HEBEL AUTOCLAVED AERATED CONCRETE (AAC) PANELS AND THIN BED MORTAR

CSI Section: 03 41 00 Precast Structural Concrete

1.0 RECOGNITION

Hebel Autoclaved Aerated Concrete (AAC) and Thin Bed Mortar have been evaluated for use as structural panels in compliance with Section 1901.2 of the IBC and Section R301.1 of the IRC as load-bearing and nonload-bearing wall panels, shear walls, wall lintels and as roof and floor panels. The panels have been evaluated for strength, durability, structural performance, fire resistance, non-combustibility, sound transmission and thermal conductivity for compliance to the following codes & regulations:

- 2015, 2012 and 2009 International Residential Code® (IRC)
- ACI 523.4R-09, Guide for Design and Construction with Autoclaved Aerated Concrete Panels

2.0 LIMITATIONS

Use of Hebel Autoclaved Aerated Concrete (AAC) and Thin Bed Mortar recognized in this report is subject to the following:

2.1 Hebel AAC panel structures shall be designed using the procedures in this report, the guidelines in ACI 523.4R-09, and the applicable code.

2.2 Construction documents, engineering design and plans specifying the use of Hebel AAC panels shall be submitted to the code official for approval. When required under IBC Section 107.1, the engineering calculations and related documents shall be prepared by a registered design professional.

2.3 Installation of the Hebel AAC panels shall comply with this report, the guidelines in ACI 523.4R-09, and the requirements for structural concrete in the IBC.

2.4 Panel connections shall be designed to the satisfaction of the code official.

2.5 Special inspection of Hebel AAC panel construction shall be provided in accordance with Section 3.8 of this report.

2.6 Hebel AAC wall panels used for lateral force-resisting systems or “diaphragms based on adhesion alone shall be limited to Seismic Design Categories A and B”, as noted in Section 7.8.2.1 of ACI 523.4R-09.

2.7 Hebel AAC roof and floor panels used for lateral force-resisting systems shall be limited to Seismic Design Categories A, B or C, in accordance with the manufacturer’s structural guidelines.

2.8 Use of AAC panels for loads that involve vibration and impact forces is outside the scope of this report.

2.9 The manufacturer’s published installation instructions and this report shall be available during construction. In the case of a conflict between this report, the published installation instructions and the code requirements, the more restrictive requirements shall govern.

3.0 PRODUCT USE

3.1 Hebel AAC panels, slabs and lintels shall be designed and constructed in accordance with the requirements of Section 1901.2 of the IBC, ACI 523.4R-09, the manufacturer’s installation instructions and this report. In the event of a conflict the most conservative shall govern. The manufacturer’s installation instructions shall be strictly adhered to and be available at the jobsite during construction. Allowable loads shall be as shown in Tables 4, 5 or 6 of this report, as applicable.

3.2 Typical installation details are illustrated in Figures 1 through 3 of this report. The figures are for general information only.

3.3 Wall Panels. Hebel Autoclaved Aerated Concrete (AAC) wall panels may be used as load bearing walls erected vertically between story heights or non-load bearing wall panels erected either vertically or horizontally between columns. Wall panels may be used with steel or concrete structures as curtain walls spanning horizontally or standing vertically. Initial wall panels shall be set in a leveling bed of Type M cement mortar complying with ASTM C270. A waterproof membrane shall be used between the foundation and the bottom of the wall panel. The exterior face of wall panels shall have code complying weather protection. Panels shall be attached to the structure in accordance with the approved plans. Panel to panel edges shall be joined with Hebel Thin-Bed Mortar complying with Section 4.6 of this report.

3.4 Roof and Floor Panels. Hebel AAC floor and roof slab panels may be used as simply supported floor and roof slabs. The panels shall be supported by load-bearing walls or structural beams. The panels shall be designed to comply...
with strength and serviceability requirements as specified in ACI 523.4R-09. Longitudinal joints between panels shall be reinforced with a No. 3, Grade 60, deformed reinforcement bar complying with ASTM A615, in minimum 3,000 psi (20.7 MPa) compressive strength concrete. Ring beams shall be placed around panel perimeters and consist of two No. 4, Grade 60, deformed reinforcement bars complying with ASTM A615, in minimum 3,000 psi (20.7 MPa) compressive strength concrete.

