



## **ADVISORY BULLETIN**

March 2016

### **Subject:**

## **Application of ABC for Structural Insulated Panels**

### **Background:**

SIPs are a product typically consisting of in-fill panels of expanded polystyrene (EPS) insulation glued to two oriented strand board (OSB) panels. For wall panels in load bearing applications, lumber studs may be installed as structural ribs at 1.2 m on centre (o.c.) at the panel joints but in most cases the manufacturer only proposes splines constructed of the panel facing material. For roof panels, either lumber or I-joists may be installed as structural ribs at 1.2 m o.c. at the panel joints. For non-structural applications on post-and-beam construction, the panels may have OSB splines for joining the panels. For Walls, floors and roofs there have also been proposals for systems that consist of other than OSB or plywood panels glued to the EPS. Currently SIPs are not a referenced product or system in the ABC.

On a single or two family dwelling and on row housing where there are 5 or less units there is generally not professional involvement required and is not specified as required under the ABC, with certain exceptions. When there is a product or system to be included in a single or two family dwelling that is not included in the requirements of Part 9 of the ABC, there generally is requirements in the other parts of the code that require professional involvement. Even when there are multiple unit buildings that do require professional involvement, there is generally reference to a product standard or method of construction for the professional to follow.

The City of Calgary has been in contact with the National Research Council, Canadian Construction Material Center (CCMC) regarding the acceptance of SIP panels for use in construction. There are 2 known SIP products that have been evaluated by and listed by CCMC. Both of these systems have studs as part of the panel design to carry structural loads. The CCMC engineer involved in the evaluation of SIP panels has provided some background on the CCMC project to develop a technical guide for how to evaluate SIPs. There are some unanswered issues still to be resolved before further evaluation of SIP panels and acceptance of further panels may occur by CCMC. Until that time the evaluation

and determination of whether or not SIPs should be permitted to be used under the ABC is up to the SCO and the City of Calgary.

At the January 20, 2015 meeting of the Codes and Standards Technical Interpretation Committee of Inspections and Permitting Services, the following decision was reached with regards to the acceptance of SIPs in the City of Calgary:

1. May accept if a CCMC evaluation report for the specific SIP is provided and the use of the panel complies with the report and the current ABC, OR
2. May accept if the SIP system includes a code complying framing system within it to address the structural issues and the remainder of code issues are complied with, OR
3. Accept if site specific engineer's review is provided complete with drawings demonstrating that the SIP system proposed complies with the prescriptive requirements of Division B (see Table 1 below).
  - a. This option requires a professional engineer to provide detailed analysis of the structure to the SCO as part of the acceptable solution under Division B. This is an option of the AHJ as indicated in Division C, Article 2.2.4.5. which states:

“The calculations and analysis made in the design of the structural members, including parts and components, of a building shall be available for inspection upon request.”

In order to show that the SIP meets the prescriptive requirements of Division B there must be a test method to follow. While there is a test standard available, this standard is not recognized in the ABC 2014 or the 2010 NBC. Since there is no recognized test method for SIP, the individual components have to be evaluated using recognized standards. Table 1 below shows the ABC issues that the SIPs manufacturer needs to address, where that issue is referenced in the ABC, how compliance may be able to be demonstrated and what compliance would look like. There are a number of issues with being able to show compliance with the structural requirements; specifically addressing Section 4.1. *Structural Loads and Procedures* and, Article 4.3.1.1. *Design Basis for Wood* (i.e. Composite panel with lumber studs/joists). As an example of the difficulty, even with the CCMC evaluated systems there are studs required at a maximum of 1.2m oc.

Further information and tools are available for assistance should method 3 be the method chosen to show compliance with the ABC 2014. It is recommended that, if option 3 is

pursued, you contact the SCO involved with the project, the Supervisor of Plans Examination or the Chief Plans Examiner to discuss the options.

### **Advisory:**

The purpose for this document is to present the interpretation of how to consider Structural Insulated Panels (SIPs) under the Alberta Building Code (ABC) in single family, duplex and row house construction, and the professional involvement requirements within the City of Calgary. This document is based on a report submitted by the City of Calgary to Safety Codes Council, Building Technical Council at the January 9, 2014 Meeting.

#### **Design Requirements for Acceptable Solutions for Design Using SIP under ABC 2014**

	Issue and 2014 ABC Reference	Requirement	Example of How Compliance Shown
1	SIPs as structural member not in Part 9 so need to design to Part 4  Div C, 2.2.2.1.(1) Div C, 2.2.4.3.(1) 4.1.1.4.	Structural Drawings to be designed by a Professional Engineer	The structural drawings shall be prepared and stamped by a professional engineer registered in the province of Alberta specific to the project being considered  2.4.2.1.(8) 9.4.1.1.(1) 2.4.2.2.
2	SIPs as structural member not in Part 9 so need to design to Part 4.  9.4.1.1. leads to 4.1.1.5.(2)(a)	Testing to be conducted using known and standardised test methods and specimens applicable to SIPs	SIP products shall be qualified by Method A or Method B in conformance with ANSI/APA Standard PRS 601.1-2013. Submit a test report, from a qualified 3 <sup>rd</sup> party testing agency, stating (and demonstrating) that the ANSI qualification requirements and criteria have been met. The report shall be prepared and stamped by a professional engineer registered in the province of Alberta and especially qualified in the methods applied.
3	Demonstrate a level of safety and performance in accordance with Part 4. Div C, 2.2.4.5. 4.1.1.5.(2) 4.1.3.2. 4.3.1.1.	The structural Standards referenced by Part 4 set the reliability targets to be achieved.	Provide a report deriving the LSD design values for strength and stiffness to allow for an engineering design to be completed in accordance with Part 4 of the ABC 2014. The report shall demonstrate that the reliability targets of CSA-086 have been met.  The report shall be prepared and stamped by a professional engineer registered in the province of Alberta and especially qualified in the methods applied.

