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# Some Caves in tunnels in Dinaric karst of Croatia

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In the last 50 years during the construction of almost all the tunnels in the Croatian Dinaric Karst thousands of caves have been encountered that represented the major problems during the construction works. Geological features (fissures, folding, faults, etc.) are described in this contribution, together with the hydrogeological conditions (rapid changes in groundwater levels). Special engineering geological exploration and survey of each cave, together with the stabilization of the tunnel ceiling, and groundwater protection actions according to basic engineering geological parameters are also presented. In karst tunneling in Croatia over 150 caves longer than 500 m have been investigated. Several caves are over 300 m deep (St. Ilija tunnel in Biokovo Mt), and 10 are longer than 1000 m (St.Rok tunnel, HE Senj and HE Velebit tunnels in Velebit Mt, Ucka tunnel in Ucka Mt, Mala kapela tunnel in Kapela Mt, caverns in HE Plat tunnel etc). Different solutions were chosen to cross the caves depending on the size and purpose of the tunnels (road, rail, pedestrian tunnel, or hydrotechnical tunnels). This is presentations of interesting examples of ceiling stabilization in big cave chambers, construction of bridges inside tunnels, deviations of tunnels, filling caves, grouting, etc. A complex type of karstification has been found in the cavern at the contact between the Palaeozoic clastic impervious formations and the Mesozoic complex of dolomitic limestones in the Vrata Tunnel and at the contact with flysch in the Učka Tunnel. However, karstification advancing in all directions at a similar rate is quite rare. The need to have the roadway and/or tunnel above water from a spring is the biggest possible engineering-geological, hydrogeological and civil engineering challenge. Significant examples are those above the Jadro spring (Mravinci tunnel) in flysch materials or above the Zvir spring in Rijeka (Katarina tunnel), and in fractured Mesozoic carbonates. Today in Croatian karst there are known about 12000 caves.