Products & Projects

Company reports on projects, products, procedures, applications and services in constructional steelwork

Deadline for press releases: **April 9th 2019**

Editorial Content

Harry Far

Dynamic Behaviour of Unbraced Steel Frames Resting on Soft Grounds

Many recent earthquakes clearly illustrate the importance of local ground properties on dynamic response of structures. The dynamic response of an engineering structure is influenced by the medium on which it is founded. On a solid rock, a fixed-base structural response occurs which can be evaluated by subjecting the foundation to the free-field ground motion occurring in the absence of the structure. However, on a deformable ground, a feedback loop exists. In other words, when the feedback loop exists, the structure responds to the dynamics of the soil, while the soil also responds to the dynamics of the structure. Structural response is then governed by the interplay between the characteristics of the ground, the structure and the input motion. This study has carried out a numerical investigation on dynamic behavior of unbraced steel frames resting on soft grounds. Two types of mid-rise unbraced steel frames, including 5 and 15 storey buildings on a soft soil deposit have been selected and analysed under influence of three different earthquake acceleration records. The above mentioned frames were analysed under two different boundary conditions: (i) fixed-base (no soil-structure interaction), and (ii) flexible-base (considering soil- structure interaction). The results of the analyses in terms of structural forces and lateral displacements for the above mentioned boundary conditions have been compared and discussed.

Aydin

Experimental Behavior of Bolted Connections with Stiffeners

This paper is focused on the behavior of top-seat angles connections with stiffeners. The present paper discusses statically loaded nine full scale tests in three groups for the stiffener thickness of top and seat angle. The purpose was to provide necessary data to develop the Eurocode 3. The maximum bending moment increased with the stiffeners' thickness increase of 6 mm to 10 mm. Moreover, the plastic flexural resistance, the bending moment capacity and increased with the decreased length of top and seat angle. Furthermore, the plastic region parallel to the beam on the seat angle rates was greater than those vertical to the beam on the seat angle and the dissipated energy depended on the lengths of angles.

Markus Schäfer

European Design Code for Composite Structures in steel and concrete Historical development and investigation in 2nd generation of Eurocode 4

The Eurocodes (EC) represent European norms (EN) for the design and construction of building and bridge constructions. The development of these European design codes is carried out on the behalf of the European Union (EU) by the "European Committee for Standardisation – CEN". The Eurocodes have now been in use for some years. The motivation behind the development of the Eurocodes is the harmonization of the planning and design process for structural components and construction elements of buildings and bridges all over Europe. Based on the experience gathered by the applications of the Eurocode conditions in the recent years and many comments from the industry, a revision of all parts of the Eurocode is currently in progress with the aim of adapting the current design standards to the state of the art and research, simplifying the application, and harmonizing the Eurocodes with each other. Finally, these modifications will be transferred to the second generation of European standards. Within this paper an overview about the development phases, and project teams is presented. Furthermore, an insight into the current standardization work and the technical discussions mainly focused on EN 1994-1-1 is given.

Thomas Misiek

On European buckling curves for aluminium members

Numerical investigations of compression members made of aluminium are presented and recommendations for the reorganisation of the buckling classes and buckling curves are derived from these. These curves were finally compared to test results.

Yingliang Wang

The Cross-Section Selection of Road-cum-railway Cable-Supported Bridge with Box Girder

This paper describes the cross-section selection of road-cum-railway cable-supported bridges with box girders from the point view of structural behavior, fabrication, transportation and installation. The application of wide single box girder, vented box girders with two separate boxes and triple separate boxes are reviewed. The number of cable planes, the relative location between the pylon legs and the main girders are also are studied. A cable-stayed bridge with a main span of 520m and a triple-separate-box-girder which accommodates 4 tracks high-speed-railway and a 6 lanes carriageway is researched as a case study. The result discloses that triple-separate-box-girder is very suitable for large span road-cum-railway cable-supported bridges with multiple railway tracks and multiple carriage lanes.

Petr Hradil

Assessment of reusability of components from single-storey steel buildings

Kiyoshi Ono

Experimental study on buckling strength of cruciform columns made of SBHS700

Jörg Lange

A contribution to tension-shear-interaction of high-strength bolts during and after fire

Connections in steel structures play an essential role in the structural stability of the entire construction. This is also true in the event of fire. The difficulty in the design of connections in fire lies in the fact that not only material properties but also loading applied to the connections change depending on temperature. In addition, temperature-dependent reduction of tensile strength of high-strength bolts does not coincide with reduction of shear-strength. So far, the influence of combined tension and shear loading on high-strength bolts has not been studied in detail. As part of this project interaction tests on high-strength bolts of the property class 10.9 (fu = 1,000 N/mm²) were carried out. In addition to the observation of load-bearing behaviour during fire, post-fire performance was examined. The examinations were completed with additional material tests. The results were compared with earlier research on the temperature-dependent load-bearing capacity of high-strength bolts during and after temperature loading as well as on the load-bearing behaviour of bolts in steel structures under combined tension and shear load. This investigation contributes to a better understanding of load-bearing capacity on high-strength bolts under combined loading during and after fire.

George Papagiannopoulos

Design considerations for photovoltaic panel arrays from aluminium: A case study

This paper presents the design considerations for typical photovoltaic panel arrays having aluminium members. Section and member design checks are performed according to Eurocode 9 on the basis of the wind, snow and seismic loadings of Eurocodes 1 and 8. Improvements in design are then sought starting by reducing the distance between the vertical posts and then by changing the thickness of specific sections. In the following, the effects of member imperfections and connection flexibility are studied using a reduced flexural rigidity and different values for the rotational stiffness, respectively. The degree of dynamic coupling when the array is placed on the top floor of an existing building as well as the influence of founding the vertical posts on compliant ground are also evaluated.

Alexander Ecker

Steel Lined Pressure Shafts – Appropriate design for external pressure

In case of revisions, when the pipe is empty, the thin walled steel pipe is susceptible to shell buckling due to external pressure. In the Sixties of the last century comprehensive research activities started, including tests, and analytical and empirical formulae were developed for the design. In the first part of the paper some of these different analytical design concepts are presented and their results are compared for the whole range of pipe slenderness in practice. Afterwards the results of extensive numerical calculations, dealing with different imperfections in practice, are shown, which are not considered in the current design solutions. In addition, also the effect of the radial flexibility of the surrounding rock mass was studied, which is ignored up to now. All these results are compared with the design formulae in practice. Therefore, finally a judgement of the individual solutions in practice is possible and appropriate design rules for external pressure are summed up.

Salomé Galjaard

Metal additive manufacturing and new ways to approach design

Ioannis Vayas

Full scale tests on used steel storage racks

Abstract: The industry operates for its storage purposes not only with new pallet racking systems, but also with old ones for which certification documents possibly do not exist. In order to check the carrying capacity of such racks full-scale experimental tests were carried out on the complete structure to serve, in addition to component tests, to the development of reliable numerical models. The racks were subjected to vertical and pushover loading inside the Laboratory, using an improved version of the base plates to obtain fixed support conditions. Vertical loading was imposed by filling tanks with water, an operation that was activated and controlled through an innovative hydraulic network specifically designed for this purpose. During the vertical loading tests, a moderate earthquake took place near the experimental facility and influenced, positively, the rack behavior. The spine brace was too flexible in out-of-plane direction and did not participate in the resistance to lateral forces. Distortional buckling of the columns was observed at high lateral loads. The experimental tests allowed the calculation of conservative values for the behavior factor q.