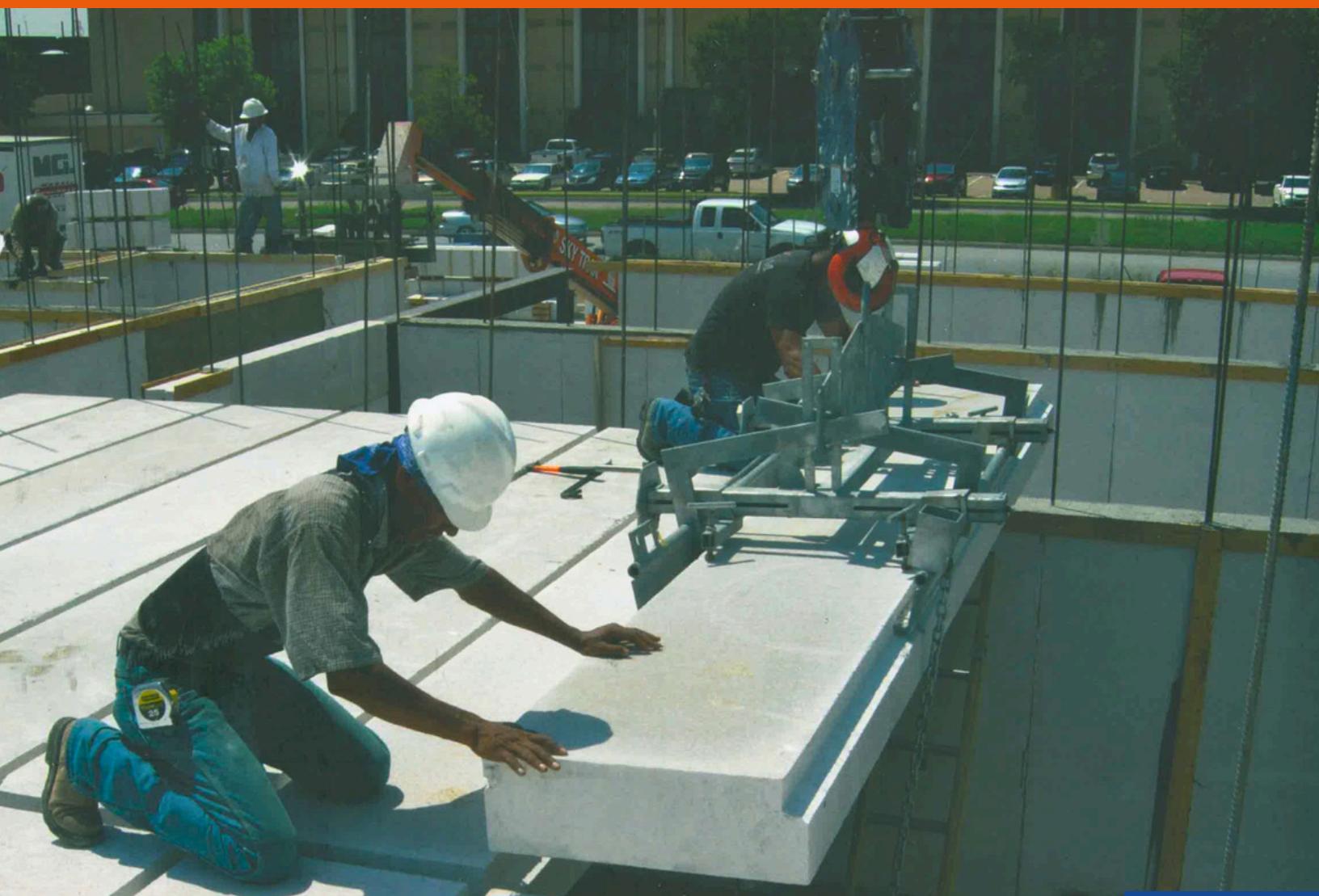


Hebel RAAC® Roof Panel Technical Sheet



German
Technology

hebel **RAAC USA Inc.**
POWERED BY XELLA GROUP DE

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About Us

Xella Aircrete North America, the leading manufacturer of Hebel RAAC® Autoclaved Aerated Concrete (AAC), is an amazingly innovative building material that has been used in Europe for more than 80 years and in the US for more than 15 years. Products and systems have been developed for all types of the construction industry: industrial, commercial, high-rise buildings, schools, hospitals, and more.

