Fact Sheet # 25: Diaphragm Design Using Lightweight Steel Cladding
Version 1: 27 August 2009

Introduction
Wind blowing across a typical gable-roof building produces forces that act directly on the cladding and structural members as well as overturning forces for the building as a whole. Discrete wind bracing or rigid pole-framing are methods for resisting these forces. Another approach is to utilize the in-plane strength of the steel roof cladding to act as a shear diaphragm to transfer these loads to the foundation. The basic forces acting on the building are illustrated in the figure below.

**Diaphragm Design Method**
A design aid is available to assist in the in the selection and detailing of the sheet steel cladding and fasteners needed to create a lightweight steel cladding diaphragm. This aid is a publication of the Metal Construction Association titled “A Primer on Diaphragm Design”, First Edition 2004, and is
Scope
The manual provides tables for a variety of different roof and wall systems that include the following components:

Cladding profiles:
- 1.5” deep x 7.2” rib spacing x 36” panel width in 33 and 50 ksi yield strengths
- 1.25” deep x 12” rib spacing x 36” panel width in 80 ksi yield strength

Insulation:
- R19 fiberglass or
- 3-1/4” polyisocyanurate or thermal spacer blocks

Fastener pattern:
- 3, 4 and 5 screws configurations across the sheet width

Fasteners:
- #12 or #14 screws
Using the general design expression also included, design shear strength and stiffness values can be calculated for other configurations.

**Use with Limits States Design in Canadian**

The tables provided in the MCA manual give design shear values that are allowable loads for use in the US with the Allowable Strength Design methodology. In Canada we use Limit States Design, and so the design shear values need to be converted. The tabulated allowable loads are multiplied by the appropriate safety factor (FAC=2.356 in the sample table above) to determine the nominal resistance. The nominal resistance is multiplied by the appropriate resistance factor to get the factored resistance for use in an LSD design. The resistance factors for cold formed steel diaphragms are given in Table D5 of CSA-S136-07 *North American Specification for the Design of Cold-Formed Steel Structural Members*. This table is reproduced below.

**CSA-S136-07, Table D5**

### Safety Factors and Resistance Factors for Diaphragms

<table>
<thead>
<tr>
<th>Load Type or Combinations Including</th>
<th>Connection Type</th>
<th>Connection Related</th>
<th>Panel Buckling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>US and Mexico</td>
<td>Canada</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US and Mexico</td>
<td>Canada</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ω_d (ASD)</td>
<td>φ_d (LRFD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ω_d (ASD)</td>
<td>φ_d (LSD)</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Screws</td>
<td>2.50</td>
<td>0.65</td>
</tr>
<tr>
<td>Wind</td>
<td>Screws</td>
<td>2.35</td>
<td>0.70</td>
</tr>
<tr>
<td>All Others</td>
<td>Screws</td>
<td>2.50</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.00</td>
<td>0.80</td>
</tr>
</tbody>
</table>

**For More Information**

For more information on lightweight steel cladding products, or to obtain other CSSBI publications, contact the CSSBI at the address shown below or visit the web site at [www.cssbi.ca](http://www.cssbi.ca)