

# Criteria of column strength in paper by De Wolf, Pekoz and Winter: the significance of imperfections

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**Criteria of Column Strength in Paper by De Wolf, Pekoz and Winter  
– the Significance of Imperfections**

Critères de résistance des colonnes dans les travaux de De Wolf, Pekoz et Winter – l'importance des imperfections

Kriterien der Festigkeit von Stützen im Beitrag von De Wolf, Pekoz und Winter – die Bedeutung von Unvollkommenheiten

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The authors, De Wolf, Pekos and Winter, have considered an important question - design curves for columns with local plate buckling. They are modest about progress to date, but I am compelled to ask whether their basic philosophy will yield the desired results.

The authors report that three column tests were discounted presumably because eccentricities of load could not be eliminated. In structural design we are not so much concerned with the average margin of safety between load and strength as we are concerned with minimising the number of failures. We are not interested in the average, or even maximum attainable, column strength, but in the minimum strength below which the risk of failure is acceptably low.

In this class of structure, so sensitive to imperfections, it is necessary to base our philosophy on probable imperfections. The load-shortening characteristics of plates are very sensitive to initial plate curvature. An initially curved plate is less stiff, axially, than a flat plate when the load is less than the initial buckling load. It is more stiff after buckling.

A thinwalled column has both local plate initial curvature and overall initial curvature. Unsymmetrical initial plate curvature can cause an overall curvature to develop from the start. Overall initial curvature will cause plate buckling to initiate unsymmetrically in the cross-section with subsequent magnification of initial deflection with further load. Dr. Skaloud's report of experiments earlier in this session supports this observation.

I am therefore compelled to ask whether the effective width concept will lead to reliable design curves for thin-walled columns. Without considerable manipulation, the effective width concept does not give the current axial stiffness of plate elements which must be known for a stability analysis at any given load. The effective width changes with load and it is also sensitive to initial imperfections. I believe a more fruitful line of attack lies in assessment of column stiffness at the current load level, using reasonable

imperfections. In this way, the three tests discarded by the authors might turn out to be useful data in the overall estimation of column strength on a statistical basis.

Finally, I would like to observe that there seems to be a pressure on the designer of columns built up from separate plates to seek an apparent optimum proportion in which plate buckling stress, column buckling stress and yield stress are about the same value. It seems that predictions of strength are most subject to error in this region; and test results are most variable, due to the extreme sensitivity of the system to imperfections. This variability is enough to wipe out any benefits of this apparent optimum proportioning of column cross-section.