Hebel RAAC® AAC is a lightweight concrete that is formed into blocks and reinforced panels for a wide range of load-bearing and non-load-bearing construction applications. It is manufactured from sand, cement, recycled material, lime, gypsum, aluminum paste, and water. It is molded, cut, and steam-pressure cured in an autoclave before being packed, ready for transport.

Hebel RAAC® AAC delivers more benefits than the traditional materials, such as strength, acoustics, fire and pest resistance, and is installed faster, saving valuable construction time.

It has a unique combination of thermal mass and insulation providing a more comfortable living environment.

Why Hebel RAAC

One of the worlds leading manufacturer of Hebel RAAC autoclaved aerated concrete (MCI, Xella Aircrete North America is transforming the building industry with Hebel RAAC, its ultra lightweight concrete.

Committed to providing the United States with environmentally responsible building products that conserve material and energy usage, Xella's Hebel RAAC Aerated Concrete is recognized as the largest producer in Europe by capacity based on management estimates based on different sources and member of the Green Building Council. In addition, it has a high UL rating for fire resistance.

More than 6,000 employees for Xella's total 97 plants and offices throughout 30 countries worldwide, including North America, Europe, and Asia.

Hebel RAAC Aerated Concrete provides contractors with strong, easy-to-install blocks and reinforced panels that are one-third the weight of traditional concrete and replace traditional multi-step construction processes. In addition, Hebel RAAC is energy efficient, fire resistant, and long lasting, which, over time, will reduce energy, insurance, and maintenance costs to building owners. A wide range of industries can benefit from Hebel RAAC's custom blocks and reinforced panels, including those in the commercial, educational, hospitality, industrial, institutional, governmental, and residential markets.

Xella Aircrete North America is a division of Germany-based Xella International.



Aerated Concrete Hebel RAAC®: Unique Properties in a single material

Benefits



Thermal Insulation

Buildings constructed of HEBEL RAAC® provide substantial energy savings in both hot and cold climates. The unique closed cellular structure and the thermal mass contribute to a high R-value and air-tightness, which reduce heating and cooling costs and improve indoor air quality. Buildings have seen savings on air conditioning up to 35% by using HEBEL RAAC.



Structural Performance

Strength can resist wind pressures without reinforcement. Shear wall strength can resist lateral loads. High impact resistance.



Fire Resistant

HEBEL RAAC has proven to remain fully intact and withstand the stress of fire for up to 4 hours without any impairment to its stability. Even under intense heat, HEBEL RAAC® remains tightly sealed against smoke and gas, emitting no toxic fumes.



Acoustic Insulation

The solid wall construction of a building made of Hebel RAAC® provides exceptional acoustic insulation. Its porous structure and high surface mass, coupled with its ability to dampen mechanical vibration energy, greatly reduces outside environmental noise.



Resistance to humidity

Your works are always protected against moisture. It allows the passage of water vapor, reducing condensation. It is an inert material.



Green Building

Hebel RAAC and green building attributes Recyclable, inert & non-toxic. Energy saving, manufacturing through occupancy. Excellent life-cycle cost. Durable, natural finish options. Supports LEED credits.

Add up USG BC LEED Credits with Hebel RAAC

Physical Properties

The physical properties of HEBEL RAAC® Autoclaved Aerated Concrete are unique to any other building material. Properties such as thermal insulation and fire resistance can not be met by another product alone.

- Speed of Construction
- Thermal Insulation & Energy Savings
- Superior Fire Resistance

- Sustainable
- Relatively High Strength for a low density
- Workability
- Acoustic Performance
- Precision

This product meets Standards and Evaluation issued by:



**ASTM
C 1693-11**
**ASTM
C 1660-09**



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Hebel RAAC® Roof Panel Autoclaved Aerated Concrete

Uses and applications

Hebel RAAC® Slab Panels are steel-reinforced units used to build roof or floor slabs that work supported over masonry walls [either Hebel RAAC® or traditional] and also by steel, concrete, or wood structures. Their design is based on span-load requirements.

Construction Advantages

- Lightweight 37 pcfl.
- No propping required.
- No concrete topping required.
- Custom made.
- Excellent load-carrying capacity.
- Covers up to 20' span.
- Lightweight equipment needed to install.
- 5 people crew to install.
- Speed of construction.

Application:

- Commercial
- Residential
- Industrial



Certifications:

NOM, ONNCCE, ASTM, UL, IAPMO, ACI, USGBC, TOI.

