Discussion and comments

Autor(en): **[s.n.]**

Objekttyp: **Article**

Zeitschrift: **IABSE reports = Rapports AIPC = IVBH Berichte**

Band (Jahr): **43 (1983)**

PDF erstellt am: **14.07.2024**

Persistenter Link: https://doi.org/10.5169/seals-33211

Discussion and Comments

Paper Title : Evaluation of Ship-Bridge Pier Impact and of Islands as Protection
Presented by: Mr. V. Minorsky, U.S.A.

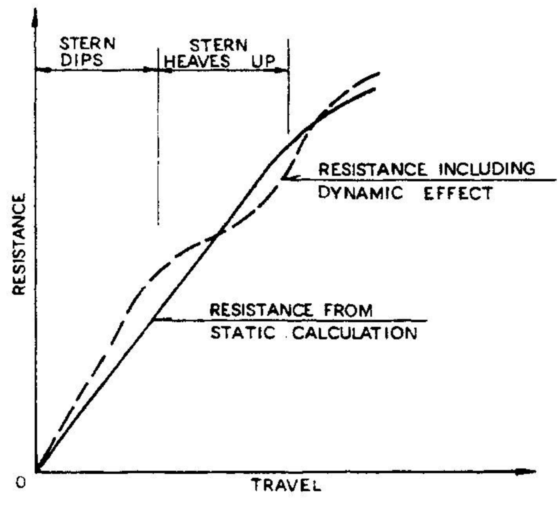
Discussion by: Professor W.C. Webster, Univ. of California, U.S.A.

I would like to make two points with regard to this paper. First, with regard to penetration of an island by a ship trimmed by the bow, the author has neglected some perhaps important dynamic effects. The ships mass distribution as well as the hydrodynamic effects arising from the immersion of the stern into the water both increase the force on the bow contact point. The immersion of the stern causes some of the kinetic energy to be carried away as waves. The net result is that the intrusion of the ship will be less than predicted by the author.

Second, I should like to underline the authors comments about seamanship. One must recognize that a ship poorly steered and controlled is far more dangerous than one with an empty bridge.

Answer by: Mr. V. Minorsky.

The dynamic effect described by Professor Webster is the dipping of the stern as the bow meets resistance during its travel upslope: the result is to reduce grounding travel. This dynamic effect is significant when the bow digs into the beach, bringing the ship to a quick stop. In the paper it is assumed that the ship will slide up the beach, which is the most dangerous condition for possible impact with a bridge pier. In this case, during the 4-7 seconds of grounding travel, one may expect that the stern, which at first is forced into the water by inertia forces, will subsequently heave upward, relieving some of the bow pressure, and that this upward movement of the stern will increase grounding travel. In both types of bow contact the mass vessel's kinetic energy and increase travel up the beach. It is estimated that the curve of resisting force vs grounding travel in the case of sliding will be as shown below, and that the overall dynamic effect will be a few percent. A high speed camera should reveal the oscillation of the stern in a model.



Probable shape of resistance curve, including dynamic effect, for vessel sliding up on a beach.

Discussion by: Mr. G. Woisin, Private Consultant, F.R.G.

Mr. Minorsky once more proposes a somewhat ingenious semi-empirical method to treat some problem unsolved up to now by science. Formerly he created a procedure to estimate the energy absorption by ship structures damaging mutually while in collision. This time he discovers and adapts the Gerard-method to derive impact forces produced by flattened ship bows. In this connection I wonder at the neglect of the distances of transverse frames, floor plates etc. in Gerard's method.

Mr. Minorsky compares the results of Gerard's method with the bulbous bow of the crude oil carrier ESSO MALAYSIA. 2 of these 5 tests were conducted with the fore peak tank empty, the remaining 3 filled completely with ballast water. Minorsky compares with the result of one of the model tests conducted without water.

As Mr. Minorsky explained the model test he compared with was conducted with two successive impacts in scale 1:12. As we measured exactly in the first impact an approach of 0.49 m, the average force evaluated was 14% higher than Minorsky derived with Gerard's method, which really is a good agreement. Still more, this agreement is consistent also comparing Minorsky's calculation with other test results gained in scale 1:7.5.

