

# Structural restoration and re-use of the historic coal mine tower

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## ABSTRACT

The coal mine is located in the town of Labin, Istria peninsula, Croatia. Restoration of the tower is a part of the project that includes thorough restoration and re-use of the Labin mining complex for cultural, tourist and educational purposes. The tower was built in 1938 by Italian authorities as part of the pre-war campaign. It is a 32.5 m high steel structure that once enveloped the elevator to 200 m deep mine shaft. The structure is a built up Vierendeel truss with four columns / chords connected with horizontal moment resistant beams. Two large steel inclined struts were resisting elevator rope forces connected to the elevator machine building. The mine was shut down in 1988.

The assessment of the tower consisted of geometry measurement, cross-section shape determination, steel quality determination, condition of members and connections (rivets and bolts), protective coating condition and underground supports condition. Two samples were taken to laboratory to determine the steel grade with tensile yield test. Structural model with existing members has also been analysed. Different loads were considered comparing the original purpose of the tower and the planned representational purpose. Also, structural member verification according to Eurocode standards has been done.

Load bearing steel structure is geometrically sound, mostly with no visible deformations, deflections or drifts. Foundations are crack free and with no visible subsiding. Lack of maintenance of the anti-corrosive coating from 1988 until today caused most of the damage. Due to the significantly aggressive environment, anchoring part of the structure was severely ruined. Lower part of the above ground structure was in the similar condition. Water retention and salt carried from the lower part of the shaft caused significant damage to the steel structure in these areas. Replaced members were built in with original riveting technique. Anchoring structure replacement called for a temporary support structure, which represented the most demanding operation in the whole restoration process. The temporary support structure was a steel truss structure in pyramidal form that allowed complete removal of the lowest segment and reconstruction of the anchoring elements and concrete foundation. According to the evaluation, existing galleries that surrounded the tower had to be completely removed and redesigned with new loads. Future use of the tower with its galleries is primarily of representational purpose. Also, new elevator is considered with its own structure inside the existing tower and has no influence on the existing structure.

Since the tower is registered as an architectural heritage by the Croatian Ministry of Culture, the specific demands regarding structural restoration were issued. The principles of structural analysis and restoration along with multidisciplinary approach have been applied in this project.

## REFERENCES

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