More benefits of the Hebel RAAC® Roof Panels:

- Fire resistance
- Acoustic performance.
- Thermal performance
- Pest and rot resistant
- Not Mildew
- Low maintenance
- Friendly to the environment and Sustainable.



Hebel RAAC® Roof Panel
Autoclaved Aerated Concrete

hebel **RAAC USA** Inc.
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Fig 1 Hebel RAAC® Slab Panels

1 Technical Sheet

1.1 Hebel RAAC® Slab Panel

Hebel® Autoclaved Aerated Concrete [AAC] Floor and Roof Slab Panels are lightweight, fire resistant, fast and easy to install, and provide lifelong superior thermal insulation. Hebel® Slab Panels are steel reinforced [Grade 70]. Autoclave aerated concrete elements. The interior steel wire reinforcement is covered with an anti-corrosion coating. Hebel® Slab Panel is produced in strength class AAC-4 and AAC-6, in accordance to the standards ASTM C 1693 and ASTM C 1694

Uses

Hebel® Slab Panels are used as floor and roof simply-supported slabs on Hebel® Masonry Components or CMU load-bearing walls, wood, concrete, or steel beams. These panels are used in residential, multi-family housing, hotels, offices, and industrial buildings. Hebel® AAC meets the diverse demands better than any other material due to the numerous advantages of its physical, mechanical, energy efficiency and safety properties.

Dimensions

Length: "Up to 20ft.

Width: 24 in.

Nominal Thickness:

4,5,6,7,8, 10 and 12in.

"Tolerance \pm 3/16," 111 Tolerance \pm 1/8..."Nominal Thickness. Manufactured according to ASTM C 1693 / ASTM C1694.

Characteristic	Unit	AAC-4 Class	AAC-6 Class
Compressive Strength [f'aac]	psi	580	870
Nominal Density	pcf	31	37
Design Weight	pcf	37	45
Drying Shrinkage	%	<0.02	<0.02
Thermal Expansion Coefficient	1°F	4.4x10 ⁻⁶	4.4x10 ⁻⁶
Modulus of Elasticity Allowable	psi	295,800	377,000
Bearing Stress	psi	348	523

Table 1: Physical and design properties.

Thermal Conductivity		Fire Performance	
Thermal	Class	Class	Hebet RAAC Slab
Conductivity	AAC-4	AAC-6	Panel Thickness (inch)
	BTU-in/ft ² ·h·°F		Reinforced Slab Panel
Steady-State	0.9124	0.9811	AAC-4/ AAC-6 >5 >5
			1 4 4
			K909 K909 P932

Units: BTU = British Thermal Unit, in = inches, ft = foot, h = hour, °F = Fahrenheit.

Table 2: Hebel RAAC Slab Panel Thermal Conductivity.

Note: Testing performed at underwriters Laboratories, Inc., Northbrook, IL under ASTM E119 (UU ANSI 263) "Fire Test of Building Constructions and Materials".

Table 3: Hebel RAAC Slab Panel fire rating.

Allowable Load Table For Hebel RAAC® Panels													
Thickness (in)	Superimposed Uniform Load (psf)												
	20	40	60	80	20	40	60	80	20	40	60	80	
	AAC-6												AAC-4
	Roof				Floor				Roof				
Maximum Permissible Span (ft)													
4	12	11	9	8	11	9	8	7	11	9	8	7	
6	18	15	13	12	16	14	13	12	16	13	11	10	
8	21	19	17	16	20	18	17	16	19	17	15	14	
10	20	20	20	19	20	20	19	19	20	20	18	17	

Table 4: Allowable service loads for AAC Slab Panels.

1. The allowable superimposed out-of-plane loads are nominal loads defined in IBC Section 1602.1 and derived from strength design.
2. The design unit weights of material are 37 pcf for AAC 4 and 45 pcf for AAC 6.
3. The roof and floor slabs are designed for dead weight and uniformly distributed downward superimposed loads only. If uplift [wind] forces are encountered, it is necessary to perform further calculations to determine the uplift load capacity.
4. For slab panels with a maximum span of 20' or less, the live load deflection [LL] should not exceed L/360.
5. For roof panels with a maximum span of 20' or less, the live load deflection [LL] should not exceed L/240.
6. More stringent deflection limits and/or analysis of long-term deflection must be provided if slabs support nonstructural panels likely to be damaged by large deflections.

- All panels that have surface or minor cracks are usable. Contact an authorized Hebel RAAC representative when a crack is extended completely through the panel.

