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Focus on IFA's work

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Use of virtual reality during the planning phase to eliminate occupational safety and health risks

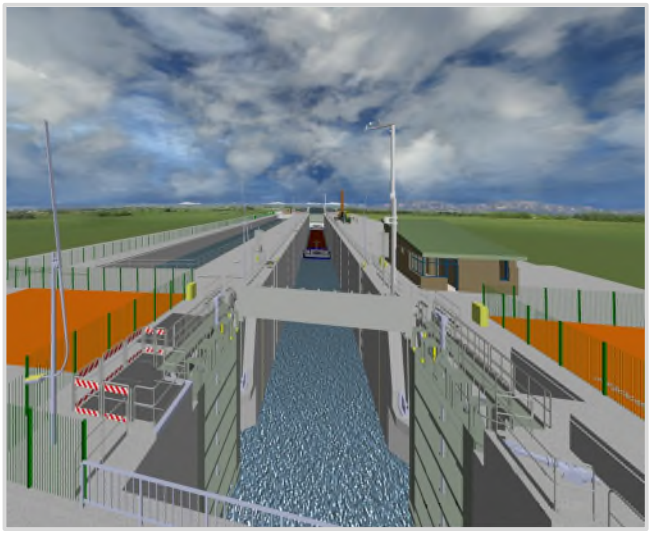
Problem

Stationary and mobile machinery, technical plants and structures are becoming more complex – and the potential hazards for workers less self-evident. Logically, it would be advantageous for hazards and risks arising during later operation to be assessed as early as the planning stage, before design and manufacturing take place. This would enable the standard of occupational safety to be raised from the point of commissioning onwards. Time-consuming reworking, corrections and transitional solutions would be required less frequently or avoided altogether.

Inland shipping locks constitute, at one and the same time, a machine, a structure and a place of work. In the future, they will be planned by means of a modular system of standardized objects, by which more occupational safety and health requirements can be implemented directly.

Activities

The German Social Accident Insurance Institution of the Federal Government and for the railway services (UVB) launched a research project which was conducted by the IFA in conjunction with various departments of the German Federal Waterways and Shipping Administration (GDWS), the German Federal Ministry of Transport and Digital Infrastructure (BMVI), the UVB and the BG Verkehr.



VR simulation at the IFA of a standardized shipping lock

The occupational safety and health requirements were based upon the EU Directives on Safety of Machinery 2006/42/EC, on Construction Sites 92/57/EEC and on the OSH Framework 89/391/EEC).

The project group selected 150 typical scenarios for work processes on shipping locks (e.g. "downstream passage", "move top gate into inspection position"). These scenarios were discussed, classified and documented. Work processes were taken into account, for example during running operation and scheduled/ unscheduled maintenance and repair. Different

variants of standardized shipping lock were also considered: different lengths and rises, alternatives for collision protection, river/canal locks, and locks with/without side pond or road bridge.

With the aid of the planning documents for standardized objects and for the new Wanne-Eickel shipping lock, virtual reality (VR) techniques were used to create a dynamic planning model.

Results and use

In its SUTAVE VR laboratory, the IFA simulated variants of standardized shipping locks and work and lockage processes in the 150 scenarios referred to above on a scale of 1:1. The simulations show the dynamics of technical functions (e.g. opening of a radial sluice gate, moving a folding mast) during lockage of various vessels (e.g. large freight motor vessels, pleasure craft) and also visualize the use of work equipment on the lock during scheduled/unscheduled maintenance and repair (e.g. slewing range of truck-mounted cranes, protective measures taken during dismantling of the lower gate). Distances can also be measured on the virtual model and sequences of operation presented from commissioning and operation to repair.

Risks and hazards were assessed at the IFA during inspections of the virtual locks. Measures for risk reduction were derived which were taken into account during planning of the Wanne-Eickel lock and are now available for use in other standardized objects of shipping locks. Model documents for the risk assessments, documentation for future work and the safety and health plan were created for future assessments in operational use.

In addition, misconceptions were identified in the planning documents and measures drawn up for the reduction of risks (e.g. for inspection and removal of the upper gate, repair of the anti-collision beam, lock railings, access to side ponds and caverns, safeguarding of sluice gates).

For the purposes of prevention activity, assessments on the structure in its completed form and in operation are also required and are legally binding. The model documents for the assessments support this process and facilitate future GDWS projects for the planning, construction, operation and maintenance of shipping locks. They expand the checklists of the UVB's guidance document and support further documentation (such as operating instructions, procedures).

The method presented here can be transferred to other large static and mobile machines and technical plant (such as lift bridges, assembly facilities, earth-moving machinery, factories) and their safe and healthy operation.

User group

Occupational safety and health experts, manufacturers and operators of machinery, technical plant and structures, employees in planning, design, operation, maintenance, servicing and repair.

Further information

- Virtual reality in human-system interaction (Technical Information of the IFA)

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