3.5 Roof and Floor Panel Fire-Resistance Rating. Roof and floor panels have the fire-resistance ratings as shown in Table 1 of this report. Roof panel assemblies shall be covered with an approved adhesively applied roof covering.

3.6 Sound Transmission Class. Wall, roof and floor assemblies of minimum 8-inch (203 mm) thickness constructed in accordance with this report have a sound transmission class (STC) of not less than 50 for air-borne noise when tested in accordance with ASTM E492 in accordance with Section 1207.2 of the IBC, and an impact insulation class (IIC) rating of not less than 50 when tested in accordance with ASTM E492 in accordance with Section 1207.3 of the IBC. The special insulation of structural concrete shall conform to Section 1705 of the IBC. The special inspector’s duties shall include verification and inspection of concrete construction as specified in IBC Table 1705.3 as well as Hebel AAC panel and Thin Bed Mortar ID identification, panel placement and placement of field-installed reinforcement.

3.7 Thermal Insulation. Hebel AAC wall, roof and floor panel assemblies have the thermal transmission properties shown in Table 2 of this report.

3.8 Inspection: Special inspection of structural concrete shall conform to Section 1705 of the IBC. The special inspector’s duties shall include verification and inspection of concrete construction as specified in IBC Table 1705.3 as well as Hebel AAC panel and Thin Bed Mortar identification, panel placement and placement of field-installed reinforcement.

4.0 PRODUCT DESCRIPTION

4.1 Hebel AAC panels are manufactured from autoclaved aerated concrete and consist of reinforced, precast, noncombustible panels complying with ASTM C1452 and ASTM C1694, as applicable, in strength classes AAC-2, AAC-4 and AAC-6. Available panel strengths and densities are as shown in Table 3 of this report.

Table 3. Hebel AAC Panel Physical Requirements

<table>
<thead>
<tr>
<th>Strength Class</th>
<th>Minimum Compressive Strength (psi)</th>
<th>Nominal Dry Bulk Density (lb/ft³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC-2</td>
<td>290</td>
<td>25</td>
</tr>
<tr>
<td>AAC-4</td>
<td>580</td>
<td>31</td>
</tr>
<tr>
<td>AAC-6</td>
<td>870</td>
<td>37</td>
</tr>
</tbody>
</table>

SI conversions: 1 psi = 0.006895 MPa, 1 lb/ft³ = 16.0185 kg/m³

4.2 The reinforced wall panels, lintels, floor panels and roof panels are reinforced with two layers of factory-installed reinforcement with protection from corrosion in accordance with ASTM C1452 and ASTM C1694, as applicable. Steel wire reinforcement shall comply with the requirements of Section 1901.2 of the IBC, ACI 523.4R-09, the manufacturer’s installation instructions and this report, and shall have a minimum yield strength of 70 ksi (485 MPa) and a minimum nominal 0.32 inch (4 mm actual) diameter to maximum nominal 0.16 inch (8 mm actual) diameter, and spaced maximum 9.44 inches (240 mm) on-center. Metal fasteners and other embedments shall be corrosion-resistant and compatible with the AAC.

4.2.1 Hebel AAC panels are manufactured in Pesqueria, Nuevo Leon, Mexico, by Xella Mexicana S.A. de C.V., under a quality control program with inspections by IAPMO UES.

4.3 Hebel AAC Wall Panels: Hebel Autoclaved Aerated Concrete (AAC) wall panels are 24 inches (610 mm) wide, up to 20 feet (6,096 mm) in length and widths of 4, 5, 6, 7, 8, 10 or 12 inches (102, 127, 152, 178, 203, 254 or 305 mm). Panel edges may be flat, notched or tongue-and-grooved.

4.4 Hebel AAC Floor Slab and Roof Slab Panels: Hebel AAC floor and roof slab panels are 24 inches (610 mm) wide, up to 20 feet (6,096 mm) in length and widths of 4, 5, 6, 7, 8, 9, 10 or 12 inches (102, 127, 152, 178, 203, 229, 254 or 305 mm). Slab edges may be flat, notched or tongue-and-grooved.

4.5 Hebel AAC Lintels: Hebel AAC lintels are reinforced beams used to cover spans above door and window openings in both load bearing and non-load bearing walls. The lintels are manufactured in standard heights of 8, 10, 12 and 24 inches nominal (200, 250, 300 and 600 mm actual), and various lengths and widths.