3. Check Existing Steel Accessories (Not Supplied by Xella Aircrete North America, Inc.)

- Steel accessories for holes [ducts].
- Check shop drawings for additional steel accessories needed.
- Steel plate for connecting Hebel RAAC Slab Panels to steel structure.

4. Check Support Structure

- All support elements (load-bearing walls, concrete or steel beams, etc.) must be already finished before receiving floor and roof panels.
- Check layout and top of supporting block adjustments must not be less than 2" in height, or else cement-sand mortar [1:4] must be used [see Fig. 12-A1].
- Bearing lengths for AAC floor and roof panels should comply with Table 5.
- Mark guidelines on top of the supporting elements according to bearing lengths in Hebel RAAC® shop drawings.
- For non-load-bearing elements, put a layer of a compressible material (polystyrene or similar) on top.



Fig. 5: Slab Panels supported by steel elements

Support Elements

- Hebel RAAC® Masonry
- Concrete or Reinforced Concrete
- Wood
- Steel Beams

Minimun Bearing Length (in)

- $L_d/80$ or 2 3/4" [min]
- $L_d/80$ or 2.0" [min]
- $L_d/80$ or 2.0" [min]
- $L_d/80$ or 1.5" [min]

Note: L_d = Effective span length, L_e = Clear span, where $L_d = L_e + 3$ inches.

Table 5: Physical and design properties.



Precaution: Always wear proper personal protection equipment when using a circular saw, band saw or an angle grinder, including goggles, face-shield, hearing protection and dust mask.

3.2 Installation Requirements

- The actual list of tools, equipment and other materials will depend on type of project and workforce.

Tools:

- Hammer-Ax
- Rubber Mallet
- Scrub Brush Hebel
- RAAC®Sanding Float Hebel
- RAAC®Plastic Bucket
- Chasing Tools Spatula
- Chalk-Line Tape Measure
- Finishing Trowels
- Ripping Bar(36")

- Circular Saw [8 1/4" diam min] with diamond blade or Gasoline-Powered Circular Saws [12" min].

- 1/2" Power Drill/Stirrer.
- Router/Bits.
- Hebel RAAC® Hand Saw
- Hebel RAAC® Turners 12 pc.
- Safety Equipment (Hard hat, face shield, goggles, dust mask, ear plugs, gloves, safety shoes, etc.).

Note: Major equipment/tools are listed but not limited to items noted above to complete the installation.



Fig. 6: Panel Lifting gear T800



Fig. 7: Panel Lifting gear T400

Other Materials

- Hebel RAAC® Thin Bed Mortar and Repair Mortar
- Hebel RAAC® Rebar Spacers
- Anticorrosive Paint
- Fiberglass Mesh. 4x4 in.
- Wood Block (2ft long).
- Rebar #3, #4.
- Cement-Sand Mortar.
- Concrete [3,000 psi]
- Steel Plates.
- Anchors & Hebel RAAC® Nails.

Installation of Hebel RAAC® Slab Panels

- a. Identify Hebel RAAC®Panels to be installed according to previous logistics (see section 3.1 [2] and Fig. 31).
- b. Carefully unpack panels using scissors or a hammer ax. Verify that panels are in a stable position prior to cutting the banding.
- c. Over 4x4" wood blocks, rotate Slab Panel 90° or until tongue and groove profiles are facing up. Mark the center of the panel—Panel length/2—(see Fig. 81).

- d. Clean the tongue and groove float surface using a sanding hammer and brush.
- e. Place lifting gear at center of panel (see Fig. 81).
- f. Using the pulleys, close clamps, clipping the tongue and groove sides of the panel.
- g. Fasten safety chains, avoiding the excessive tightening, lower locking lever (unlock position), and indication to the crane operator to lift the panel (see Fig. 9.1).
- h. Two people will lead the panel to place it on to its final position.
- i. remove safety chains (see Fig. 10)
- j. Place the panel on the guidelines previously traced. Verify minimum bearing length [see Fig. 11].
- k. Once the panel is placed, open the clamps and raise the locking lever (lock position). and remove the lifting gear.
- l. This procedure should be followed for each successive panel.



Fig. 8:



Fig. 9:



Fig. 10:

IMPORTANT:

- All crew members must comply with all safety requirements set by OSHA.
- Handle panels with care to avoid damage.
- Make chases needed prior to installation.
- It is strictly forbidden at any time for people to be under the load during lifting.
- Never put hands, arms, feet, or legs between the jaws of the clamp.
- The load must always be hoisted; it may not be dragged along the ground.
- Avoid sudden movement to prevent accidental release of the load.



