THE COLLEGE OF AERONAUTICS
CRANFIELD

STABILITY OF HONEYCOMB SANDWICH PANELS IN SHEAR

by

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The Stability of Honeycomb Sandwich Panels in Shear


This abstract presents the results obtained by theoretical and experimental methods for the buckling of honeycomb sandwich panels in shear. Details of the specimens analysed are shown in Figs. 1 and 2. The test rig is shown in Fig. 3, and the accuracy with which uniform shear was obtained is illustrated in Fig. 4. The experimental results are given in Fig. 5, where buckling and failing shear stresses are plotted against the ratio panel width "b" to panel thickness "d". No consistent effect attributable to the difference in face thickness for the panel series A and B is shown by these results. Comparison between theory and experiment is shown in Figs. 6 and 7. The results for buckling agree substantially with plate theory for the case of simply supported edges. Corrections of plate theory to allow for shear flexibility of the filling can virtually be neglected. Discrepancies between theory and experiment for b/d < 80 are probably due to an insufficiently accurate allowance for plasticity.
FILLING - HARD TEMPER ALUM. FOIL 0.003" THICK - SYMMETRICAL HEX. HONEYCOMB.

FACES ~ 26 S.W.G. & 22 S.W.G. ALUM. ALLOY - SPEC. D.T.D 646.

both faces cut from same sheet.

<table>
<thead>
<tr>
<th>Panel N°</th>
<th>Filling Thickness</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0.60&quot;</td>
</tr>
<tr>
<td>2</td>
<td>0.40&quot;</td>
</tr>
<tr>
<td>3</td>
<td>0.30&quot;</td>
</tr>
<tr>
<td>4</td>
<td>0.25&quot;</td>
</tr>
<tr>
<td>5</td>
<td>0.20&quot;</td>
</tr>
</tbody>
</table>

'A' SERIES PANELS ~ 10% EACH FILLING THICKNESS, WITH FACES 26 S.W.G. (0.018") DESIGNATED PANEL N° 1A; 2A... ETC.

'B' SERIES PANELS ~ AS ABOVE BUT WITH 22 S.W.G. FACES (0.028")

FIGURE 1 - DETAILS OF PANEL SPECIMENS
FIGURE 2 - GEOMETRY OF HONEYCOMB FILLING

MATERIAL: HARD TEMPER ALUMINIUM FOIL ~ 0.003" THICK.
Key:  
A - upper suspension pin  
B - shear panel test frame  
C - lower shackle links and pins  
D - moving platen of testing machine  
E - dummy strain gauges  
Testing machine - 50 ton Avery 'Universal'

FIGURE 3 - END VIEW ON TEST RIG
FIGURE 4 - DISTRIBUTION OF SHEAR STRESS ON PANEL NO. 3A. AT A SHEAR LOAD OF 5.65 TONS
FIG. 5. EXPERIMENTAL BUCKLING & FAILING STRESSES.

[A' SERIES PANELS ~ FACES 0.018" THICK ~ MATERIAL D.T.D. 546.]
[B' SERIES PANELS ~ FACES 0.028" THICK ~ MATERIAL D.T.D. 546.]
FIG. 6. COMPARISON OF EXPERIMENTAL & THEORETICAL RESULTS
($'A$ SERIES PANELS ~ FACES 0.018 THICK)

KEY:

$\delta$ = WIDTH OF PANEL 30"

$\delta$ = DEPTH OF FILLING BETWEEN MEDIAN PLANES OF FACES

--- $\Delta$ EXPERIMENTAL BUCKLING STRESS

--- $X$ EXPERIMENTAL FAILING STRESS

--- --- THEORETICAL BUCKLING STRESS FOR PANEL HAVING CLAMPED EDGES-EQUIVALENT PLATE THEORY

--- --- --- THEORETICAL BUCKLING STRESS FOR PANEL HAVING SIMPLY SUPPORTED EDGES-EQUIVALENT PLATE THEORY

CORRECTED EQUIVALENT PLATE THEORY FOR SIMPLY SUPPORTED PANEL

FIG. 7. COMPARISON OF EXPERIMENTAL & THEORETICAL RESULTS
($'B$ SERIES PANELS ~ FACES 0.026 THICK)