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Collapse Load and Absorbed Energy Estimation of Tubular Members Subjected to Local Loads

Setsuo Yamanoi, Masao Ishiwata, Yutaka Kawai, Sigeo Takezono

Synopsis :
A series of static loading tests was conducted on large tubular structural models subjected to local lateral loads. The main objective was to estimate the collapse load and absorbed energy of steel tubular structures

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Tubular Members Subjected to Local Lateral Loads*

Synopsis:

tests was conducted on large steel pipe specimens with various diameters and wall thicknesses, in order to propose a more reasonable estimation method for the ultimate strength and absorbed energy of tubular members when subjected to a collison load on their wall surface.

The applied load was recorded directly by a microcomputer, all other measurements being recorded by the microcomputor through a digital static strain meter. The system for data acquisition is shown in **Fig. 1**.

Details of the nine test specimens used are summarized in **Table 1**, including length, wall thickness and

Table 1 Dimension of test specimens and estimated values of k in Eq. (10)

Test specimen No.	Max. load P_p	Dent depth under max. load δ_{dp}	Thickness t	Mean. diameter D	Plastic section modulus of cicle Z_c	Span l	Plastic section modulus of ellipse z	Eq. (10)

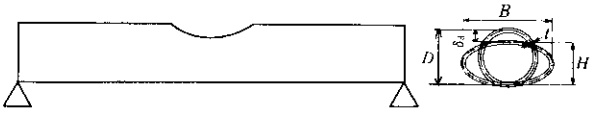
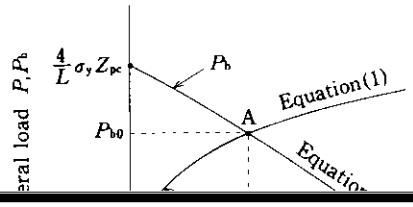
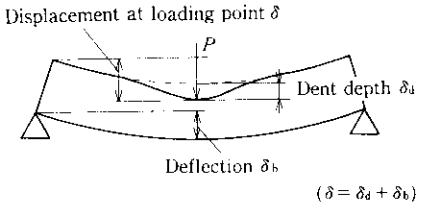


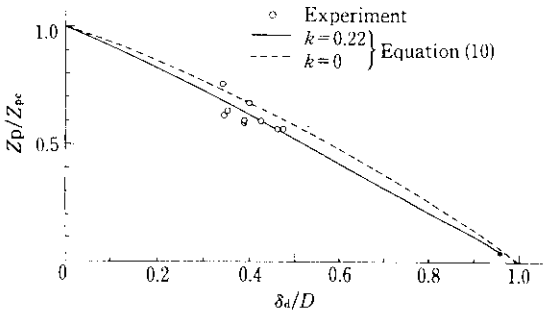
Fig. 5 Steel tube with local dent depth δ_d

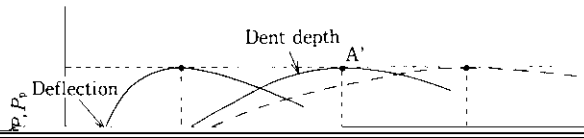


In Eq. (4), Z_p is a plastic section modulus, and for a

Fig. 6 Relation between lateral load and dent depth


Displacement at loading point δ
P
Dent depth δ_d
Deflection δ_b
$(\delta = \delta_d + \delta_b)$


Experiment
$k=0.22$
$k=0$
Equation (10)
1.0
0.5
0
Z_D/Z_{pc}
0.2
0.4
0.6
0.8
1.0
δ_d/D


Dent depth
A'
Deflection

(19) is compared with that from the loading test.

The table shows that the estimated values agree well

load and denting deformation, and in neglecting the loss in sectional rigidity due to local out-of-plane deforma-

which will be sufficient for practical design purposes.

4 Conclusions

A method for estimating the collapse load and

Despite these simplifications, the proposed estimation method well explained the test results.

The semi-empirical formulas obtained here may more applicable than others for the design of large tubular structures that are subjected to lateral loads, because