Client: Dymon Industries Pty Ltd

Attention: John Cummins

Your Reference: Purchase Order No. N08425-S

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Grate Load Testing

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Principal Consultant Mechanical Engineering
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1 INTRODUCTION

*Dymon Industries Pty Ltd* engaged PearlStreet ETRS to perform load testing of a fabricated steel grate sample, shown in Figure 1.

The tests were carried out in accordance with AS 3996-2006 “Access covers and grates” (“the standard”) at the premises of Pearlstreet ETRS, 6/29 Collinsvale St, Rocklea, on 24th August 2007.

The client asked that the grate be tested first for compliance with Class D and, if so compliant, that it also be tested for compliance with Class E.

2 CONCLUSIONS

The grate sample conformed to Class D specification of AS 3996-2006 for deflection and permanent set. It did not conform to Class E.

3 PROCEDURE

3.1 Classification

The Circular Opening (CO) of the grate was assessed, as defined in S.1.4.4 of the standard and test loads (related to Serviceability and Ultimate limit state design loads) for the particular grate were determined using Table 4.1 of the standard.

Limits on deflection and permanent set were determined using Table 4.2 of the standard.

3.2 Load Configuration

Two separate tests configurations were used: the first with the grate supported along its long sides; the second with the grate supported along its short sides.

Figure 2 shows the setup used to apply test loads to the central portion of the grate, using the first method of support.

3.3 Loading

For each test configuration, the relevant serviceability test load was applied five times, as required by the standard, before a measurement of the grate deflection was taken. The ultimate limit state test load was then applied and a final deflection measurement was made to determine the permanent set.

Testing was halted when a failure occurred.
3.4 Deflection Measurement

Changes in vertical position of the central point of the grate were measured with a optoNCDT 1300 laser displacement transducer connected to a DT800 dataTaker data logger.

3.5 Assessment

Deflection and Permanent Set limits were assessed according to Table 4.2 of the standard.

4 RESULTS

4.1 Classification

The grate was assessed as having a clear opening CO = 70 mm.

4.2 Test Load Determination

Design loads for serviceability and ultimate limit state conditions and this CO value were selected according to classifications shown in Table 3.1 of the standard, as shown in Table 1, below:

Table 1. Extract from Table 3.1 of the standard

<table>
<thead>
<tr>
<th>Class</th>
<th>Serviceability design load (kN)</th>
<th>Ultimate limit state design load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>140</td>
<td>210</td>
</tr>
<tr>
<td>E</td>
<td>267</td>
<td>400</td>
</tr>
</tbody>
</table>

A load reduction factor was determined by taking the rectangular slot dimensions as 150 x 70 mm, thus;

\[
\text{Load Reduction Factor} = \frac{150 \times 70}{\frac{\pi \times 250^2}{4}} = 0.21
\]

Multiplying the design loads in Table 1 by this factor gave the test loads shown in Table 2, below:

Table 2. Test Loads

<table>
<thead>
<tr>
<th>Class</th>
<th>Serviceability Test load (kN)</th>
<th>Ultimate limit state Test load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>29.95</td>
<td>44.92</td>
</tr>
<tr>
<td>E</td>
<td>57.11</td>
<td>85.56</td>
</tr>
</tbody>
</table>
4.3 Deflection and Permanent Set Limits

The deflection limit is calculated as, \( \frac{CO}{45} = \frac{70}{45} = 1.56 \text{ mm.} \)

The deflection limit and permanent set limit for this grate are shown in the Table 3, below.

Table 3. Deflection and Permanent Set Limits for Class D and E

<table>
<thead>
<tr>
<th>Class</th>
<th>Deflection Limit (mm)</th>
<th>Permanent Set Limit (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D and E</td>
<td>1.56</td>
<td>1.00</td>
</tr>
</tbody>
</table>

4.4 Measured Deflection and Permanent Set

The results of all tests are summarized in Table 4

<table>
<thead>
<tr>
<th>Class Test</th>
<th>Sides Supported</th>
<th>Deflection (mm)</th>
<th>Permanent Set (mm)</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Long</td>
<td>1.0</td>
<td>1.3</td>
<td>Pass</td>
</tr>
<tr>
<td>D</td>
<td>Short</td>
<td>0.6</td>
<td>0.0</td>
<td>Pass</td>
</tr>
<tr>
<td>E</td>
<td>Long</td>
<td>1.3</td>
<td>1.7</td>
<td>Fail</td>
</tr>
<tr>
<td>E</td>
<td>Short</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIGURES

Figure 1
Grate, as supplied.

Figure 2
Grate under load, supported on long edges.
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