4.6 Hebel Thin-Bed Mortar: Hebel thin-bed mortar for AAC complies with Section 2103.2.1 of the 2015 IBC (Section 2103.12 of the 2012 IBC, Section 2103.11 of the 2009 IBC). Thin-bed mortar is a dry mix, pre-packaged in 48.5 lbs. (22 kg) bags. The working life of the thin-bed mortar is four hours. When stored in unopened bags and
protected from moisture the thin-bed mortar has a one-year shelf life from the date of manufacture.

4.6.1 Hebel thin-bed mortar is manufactured in Pesqueria, Nuevo Leon, Mexico, under a quality control program with inspections by IAPMO UES.

4.7 Grout: Cement grout used with Hebel AAC panels shall consist of one part portland cement and three parts fine aggregate (sand) conforming to ASTM C476.

5.0 IDENTIFICATION

Hebel Autoclave Aerated Concrete (AAC) panels, slabs and lintels are identified by labels or die-stamps which include the manufacturer’s name (Xella Aircrete North America, Inc., or Xella Mexicana S.A. de C.V.), and/or trademark (Xella™), brand name (Hebel), product type, strength class and density, the IAPMO Uniform ES Mark of Conformity, and the Evaluation Report Number (ER-400).

Hebel Thin Bed Mortar is identified by packaging which shall include the name Xella Mexicana S.A. de C.V., brand name (Hebel), the weight, and mixing and application instructions. Either Mark of Conformity may be used as shown below:

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with the ICC-ES Acceptances Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems (AC15), dated February 2010; editorially revised April 2015; test results are from laboratories in compliance with ISO/IEC 17025.

6.2 Manufacturer’s descriptive literature and installation instructions.

6.3 Reports of testing for compliance with the Standard Specification for Reinforced AAC Elements in accordance with ASTM C1452.

6.4 Reports of Airborne Sound Transmission testing in accordance with ASTM E90.

6.5 Reports of Impact Sound Transmission testing in accordance with ASTM E492.

6.6 Report of flexural bond strength testing in accordance with ASTM E518.

6.7 Report of fire testing in accordance with ASTM E119.

6.8 Report of testing for compliance with the Standard Specification for Precast AAC Wall Construction Units in accordance with ASTM C1386.

6.9 Report of diagonal tension (shear) testing in accordance with ASTM E519.

6.10 Report of testing for noncombustible materials in accordance with ASTM E136.

6.11 Report of splitting tensile strength testing in accordance with ASTM C1006.

7.0 CONTACT INFORMATION

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8.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research carried out by IAPMO Uniform Evaluation Service on Hebel Autoclaved Aerated Concrete (AAC) and Thin Bed Mortar to assess its conformance to the codes and standards shown in Section 1.0 of this report and documents the product’s certification.

Brian Gerber, P.E., S.E.
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Uniform Evaluation Service

Richard Beck, PE, CBO, MCP
Vice President, Uniform Evaluation Service

GP Russ Chaney
CEO, The IAPMO Group

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org
Table 4. AAC-6 Floor Panel Allowable Loads ², ³

<table>
<thead>
<tr>
<th>Nominal Panel Thickness (inch)</th>
<th>Moment Capacity (lb-ft/ft)</th>
<th>Superimposed Uniform Load ¹, w (psf)</th>
<th>Maximum Permissible Span ⁴, ⁵, ⁶, ⁷ (feet)</th>
<th>Dead Weight (psf)</th>
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<tbody>
<tr>
<td>4</td>
<td>814</td>
<td>8</td>
<td>7</td>
<td>7</td>
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<td>9</td>
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<td>5,917</td>
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<td>12</td>
<td>6,333</td>
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</tbody>
</table>

For SI: 1 inch = 25.4 mm; 1 foot = 305 mm; 1 psf = 47.88 Pa, 1 lb-ft/ft = 4.488 N-m/m³; 1 pcf = 16.02 kg/m³