Against a general application of the impact forces given by Minorsky's diagram in his figure 4, I want to object however two points:

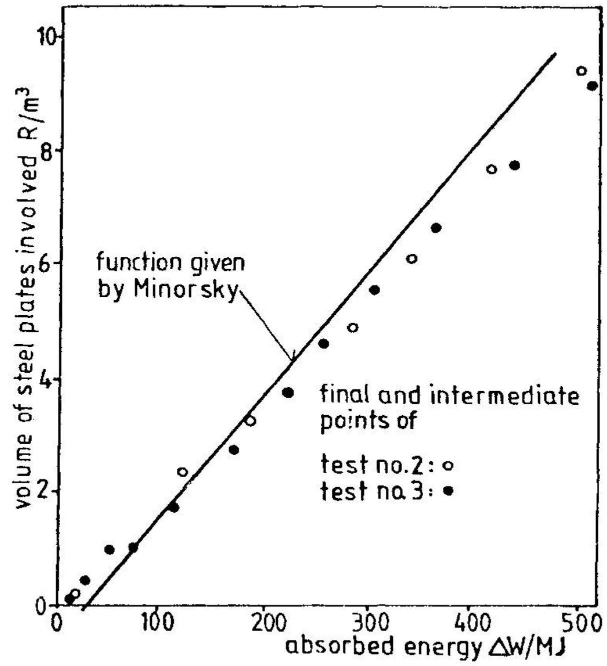
1) At first, Gerard's method seems to be in good agreement with ship model structures with material thickness of 1 to 3 millimeters; but a possible scale effect produced mainly by dissimilar crushing of model and prototype structures remains. Therefore in real ship size the impact forces may be only about 70% as high as derived from the models, and also derived from Gerard's calculation method in good agreement with the models.

   Contrary to Mr. Minorsky I do not think 'the problems of scale effects', as far as they are quantitative or qualitative size effects, could be eliminated simply using Gerard's method. A full scale test conducted with a ship's bow for instance would yield the empirical factor of 0.56 in Gerard's method to be adjusted to the full scale result, if a size effect actually exists. This is because a size effect would not be a shortcoming of the models only but a fundamental mechanical phenomenon.

2) Secondly I want to point out that due to our experience a water filling of the fore peak tank yields average forces 40 to 67% higher. Due to our model tests the average impact forces was a further 110% higher in case of a so-called cylindrical bow, having a vertical stem and blunt waterlines. That means average impact forces could be altogether roughly 3-times as high under unfavourable circumstances.

Answer by: Mr. V. Minorsky.

As for Mr. Woisin's observations, there is always some scale effect present between model and full size. It is important to estimate its magnitude: in this respect, Mr. Woisin's paper: "Design against Collisions", International Symposium on Advances in Marine Engineering, Trondheim 1979, is very valuable. Fig. 5 from this paper compares the Savannah curve for energy absorption in full size ship collisions with results obtained by Mr. Woisin in Hamburg using models. It may be concluded from this comparison that results from model tests are dependable; one may also expect that results derived from Gerard's method using a model will not differ much from full size and that Gerard's calculation can be applied to a full scale ship.



Plot of test results from Hamburg in Minorsky's diagram.

Mr. Woisin's comment on the increase in impact forces when the forepeak tank is full of ballast is well taken: upon impact the water cannot escape fast enough through vents and overflows, and will cause deck and bulkhead plating to bulge. An allowance must then be made based on data such as that obtained by Mr. Woisin. However, if the tank is only partially filled, the effect of the ballast will be negligible.

==

Paper Title : Ultimate Strength of Bow Construction.
Presented by: Mr. T. Ohnishi, Kawasaki Heavy Industries Ltd., Japan.

==

Discussion by: Dr. C.P. Ellinas, J.P. Kenny & Partners, U.K.

