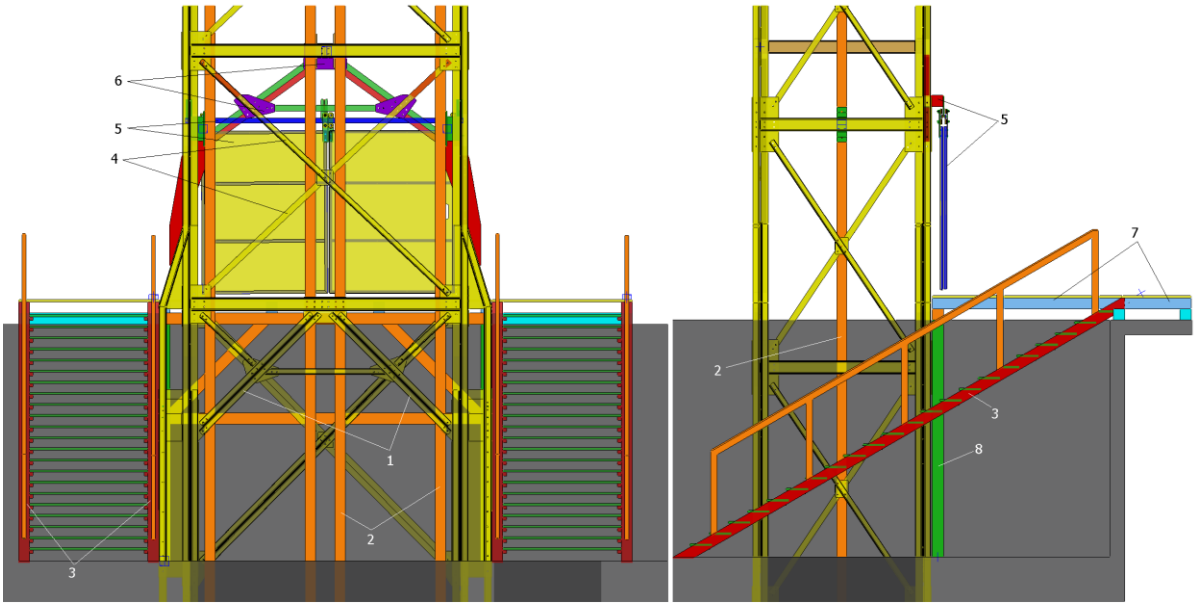

Figure 6. The 3D model of the new ramp at the surface of the shaft of the Unirea saline from Slănic

The new ramp was designed to have a single access entry for persons at the two embarking ramps, one stair being used for access at the superior ramp, and the other for evacuating persons that come out from the saline using the superior ramp. For this, we used the parapet and the support platform of the tower's abutment.

In order to set up the new ramp, we must dismantle the two braces, marker 4, on the eastern side of the tower and replaced with the metallic construction, marker 6. Also, we must modify the metallic stair that provides access at the pulleys platform, by annulling the inferior section and realizing a new access section at the stair's platform on the southern wall of the tower. This new access section at the metallic stair of the tower must be separated from the superior embarking ramp with an access door.

The superior ramp is provided with safety doors for closing the shaft's compartments during the movement of the cages on the shaft.

The sustaining system of the doors is tied to the new metallic construction of the tower.

The platform, marker 7, set up at the superior ramp, is resting on a foot, marker 8, that is resting on the concreted platform of the lower ramp and on the eastern wall of the tower.

The metallic construction of replacing the braces from the second section of the eastern wall of the tower is shown in figure 7, where the following were noted: 1 – stiffening and support gusset; 2 – closing braces; 3 – linking gusset; 4 – support braces; 5 – dash gusset; 6 – stiffening stringer; 7 – spar for door support; 8 – pulley support for the door; 9 – sliding doors. The fitting of the new metallic construction of stiffening the tower's section is realized by assembling with screws of M16 X 45, using the gussets of the replaced braces.

