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The expansion joints of the 1915Çanakkale Bridge

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ABSTRACT

The recently opened 1915Çanakkale bridge 300 km south-east of Istanbul has a main span of over two kilometres and a total length of 4,608 m.

Based on the bridge kinematics, complex expansion joints at both main deck ends with movements of up to 2800 mm, low noise emission and highest durability were required.

In addition, the approach bridges to the main bridge, which are seismically isolated, requested large transversal movements.

So-called modular swivel joist expansion joints allow six degrees of freedom: displacements transverse, longitudinal and vertical to the direction of traffic as well as any kind of rotations can be compensated, to address the specific needs of a suspension bridge located in a highly seismic region.

The expansion joint structure, consisting of bars supporting the lamellas, features a new low-friction, almost wear-free guiding system with a next generation of sliding material. This prevents restraints, provides a superior smoothly controlled movement mechanism, and increases the service life to at least 50 years.

Particularly, an approved sliding material (modified UHMWPE, pre-loaded and equipped with greased dimples within the moving components, which has been successfully applied for two decades in the bridge bearings, grants proper function for a certified accumulated travel path of 50+ kilometres even combined with high seismic displacement velocities. A more precise prismatic guide mechanism was developed to achieve a permanent contact between all relevant sliding elements.

In this way both the bridge bearings and the expansion joints systems can reach the same certified nominal life and durability while resisting major earthquakes without damage.

The expansion joints were additionally equipped on their surface with welded rhombic steel plates to remarkably reduce the noise, increase the driving comfort and assure a durable anti-skid resistant across the overpassing surface. Also, welded instead of bolted applications within the construction enhance fatigue-proof and durable service lifetime of the applied expansion joints.

The joints of the approach bridges were designed with special rhombic steel plates that allow also large transversal movements.

Keywords: Long Span Bridges; modular expansion joints; durability; earthquake.