4	<p>Assurance that design values based on testing will be maintained by the manufacturer over time.</p> <p>4.3.1.1.</p>	<p>Products whose strength properties are based on test data must continue to be manufactured in the same manner as the product on which the testing was done.</p> <p>For example CSA-086 requires lumber, plywood, OSB, glulam, I-joists, and SCL to be certified by a 3<sup>rd</sup> party CO and/or accredited agency to verify for example:</p> <ol style="list-style-type: none"> <li>1) quality control procedures for staff,</li> <li>2) panel components,</li> <li>3) manufacturing equipment,</li> <li>4) panel tolerances, and</li> <li>5) routine quality assurance testing</li> </ol>	<p>All SIP products supplied for construction shall bear the mark of a qualified Certification Organization (CO) accredited by the Standards Council of Canada</p>
5	<p>Lack of test data with respect to long term performance under wet service conditions, floor vibration performance, shear resistance, bearing resistance or resistance to concentrated loads.</p> <p>4.1.3.6.(1) 4.1.2.1. 4.1.5.10. 4.3.1.1. 5.1.4.2.(1) 9.4.1.1. / 9.23.4.2.</p>	<p>CSA-086 does not permit OSB for use in wet service conditions.</p> <p>BP applications shall be limited to the scope of work stated in ANSI/APA Standard PRS 601.1-2013 (dry service conditions, wall panels only, above grade applications).</p>	<p>Indication of limitations of the use and location of the panels on the drawings</p>
6	<p>No provision for design of SIPs without studs in panel</p> <p>4.3.1.1.</p>	<p>The SIP product must include structural studs spaced at not more than 1.2 m o.c. Required due to the lack of recognized test standards applicable to SIPs for evaluation of long term durability and structural performance.</p>	<p>Refer to NRCC and CCMC evaluations for Insulspan and Eco-Pan</p>
7	<p>Meet the code requirements for long term deformation under load (i.e. creep)</p> <p>4.1.2.1.(1) 5.2.2.1.(2)(d)</p>	<p>Panel must support sustained structural loads without excessive deformation.</p>	<p>Conduct and pass the CCMC creep and recovery test. Refer to NRCC and CCMC evaluations for Insulspan and Eco-Pan</p>
8	<p>Compatibility of SIPs with other structural systems that it is connected to such as floor and roof (see also item 13)</p> <p>4.1.1.3. 4.3.1.1.</p>	<p>Provide details of the connection details to adjacent components</p> <p>The structural compatibility of the SIP product with I-joists shall be verified by each individual I-joist manufacturer. This verification shall include:</p> <ol style="list-style-type: none"> <li>1) Bearing capacity of I-joists supported by SIP product, and</li> <li>2) Squash block requirements for I-joists supporting load bearing SIPs</li> </ol>	<p>Loads introduced to floor joists through the inner flange of the SIP cannot be "headed-off" by a rim joist. These loads would have an effect on the bearing resistance of the I-joist. As per CSA-086 the bearing resistance of I-joists must be verified by testing in accordance with ASTM D 5055. Test results are typically proprietary in nature and would not be known to the SIP designer</p>