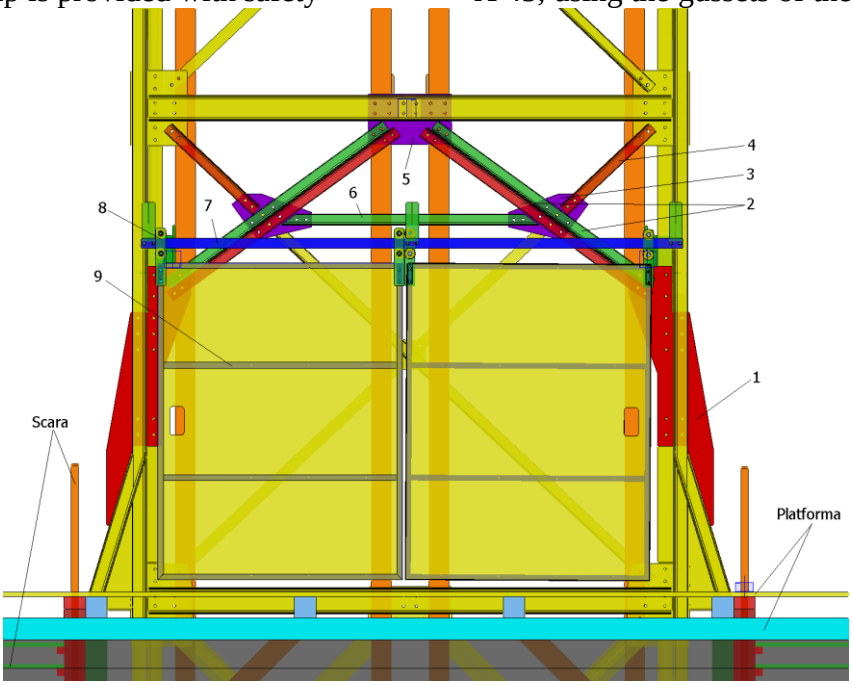

Figure 7. The metallic construction for the superior ramp

5. THE STUDY OF THE NECESSARY MODIFICATIONS AT THE RAMP OF THE UNDERGROUND SHAFT

In figure 8a we show the actual solution of timbering the pit, solution which must be modified by the new transport system according to the model in figure 8b, where the following were noted: 1 – foot; 2 – longitudinal base dash; 3 –transversal dash; 4 – supplementary longitudinal dash; 5 – longitudinal dash 1; 6 longitudinal dash 2; 7 – cage guy; 8 – central foot; 9 – left inferior foot; 10 – right inferior foot; 11 – superior foot.

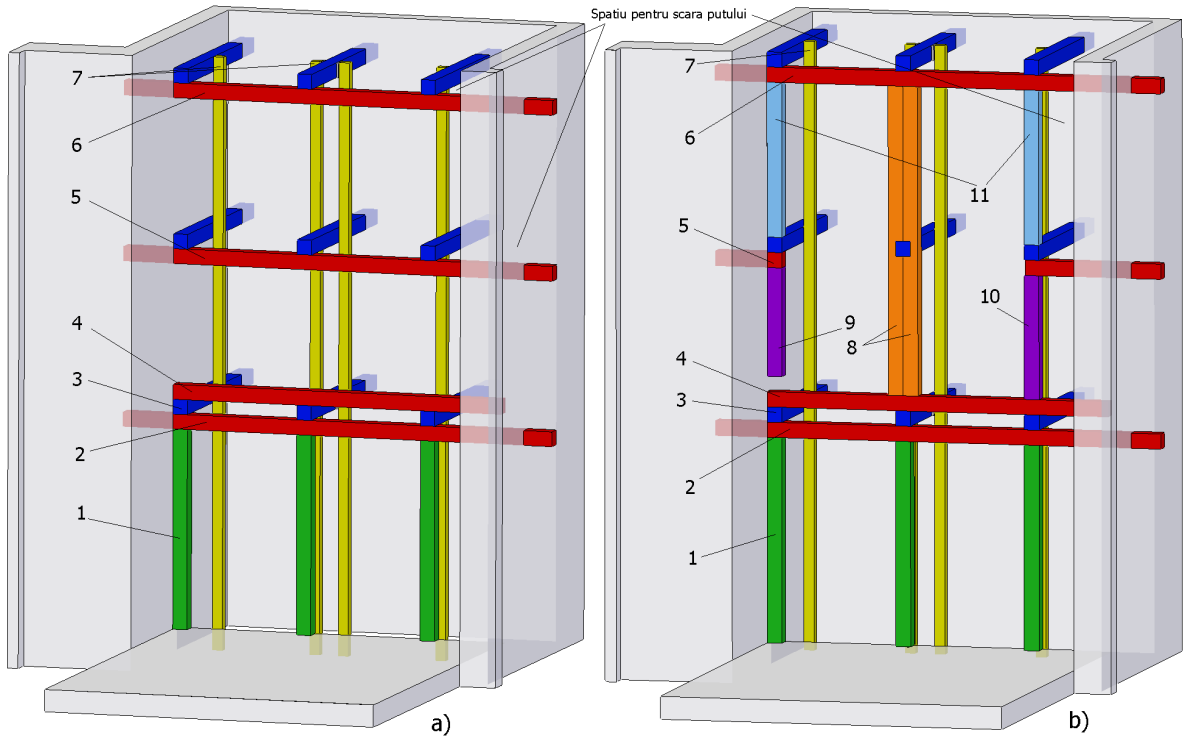

Figure 8. The modification method of the shaft's binding in order to realize the underground ramp

The modification of the ramp of the underground shaft is done by cutting the longitudinal dash 1, marker 5, in order to create the access space to the superior cabin of the two storeys cage. The ends of the dash that was cut are sustained by the inferior and superior feet, and the central transversal dash will be supported by the central foot, marker 8, composed of two wooden profiles of 200 X 200 mm.

The left inferior foot rests on the longitudinal dash of the ramp which will be fitted over the inferior ramp.