Fig. 11:

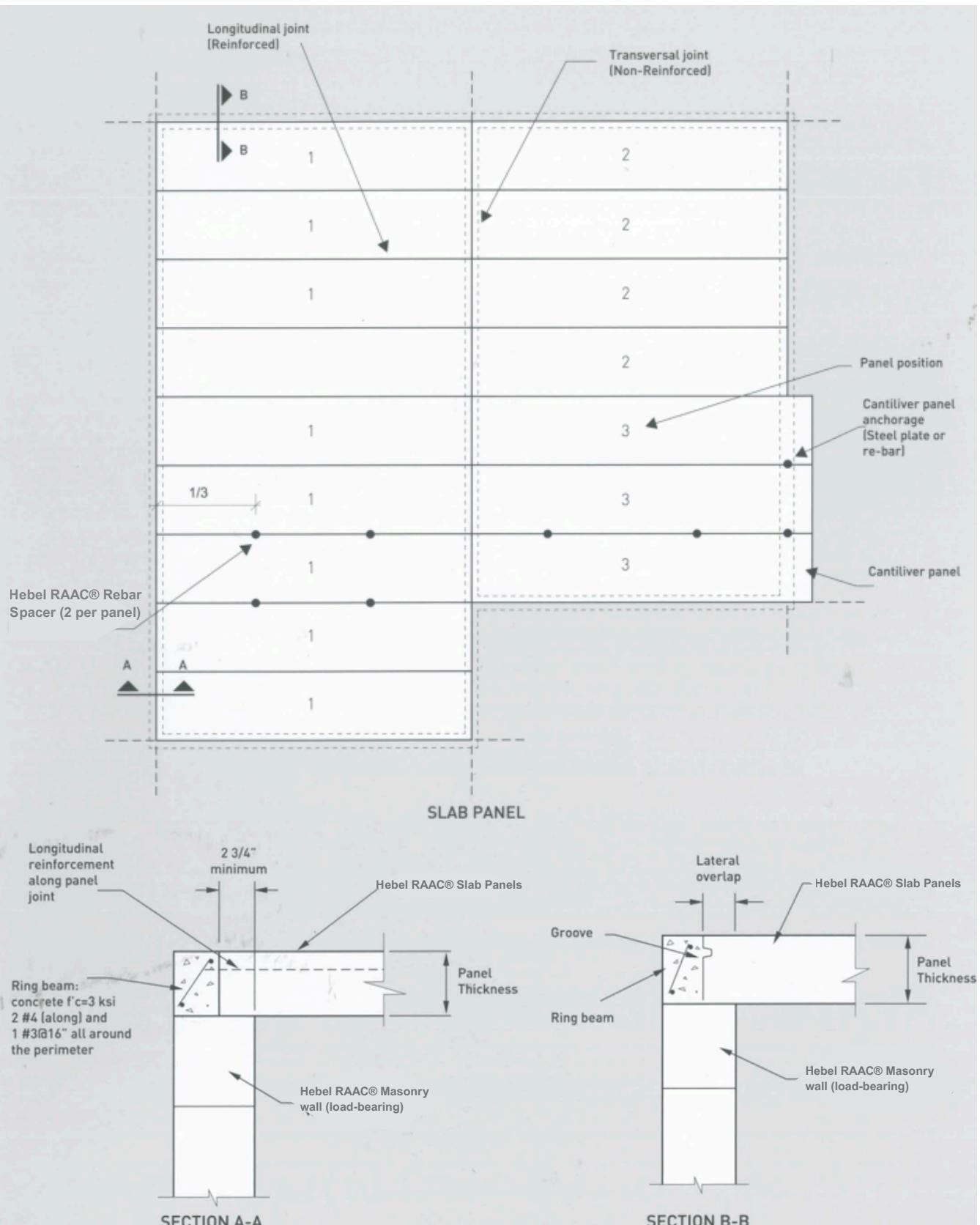


Fig. 12: Hebel RAAC® Slab Panels Slab Panels over masonry

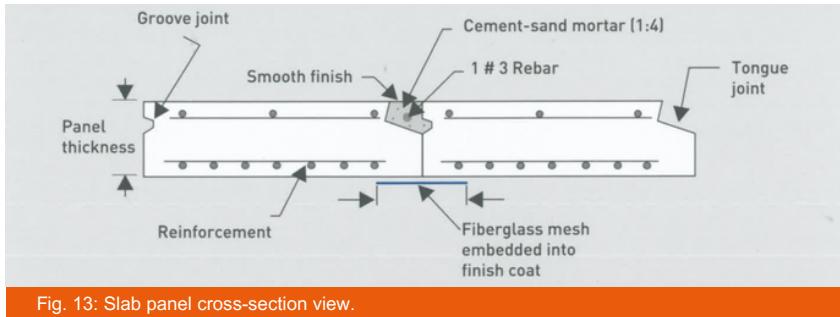


Fig. 13: Slab panel cross-section view.

