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## Industrial Cranes

Industrial cranes are a means of handling and transportation and, in particular, they play an important role in most civil engineering works. When discussing cranes special consideration is given to:

- structural problems in connection with crane design, manufacture and erection
- cranes as a tool for civil engineering construction
- cranes as a means of handling and transportation of goods

### Structural problems associated with cranes

In actual crane design major importance is given to the **fatigue behaviour** of structural components. The tendency to reduce the mass of the crane and to use higher strength steels calls for a better understanding of the fatigue behaviour of steel elements and connections. Better knowledge of fatigue resistance is not enough but has to be accompanied by a corresponding information about the effective load or stress conditions during the lifetime of the structure. By monitoring actual crane structures, however, a better approach for the remaining lifetime can be established (see «Entwicklungstendenzen im Kranbau»).

In large crane structures, like those for gantry cranes for ship construction or ship repair, with structural steel weights of up to 5000 tons or even more the structural engineer has to face problems analogous to **light-weight construction**. Due to the overall dimensions stiffened thin plates are mostly used. Similar problems are known from long span bridge design, but the higher relation of live load (service load plus self weight of the trolleys) to dead load in crane construction, the higher probability of occurrence of the design load and the introduction of concentrated loads from the trolley-wheels into the webs require a more sophisticated strength approach.

**Manufacturing tolerances** are generally lower than in bridge construction. However, the fact that the structure is part of a machine calls for more severe deformation criteria.

The large and heavy self-standing structures of such cranes require an adequate **erection procedure**. Different approaches have been used, i.e. in gantry crane erection. Most promising are those procedures which make much use of the crane structure itself for the erection. A description of such an erection procedure is given by the contribution on the «Werftportalkran, Setubal, Portugal».

### Cranes as a tool for civil engineering works

The rational use of specially designed cranes leads to innovative solution in civil engineering works. Heavy, pre-assembled elements can be placed in a short time. Different aspects of such tools and their appropriate use are shown in the contributions: «Lifting frame for heavy equipment», «Travelling crane», «Application d'un pont-roulant pour la réfection d'une piste d'aéroport», «Portique pour la pose d'éléments de ponts en béton précontraint».

### Cranes as a means of handling and transportation

The handling of containers in large depot areas calls for special container cranes with easy access to all points. Rubber tyre container cranes (see «Container-Stapelkran im Hafen von Hamburg») can be the answer to this problem.

For the handling of potash in a large steel silo a circular bridge crane with screw conveyor was developed taking into account restrictions given by the existing silo structure (see «Circular bridge crane»).

*Ernst Gehri*

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