

Ship impact loads on construction pits of bridges

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Abstract

While ship impact loads for the design and dimensioning of bridges over waterways are adequately regulated for a large number of cases in codes, cf. EN 1991-1-7 (2006), [1], there is a lack for the approach of impact loads during the construction period. The primary focus here is on the safety of the construction site situation with a view to protecting the lives of the construction workers and secondarily on avoiding major economic damage. The ship impact load approach from the relevant standards would not be feasible in some cases, would be uneconomical and would possibly not be implemented. In view of the concept of the remaining service life, which is already used for existing structures, [8], the concept was transferred to short periods of time such as construction periods. In recent years, BAW, the Federal Waterways Engineering and Research Institute, has developed impact loads for construction pits in waterways, protecting structures in front of these pits as well as auxiliary supports for bridge structures and has created a concept.

Keywords: ship impact; bridges; collision model; failure probability; construction pit, temporary structure, auxiliary structure, remaining lifetime.

1 Introduction

The determination of ship impact loads on bridges is sufficiently regulated in relevant codes, c.f. EN 1991-1-7 (2006), [1], for the design service life of the bridge, which often is at least 100 years. Both tabulated values and methods for determining impact forces are available, [1].

For the construction of a new bridge, however, construction conditions are required, such as construction pits for bridge piers, which, as temporary structures, sometimes have a significantly shorter service life than the actual bridge structure. To dimension these construction pits for an impact load as for a bridge with a long service life would be uneconomical and, in some cases, not feasible.

Therefore, a concept for the dimensioning of construction pits and also protection constructions

against ship impact is required. Often, it is not possible, to design the actual construction pit against ship impact, but a protection structure in front of it has to take over this function, which is subjected to the same problem. Figures 1 and 2 show some examples for such construction pits and their protection.

Figure 1 shows as example a topview with a dotted construction pit for a new bridge pier and a surrounding polygonal-shaped protection structure on the right hand side. The existing bridge pier of the old bridge is on the left hand side. The construction pit is located in the fairway. Figure 2 shows as example a construction pit of a new bridge abutment, in the bottom right corner, which is located besides the fairway on the embankment where ships can strand in case of an accident. A protection structure is located at the edge of the shipping lane, in the top left corner of the Figure.