Table 5. AAC-4 Roof Panel Allowable Loads ⁵, ³

<table>
<thead>
<tr>
<th>Nominal Panel Thickness (inch)</th>
<th>Moment Capacity (lb-ft/ft)</th>
<th>Superimposed Uniform Load ¹, w (psf)</th>
<th>Maximum Permissible Span ⁴, ⁵, ⁶, ⁷ (feet)</th>
<th>Dead Weight (psf)</th>
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<td>11</td>
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</table>

For SI: 1 inch = 25.4 mm; 1 foot = 305 mm; 1 psf = 47.88 Pa, 1 lb-ft/ft = 4.488 N-m/m³; 1 pcf = 16.02 kg/m³

Table 6. AAC-6 Roof Panel Allowable Loads ⁵, ³

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</table>

For SI: 1 inch = 25.4 mm; 1 foot = 32005 mm; 1 psf = 47.88 Pa, 1 lb-ft/ft = 4.488 N-m/m³; 1 pcf = 16.02 kg/m³

¹ Superimposed uniform loads are nominal out-of-plane loads as defined in IBC Section 1602.1 and derived from strength design.
² Design unit weight of material is 37 pcf for AAC-4 and 45 pcf for AAC-6.
³ Roof and floor slabs are designed for dead weight and uniformly distributed downward superimposed loads only. Uplift (wind) forces required further investigation to determine uplift load capacity.
⁴ Total load deflection (DL + LL) shall not exceed 1/300 of span for floor panels.
⁵ Total load deflection (DL + LL) shall not exceed 1/300 of span for roof panels having spans less than or equal to 19.4 feet.
⁶ Total load deflection (DL + LL) shall not exceed 1/200 of span for roof panels having spans greater than 19.4 feet.
⁷ More stringent deflection limits and/or analysis of long-term deflection shall be provided if slabs support nonstructural panels likely to be damaged by large deflections.
Figure 1 – Typical Floor Panel Connection and Minimum Bearing Depth of Roof/Floor Panels

HEBEL FLOOR PANEL

NOTE:
Larger bearing length shall be provided to accommodate anchorage requirements and/or permissible bearing stresses at the support.

HEBEL FLOOR PANEL

CONCRETE, TIMBER, MASONRY, OR AAC MATERIALS

STEEL BEAM

STEEL, REINFORCED OR PLAIN CONCRETE, TIMBER CONSTRUCTION

Minimum "A" is 2" (50 mm) or L/80 whichever is greater.
B ≥ 3/4" (19 mm)
(where L= clear span + A)

MASONRY CONSTRUCTION

Minimum "A" is 2.75" (70mm) or L/80 whichever is greater.
(where L= clear span + A)

AAC MATERIAL CONSTRUCTION

Minimum "A" is 2" (50mm) for center bearing and 2.75" (70mm) for end bearing

1 BAR #3 IN GROUT @ PANEL JOINT

HEBEL FLOOR PANEL

BOND BEAM FILLED W/ CONCRETE GROUT & 2 #4 BARS (MIN.)

BEAM / WALL
Figure 2 - Typical Exterior Wall Section

- Cored Cell (filled with concrete 3,000 PSI)
- Spacing per the structural engineer
- Panel thickness 6", 8", 10" & 12"
- Hebel thin-bed mortar @ every contact face
- Vertical joint reinforcement (spacing per structural engineer)
- Hebel floor panel
- Mortar bed
- Bond beam filled w/ concrete grout & 2 #4 bars (min.)
- Type "M" mortar joint
- Hebel vertical wall panel
- 1 bar #3 in grout @ panel joint
- Hooked dowel or epoxy dowel as req. (specified by the structural engineer)

EXTERIOR WALL
Figure 3 - Typical Interior Wall Section

- CORED CELL (FILLED WITH CONCRETE 3,000 PSI)
- SPACING PER THE STRUCTURAL ENGINEER
- HEBEL THIN-BED MORTAR @ EVERY CONTACT FACE
- VERTICAL JOINT REINFORCEMENT (SPACING PER STRUCT. ENGINEER)
- HEBEL FLOOR PANEL
- RING BEAM (SEE STRUCTURAL DWGS.)
- 1 BAR #3 IN GROUT @ PANEL JOINT
- PANEL THICKNESS 6", 8", 10" & 12"
- HOOKED DOWEL OR EPOXY DOWEL AS REQ.
  (SPECIFIED BY THE STRUCTURAL ENGINEER)
- INTERIOR WALL