

SUMMARY

This paper presents a research study performed on lock gates. It concerns the downstream lock gate of the one of the four new locks planned within the framework of the 'Seine-Escaut Est (SEE)' project in the Walloon Region of Belgium. At the stage of the basic preliminary design, it was decided to use four identical gates, all suspended and moved transversally to the lock. On this basis, the present work tackles different aspects of the lock gate study. The aim is double: on the one hand, to advance in the study of the four SEE project downstream lock gates and, on the other hand, to focus more particularly on lock gate structural analysis, notably the design, optimisation and structural behaviour in the case of ship impact.

First, the design and optimisation of the gate are performed, using the LBR5 lock gate optimisation software and a linear elastic analysis. An optimised solution is obtained considering the best

compromise between the cost and weight aspects of the structure. Then, this optimised gate is modelled with the nonlinear finite elements software FINELG. This program is used to conduct nonlinear numerical analysis of the effect of boat impact on the previously optimised downstream gate. Several analyses are performed, which allow for a discussion on the influence of the stiffener dimensions and the impact zone on the structural behaviour of the gate submitted to the impact. Two different behaviours are brought to light, a ductile one and a fragile one. The results of the numerical analysis underline the importance of the development of a global plastic mechanism with the purpose of dissipating a large amount of energy. Finally, an analytical model presented in literature allows for the simplified calculation of the gate theoretical strength in case of ship impact, and the calculated value is compared with the computed results.