While the agreement between theory and experiment in Figures 5 and 6 is good as far as peak loads are concerned, how well does the FEM method, and of course the theoretical modelling predict the energy absorption characteristics of the ship models? The energy absorption capacity will surely govern the final extent of damage as a result of a ship collision. The theoretical and experimental plots in figures 5 and 6 suggest an unsatisfactory correlation.

Answer by: Mr. T. Ohnishi.

In this report, we would like to treat only for the peak load of which the lower part will not be required.

In case the resisting barrier structures are considered, the maximum load acting on the side structures of a struck ship becomes very important.

In the increase of the load corresponding to the increasing of deformation is not so remarkable, and a load-deformation curve ($p - \delta$ curve) obtained from a calculation is used, the amount of collapse may be calculated in a small way. However, the max. load would not vary so much.

On the other hand, when the struck ship has no resisting barrier structures, we must analyze the damages of both the striking ship and struck ship.

In this case, however, the applicable energy absorption capabilities become essential. Furthermore, it is also required to procure the lower part of the load.

If we were able to obtain the whole load-deformation curve ($p - \delta$ curve) accurately, the accuracy of the collision analysis thus evaluated seems to be considerably high.

We earnestly hope that these problems will be studied more deeply in the future for the successful solution of the problems.

Paper Title : Energy Absorption in Ship-Platform Impacts
Presented by: Mr. J. Amdahl, Norwegian Institute of Technology, Norway

Discussion by: Dr. C. P. Ellinas, J.P. Kenny & Partners, U.K.

Normally when tubular members are loaded laterally by concentrated loads some local denting of the tube wall occurs. The extent of local denting will depend on the flexural stiffness of the beam. However, even small amounts of denting can have a considerable effect on the plastic collapse load carrying capacity of the beam (see for example p. 257), because of the local reductions to its effective flexural stiffness. How did such an effect affect the experimental results in Fig. 3, where it is shown that the horizontally free beam with D/t = 62.5 attained only about 70% of P_0?

Answer by: Professor T. Søreide.

The reduction in section modulus due to local denting at point of impact is an important factor which reduced the collapse load. Related to Fig. 3 of our paper the difference between theoretical P_0 and experimental value for the horizontally free specimen is explained by this phenomenon. The unloading by further deformation is due to local wall crippling on the compression side at the ends.

Discussion by: Mr. M.F. de Rooij, Shell U.K. Exploration and Production, U.K.

So far both the topics of establishing the probabilities of collision between vessels and fixed structures as well as the relation between impact force and damage have been addressed.

However for design-purposes a probabilistic relation between impact force, impact zone and probability of occurence needs to be established. In particular for fixed offshore platforms it would be useful to be able to establish incremental costs of added safety.

Answer by: Professor T. Søreide.

Ideally, a full probabilistic design against collision is a desirable alternative. However, our experience is that in practice the only applicable procedure is to specify design events.

Discussion by: Mr. G. Woisin, Private Consultant, F.R.G.

I want to ask Mr. Amdahl whether the cylinders with constant cross section and, i.e., a buckling strength constant over their length always started to be deformed from one end; if so, has Mr. Amdahl any explanation, why it didn't happen sometimes from the other end or from in-between?

The second point I want to ask: Why did he introduce the formula of Cowper and Symonds for the strain rate effect? This formula is not valid for small strain rates as are produced in his quasi-static tests ($\varepsilon = 10^{-3} s^{-1}$). If the formula was used for the theoretical figures given in table 1 they are still calculated roughly about 10% too high and the real relation figures of theoretical to empirical values of average impact forces are to be reduced correspondingly.

Thirdly: Remarkable, to my opinion, is the fact which can be derived from table 1, that the only reproduction of a test led to a scatter of at least ±13% or a deviation of + 30% of the higher to the lower value. This would not be surprising in case of the initial buckling force, but it is for the average impact force.

Answer by: Professor T. Søreide.

For all cylinders with constant cross-section and constant stiffener spacing the buckling started from one of the ends. This is explained by the boundary conditions with no rotational restraints and by inaccuracy in the machined ends giving uneven stress distribution.

