

STRENGTH LOSS IN WELDED ALUMINIUM STRUCTURES

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Abstract

Welding of heat treated aluminium alloys causes, in addition to residual stresses, loss of strength. The zone suffering strength loss is called the “Heat Affected Zone” (HAZ). For many years, in Europe and North America, the same approach has been adopted to allow for the effect in the design of welded aluminium structures. Based on the “1-inch rule” this approach is very simple but it can also be inaccurate.

Aims of the research are to:

- i. define the extent of the HAZ around welds
- ii. define the severity of strength loss in the HAZ
- iii. study the structural performance of welded members using the results of i and ii

Based on experimental work with 6000 ($Al - Si - Mg$) and 7000 ($Al - Zn - Mg$) series aluminium alloys, a model is proposed for the extent and severity of strength loss of the HAZ. Compared to the 7000 alloys the 6000 alloys show, in general, a smaller extent but greater severity of strength degradation. Apart from alloy type the model takes account of other previously unconsidered factors; these include the effects of interpass welding temperatures and of welds close to a free edge.

Experiments on welded structural members (ties and beams) were undertaken and the proposed HAZ model is validated by comparing experimental and predicted behaviour. A more general computer based, study of the performance of ties and beams is also presented.

Dependent on welding detail current design rules (e.g. CP118¹) may give large underestimates or overestimates of welded member strength. The proposed HAZ model allows for all of the important parameters and gives accurate results. Therefore it provides the

basis for the treatment for HAZ effects in the draft British Standard BS8118 “Code of Practice for the Design of Aluminium Structures”.