9	Ability of components constructed of SIPs to meet building envelope requirements 4.3.1.1. 5.1.4.2.(1)	Water penetrating the cladding from the exterior must be allowed to drain away. As per CSA-O86, OSB is not permitted for use in wet service conditions	All cladding systems used with SIP products must be installed as "rain screen systems" with a minimum of 10 mm air space between the inside face of the cladding and the outside face of the SIP
10	SIPs not tested under point loads.  4.1.1.5.(2)(a)	Structural framing at door and window openings and at the support of points loads (e.g. girder trusses, floor beams, etc) must be constructed following conventional wood frame construction methods and in conformance with ABC 2006	Review framing details and view point load carry system on-site.
11	Verification that construction completed as per structural design Div C, 2.2.12.6.	Verification of Compliance	Field review and written verification of the SIP installation is required to be done by the engineer taking responsibility for the design
12	Expectation of some length of service life  Appendix A-5.1.4.2 Div A, 5.1.4.2. 4.1.1.3.(1) 4.3.1.1.	Service life is between 30 - 50 years as per CSA-086.  <b><i>"Building components must be designed with some understanding of the length of time over which they will effectively perform their intended function. Actual service life will depend on the materials used and the environment to which they are exposed. The design should take into consideration these factors, the particular function of the component and the implications of premature failure, the ease of access for maintenance, repair or replacement, and the cost of repair or replacement."</i></b>	Perform testing on the SIP product to demonstrate the long-term durability of the facing-to-core bond, dimensional stability of the panel, and stability of the foam core. As a minimum the long-term durability shall exceed the requirements of an approved Standard for SIP product testing acceptable to the AHJ
13	SIPs form only part of the overall structural system of a building. All structural components must be compatible with each other and act together to ensure the stability of the overall building.  2.2.2.1.(1) 2.2.4.3.(1) 2.4.2.1.(8) 9.4.1.1.(1) 2.4.2.2.  SIPs not tested under concentrated loads.  Sufficient information	Each Building Permit application shall be accompanied by structural drawings signed and stamped by an engineer registered in the Province of Alberta	The drawings shall include the following information: 1) A statement confirming that the structural design conforms to the current edition of the ABC. All loads used in design (dead, use and occupancy, wind, seismic, and lateral earth pressure loads (where applicable)). 2) All ABC referenced design standards to which the design conforms. 3) All ABC referenced material standards to which the SIPs conform (i.e. OSB/ plywood, insulation, wood framing, fastenings (nails/screws etc). 4) Erection sequence and panel erection instructions. 5) SIP panel layout c/w dimensions,

	<p>needed to complete the work.</p> <p>Compatibility issues.</p> <p>Standata BCI-015</p> <p>Structural compatibility issue.</p>		<p>location, and size of all panels.</p> <p>6) Elevation view of each individual SIP showing:</p> <ul style="list-style-type: none"> <li>a. Panel dimensions and components,</li> <li>b. Wood framing required at all openings within the SIP (i.e. for door, windows,etc.)</li> </ul> <p>Note: Framing shall be in conformance with ABC Section 9.23.</p> <ul style="list-style-type: none"> <li>c. Wood framing required at all point loads</li> </ul> <p>7) Construction details showing:</p> <ul style="list-style-type: none"> <li>a. SIP to wood framing connections at openings and point loads including fastener requirements</li> <li>b. SIP to top and bottom plates including fastener requirements</li> <li>c. All SIP to SIP connections including fastener requirements</li> <li>d. SIP to foundation connection including fastener requirements</li> <li>e. SIP to floor and roof systems including fastener requirements</li> <li>f. Rim joist (both the type, and the connection requirements to the SIPs)</li> <li>g. Hold down connections (when required to resistance wind or seismic loads)</li> <li>h. I-joist bearing including fastener requirements</li> <li>i. I-joist squash blocks requirements</li> <li>j. Fastener and blocking requirements for load transfer to wood frame dropped headers above any openings in the SIPs</li> <li>k. Provisions for electrical wiring and outlet boxes</li> <li>l. Provisions for plumbing vents (Note: Wet vents and water lines shall not be located within SIPs used for exterior walls)</li> <li>m. Ledger connections to SIPs</li> </ul>
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			<p>when applicable</p> <p>n. Reinforcing required at stair support brackets where applicable</p> <p>8) Where manufactured I- joists are used for either floor or roof systems the manufacture's design drawings must:</p> <ol style="list-style-type: none"> <li>indicate the size and type of SIP being used, and</li> <li>be signed and sealed by a professional engineer registered in the Province of Alberta</li> </ol> <p>9) Where roof trusses are supported by SIPs, the roof truss layout must:</p> <ol style="list-style-type: none"> <li>indicate the size and type of SIPs being used, and</li> <li>be signed and sealed by a professional engineer registered in the Province of Alberta</li> </ol>
15	Compliance with other than structural parts of the ABC	For SIP product applications limited to Part 9 buildings, conformance with the prescriptive requirements of the ABC Part 9 will need to be demonstrated.	<p>These include, but are not limited to, the following ABC requirements:</p> <ol style="list-style-type: none"> <li>9.3.2.9.: Decay Protection (i.e. for SIPs used within 150 mm of ground level)</li> <li>9.10.3. / 3.1.7.: Fire-resistance ratings (for SIPs used in wall or floor assemblies required to have a fire-resistance rating).</li> <li>9.10.17.10. / 3.1.5.12. (2)(e): Protection of foamed plastics.</li> <li>9.10.17. / 3.1.12.: Flame-spread rating and smoke development classification.</li> <li>9.19.1. Venting (for SIPs used as roof panels).</li> <li>9.23.: Wood framing (for framing required around wall/floor openings and to support point loads).</li> <li>9.25.1.: General requirements (i.e. with regards to the location of materials with low permeance).</li> <li>9.25.2.: Thermal insulation requirements.</li> <li>9.25.3.: Air barrier requirements (e.g. continuous air barrier required, sealed joints, etc.).</li> <li>9.25.4.: Vapour barrier requirements.</li> <li>9.27.: Cladding (e.g. attachment and second layer of protection). It is expected that all cladding</li> </ol>

			systems used with OSB faced SIPs will be installed as 'rain screen systems' with a minimum of a 10 mm air space between the inside face
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