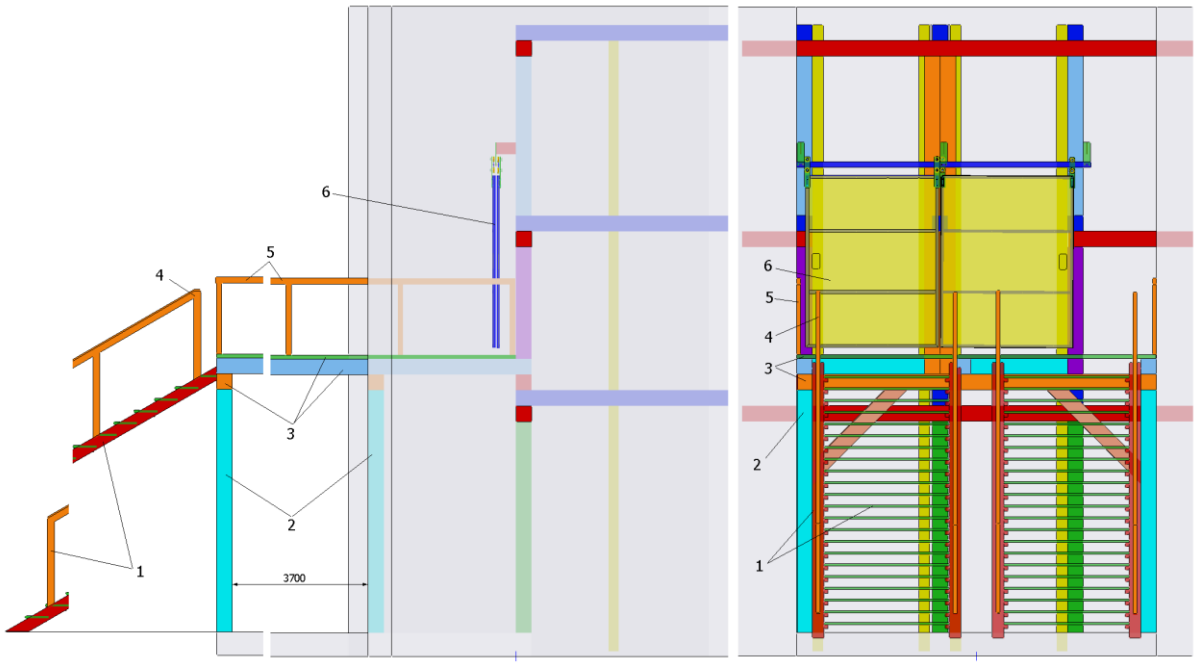

Figure 9. The construction of the superior ramp of the underground pit

A solution of setting up the superior ramp of the pit in the underground is shown in figure 9, which is composed of: 1 – access stair to the superior ramp; 2 - the feet that support

the platform of the ramp; 3 – the structure of the platform; 4 – stair handrail; 5 – platform handrail; 6 – safety doors of the superior ramp.

The solution proposed for the platform of the superior ramp of the underground shaft took into consideration the set up mode of the current ramp, which has a waiting space for the persons that will be transported at the surface, a space that is separated from the access aisle to the saline by a wall. Also, according to work protection and safety regulations, the space in front of the safety doors of the ramp must be free for a distance of 5 meters.

The two access stairs to the platform of the superior ramp will be allocated thus: one for the waiting space (the one on the right), and the other to the access aisle to the saline.

The construction of the stairs is similar to the ones at the surface, with an inclination of 30 degrees and a transversal space of 1,6 mm, which is enough for the moving of two persons in parallel.

6. CONCLUSION

In order to realize the superior ramp in the tower of the extraction installation at Unirea mine from Slănic, we must make the following modifications:

- We will dismantle the braces in the second section of the eastern wall of the tower;
- We will fit in a new metallic structure for stiffening the second section of the eastern wall of the tower;
- From the calculation abstract regarding the comparison of the resistance modules of the sections by way of the new construction of the tower's section with the ones of the old construction there are no differences, which is favorable to the new construction;
- We must discard the metallic stair from the eastern wall, in the area of the first section of the tower;
- We will realize a new part of the access stair to the platform of the pulleys in the superior ramp – the platform must be separated from the ramp by a door;
- In order to set up the platform of the superior ramp we used the construction of the parapet of the inferior ramp and the concreted platform under the abutment, and the access to this is done by two stairs, one for ascending and one for descending;

In order to realize the superior ramp in the underground in the shaft of the Unirea Mine in Slănic, the following modifications must be made:

- The reinforcing structure of the shaft is modified, by cutting the longitudinal dash that is second to the last dash and by rebuilding the reinforcing structure of the shaft with support feet of the transversal dashes;
- We must set up a superior ramp with a big platform of 4,59 X 5,80 min order to keep the space from the inferior ramp and to embark from the waiting area and the disembarking into the access aisle existing in the saline;
- The platform of the superior ramp has one end fixed on the reinforcing structure of the shaft and is enclosed by the shaft's walls, having the same width as the inferior ramp of the shaft.

All these modifications were imposed by the dimensions of the cage with two storeys, respectively by the distance between the floors of the two cabins of 3560 mm..

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