We agree that the Cowper-Symonds formula is not valid for small strain rates. According to this experience our calculation of average loads is modified including the influence from finite radius of curvature at yield hinges, and the new results are given below.

Test specimen	MA1	MA2	MA3	MA4	FA1	FA2	FA3	FA4	FA5
Experiments (kN)	68.1	103.2	80.5	62.5	158.2	147.8	143.6	139.9	147.7
Theory (kN)	54.5	73.0	52.2	51.3	130.7	125.0	121.3	115.3	113.1
Theory/Exper.	0.80	0.71	0.65	0.82	0.83	0.85	0.84	0.82	0.77

Analytical and Experimental Values for Average Load P_{av}

The two test specimens MA3 and MA4 have almost the same plate thickness and stiffener spacing. However, stiffener geometry differs, and for specimen MA3 a considerable part of plastic energy was absorbed by the stiffeners. This explains the discrepancy between test results for MA3 and MA4.

Paper Title : Punching of Concrete Shells under Ship Collision
Presented by: Mr. N. Ashtari, CETEN APAVE, France

Discussion by: Mr. M.W. Braestrup, Rambøll & Hannemann, Consulting Engineers, Denmark.

On theory:

1. What value of tensile concrete strength (ft) is used in Modified Coulomb Criterium?

2. How was the numerical values obtained from analytical solution?

On tests:

3. Explanation of similitude between static and dynamic failure surfaces. On flat slabs, dynamic failures tend to be more concentrated around punch.

4. Test section confined by steel cylinder to preclude flexural failure modes?

Answer by Mr. Ashtari.

1. ft=0.008 fc

2. By computer analyses. Failure surface represented by sequence of sections varying from longitudinal to circumferential. Each section obtained by minimization of upper bound solution.

3. The similitude of failure surface in the static and dynamic tests is due to low speed of the impact tests (1.5 $^m/s$).
The difference between shape of failure surface on slabs and cylinders comes from cylinder's curvature. The section of failure surface in the plane containing the cylinder axis is the same as on the slab, (no curvature) but other sections are different.

4. Confirmed.

==
Paper Title : Damage on Offshore Tubular Bracing Members
Presented by: Dr. C.P. Ellinas and Professor A.C. Walker, J.P. Kenny & Partners Ltd., U.K.
==

Corrections:

1) p. 259 of Preliminary Report
second of eqns (21)
Denominator should be

$[1 - 2\, d_d/D+2e_d/D]$

2) p. 260 last paragraph in Section 5.
"-- goes some way in aurgmenting --"
should be changed to
"-- go some way in augmenting --".

3) Fig. 7. p. 260 Top Curve should be $\lambda R = 0.38$
Bottom Curve should be $\lambda R = 1.55$

Discussion by: Dr. P.A. Frieze, Dept. of Naval Architecture & Ocean Eng. Univ. of Glasgow, U.K.

Figure 7 suggest that strength increases with slenderness. Is it possible the λR's indicated on the figure have been interchanged, or am I interpreting λR incorrectly?

On Fig. 6, the strength is reportedly given as a function of local depth dent ratio. With the overall initial bow used one would expect some interaction between the two. Could the authors comment please?

Answer by: Dr. C.P. Ellinas & Professor A.C. Walker.

We would like to thank Dr. Frieze for his comments. The reduced slenderness parameter, λ_R, had been interchanged in Figure 7 due to a draughting error. This has now been amended. Figure 6 contains an overall bending imperfection $d_o/L=0.0015$, which is the DnV (1) tolerance for beam-columns. Its effect on strength, in the absence of local dent damage, is indicated by the intersection of the theoretical curves and the ordinate. The additional loss of strength, shown in Figure 6, as d_d/D increases, is clearly caused by the growth of the local dent damage. A small level of interaction between the two types of imperfection exists, and this may increase considerably as d_o and d_d increase as indicated by the ultimate strenth equation (16). But the overall initial bow used in Figure 6 is merely the imperfection tolerance and the most significant reductions in $_{ud}$ are due to the presence of local dent damage.

Leere Seite
Blank page
Page vide