LOCAL BUCKLING EFFECTS ON THE SUPPORTS OF CONTINUOUS TRAPEZOIDAL PROFILED STEEL SHEETS

GRAZIELLA MATEESCU, VICTOR GIONCU
BUILDING RESEARCH INSTITUTE TIMISOARA
STR. TRAIAN LALESCU 2
1900 TIMISOARA, ROMANIA

Corrugated sheet roof decking panels are more often continuous than simply supported. They are generally designed in the elastic range, to resist the maximum bending moments at the intermediate supports. A tentative plastic design must consider the differences in the behaviour of these corrugated sheet at the supports and that in the central zone of the span. While the postcritical behaviour under bending is stable (fig. 1a), it becomes unstable under bending and shear (fig. 1b).

In the case of a continuous flexural member, the decrease in the moments at the supports $\Delta M_R$ due to local buckling results in an increase in the central zone moments $\Delta M_1$. If $\Delta M_R = \Delta M_1$, it follows that $\Delta M_1 = \Delta M_1$.

Laboratory tests were carried out on 21 panels modelling the behaviour of continuous panels at the intermediate supports (fig. 3 and 4), and 6 panels modelling the behaviour in the central zones of continuous elements (fig. 3 and 5). It can be noticed that in the first case the behaviour is strongly unstable, while in the second case a horizontal plateau is present. For practical design purposes, the actual curve characterizing the behaviour in the zones of intermediate supports was replaced by a tri-linear diagram (fig. 2b). The following values were obtained, based on test results:

$\Delta M_R = 0.481$; $\Delta M_1 = 0.577$; $\Delta M_2 = 0.635$

For a two-bay continuous panel, one obtains $\Delta = (\Delta M_1 \times \Delta M_2) / \Delta M_R$ and for the value of determined experimentally, $\Delta = 0.47$. This rise is very substantial and the strength reserves in the central zones are considerably reduced.

A two-bay panel was tested in order to check up the validity of the theoretical results. The panel failed immediately after the appearance of local buckling, thus the element did not exhibit any capacity of plastic adaptation.

Conclusion: The local effect of the shear forces at the intermediate supports is to reduce the bending moments in these regions (due to local buckling) and consequently to increase the moments in the central zones.
FLEXURAL BUCKLING

FIG. 1

FLEXURAL AND SHEAR BUCKLING

FIG. 2