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Analysis of Deformation and Their Development in Loaded Structural Members Using Dynamic X-Ray Testing and Digital Image Processing

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Abstract

The combination of X-raying and digital image processing allows an objective recording of deformation in structural members subjected to external loading. It is also possible to measure deformation during loading.

Using the example of pull-out specimens made of autoclaved aerated concrete, investigations have been carried out to ascertain the accuracy of this method of measurement. It had to be taken into account, that according to the quality of the images, there was a close relationship between the period of X-raying and the loading rate.

The set period for X-raying (0.27 s per image) enables a dynamic measurement of deformation with an accuracy of up to 0.05 mm in case of an appropriate loading rate. Consequently, it is possible to measure deformation for gradually altering loads. The accuracy of the analysed method of measurement is equivalent to alternative methods, but it has advantages due to the principle of non-contact measurement. It is possible to measure deformation within the structural member and to visualize pictorially without influencing mechanical conditions. The deformation are quantified in the following analysis.

The high degree of precision of this method of measurement combined with the advantages of contact-free measurement opens up the opportunity for a new quality in measuring deformation and the interpretation of mechanical conditions.