MEMORANDUM

TO: David Yu
COPY TO: Max Liu
FROM: Roger Shelton
DATE: 8th July 2019
SUBJECT: Results of testing CNYD panels

PROJECT NO.: ST10365

This is an addendum to BRANZ Test Report ST10365.

For all details of the testing, including specimen construction, test methodology, and results, refer to the report.

The in-plane shear test results were further analysed using the BRANZ P21 test procedure, using the set of three replicate specimens of each tested configuration. The results of these analyses are presented in Figure 1, 2, 3 and 4.

Note that the P21 methodology only allows for rating at a maximum displacement of +/-36 mm, while the shear tests were continued up to greater than +/- 60 mm. The deflection limits in P21 are to ensure displacement compatibility of the rated bracing elements with the rest of the timber framed structure, and ultimately, to limit building displacements under lateral loading. As a result the bracing ratings presented here do not reflect the apparent performance of the specimens.
Figure 1. P21 analysis for 1.2 m long wall, 90 mm thick.
**Figure 2. P21 analysis of 1.2 m long wall, 140 mm thick.**

\[
\text{EVALUATION: EARTHQUAKE PERFORMANCE}
\]

\[
BU(\text{EQ}) = 20 \times \text{the lesser of } K_R R \text{ or } F_{x1} 219.55
\]

\[
K_4 \times R = 2.48 \quad F_{x1} 20.55 = 2.45
\]

Therefore \(BU(\text{EQ}) = 20 \times 2.45\)

\[
BU(\text{EQ}) = 49 \quad \text{Bracing Units}
\]

**EVALUATION: WIND PERFORMANCE**

\[
BU(\text{WIND}) = 20 \times \text{the lesser of } P \text{ or } F_{x1} 20.71
\]

\[
P = 3.40 \quad F_{x1} 20.71 = 1.9
\]

Therefore \(BU(\text{WIND}) = 20 \times 1.90\)

\[
BU(\text{WIND}) = 38 \quad \text{Bracing Units}
\]

1.2m long wall, 140mm thick
Figure 3.

P21 analysis of 2.4 m long wall, 90 mm thick

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Load S (kN)</th>
<th>Residual Displacement C (mm)</th>
<th>Maximum Load P (kN)</th>
<th>Calculated Load P(s) (kN)</th>
<th>Displacement F(Q) (mm)</th>
<th>4th Cycle Load at y mm F (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+ 4.66</td>
<td>+ 3.20</td>
<td>+ 12.70</td>
<td>+ 6.35</td>
<td>+ 11.70</td>
<td>+ 12.30</td>
</tr>
<tr>
<td></td>
<td>− 3.90</td>
<td>− 4.00</td>
<td>− 11.30</td>
<td>− 6.70</td>
<td>− 11.50</td>
<td>− 12.90</td>
</tr>
<tr>
<td>2</td>
<td>+ 5.26</td>
<td>+ 3.10</td>
<td>+ 13.40</td>
<td>+ 6.70</td>
<td>+ 11.50</td>
<td>+ 11.90</td>
</tr>
<tr>
<td></td>
<td>− 4.40</td>
<td>− 3.50</td>
<td>− 11.70</td>
<td>− 6.90</td>
<td>− 13.90</td>
<td>− 10.70</td>
</tr>
<tr>
<td>3</td>
<td>+ 5.20</td>
<td>+ 3.50</td>
<td>+ 13.10</td>
<td>+ 6.55</td>
<td>+ 11.30</td>
<td>+ 12.40</td>
</tr>
<tr>
<td></td>
<td>− 4.50</td>
<td>− 3.50</td>
<td>− 11.60</td>
<td>− 6.80</td>
<td>− 12.60</td>
<td>− 10.80</td>
</tr>
<tr>
<td>Averages</td>
<td>+ 4.66</td>
<td>+ 3.55</td>
<td>+ 12.28</td>
<td>+ 6.58</td>
<td>+ 11.50</td>
<td>+ 11.53</td>
</tr>
</tbody>
</table>

\[ F = K1 \times C \times X = 0.91 \]

The "Symmetry Of Performance" criterion in the last paragraph of Section 6.5 shall be followed.

\[ u = yd = 3.13 \]

\[ u = 1.00 \quad 2.00 \quad 2.50 \quad 3.00 \quad 3.50 \quad 4.00 \]

\[ K4 = 0.35 \quad 0.60 \quad 0.67 \quad 0.74 \quad 0.87 \quad 1.00 \]

For other values of \( u \), linear interpolation is used to determine \( K4 \).

Therefore \( K4 = 0.77 \).

**EVALUATION: EARTHQUAKE PERFORMANCE**

\[ BU(EQ) = 20 \times \text{the lesser of } K4 \text{ or } F \times 1.20/55 \]

\[ K4 \times R = 0.77 \quad F \times 1.20/55 = 9.3 \]

Therefore \( BU(EQ) = 20 \times 0.77 \)

**BU(EQ) = 175** Bracing Units

**EVALUATION: WIND PERFORMANCE**

\[ BU(wind) = 20 \times \text{the lesser of } P \text{ or } F \times 1.20/71 \]

\[ P = 12.38 \quad F \times 1.20/71 = 7.2 \]

Therefore \( BU(wind) = 20 \times 7.20 \)

**BU(WIND) = 144** Bracing Units

2.4m long wall, 90mm thick
Figure 4. P21 analysis of 2.4 m long wall, 140 mm thick.

Summary of bracing ratings:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Rating of wall (BU)</th>
<th>Rating per metre (BU/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wind</td>
<td>Earthquake</td>
</tr>
<tr>
<td>1.2 m 90 mm</td>
<td>53</td>
<td>61</td>
</tr>
<tr>
<td>1.2 m 140 mm</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>2.4 m 90 mm</td>
<td>144</td>
<td>175</td>
</tr>
<tr>
<td>2.4 m 140 mm</td>
<td>147</td>
<td>178</td>
</tr>
</tbody>
</table>

Regards

Roger Shelton

Senior Structural Engineer