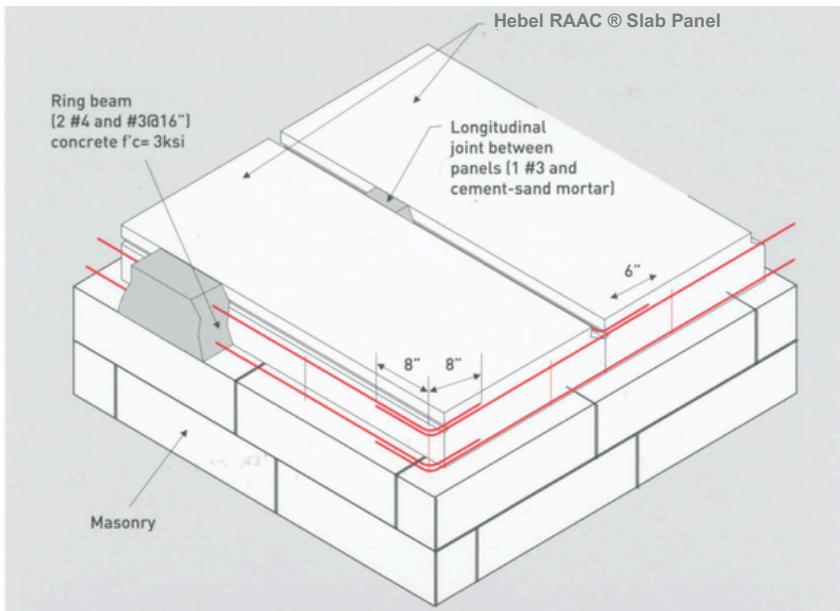


Fig. 14: Longitudinal joint and ring beam.



Fig. 15: Five story hotel built with AAC (Floor Panel)

3.4 Cast and Reinforcement of Longitudinal Joints and Ring Beams

After panel installation, place steel reinforcement in longitudinal joints. (see Fig. 12 to 15 and 17) and ring beams surrounding panels (see Fig. 14 and 171. Forms must be placed in perimetral ring beams.

One #3 rebar is required in longitudinal joints [shear joints], wedged with rebar spacers [2 per panel], and filled with cement-sand mortar [1:4] - see Fig. 14. Moist Panel joints before application.

Ring beams require 2 #4 rebars. (along) and a #3 every 16" [diagonal] and filled with regular concrete $f'c= 3$ ksi. The maximum size of aggregate is, of coarse 3/8" and 5" to 6" of slump. Ring beam and form surfaces must be moist before concrete casting.

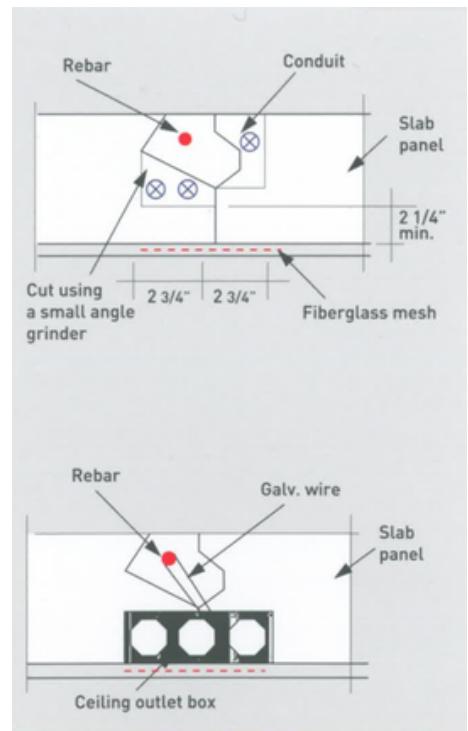


Fig. 16: Conduits and Ceiling Fixtures

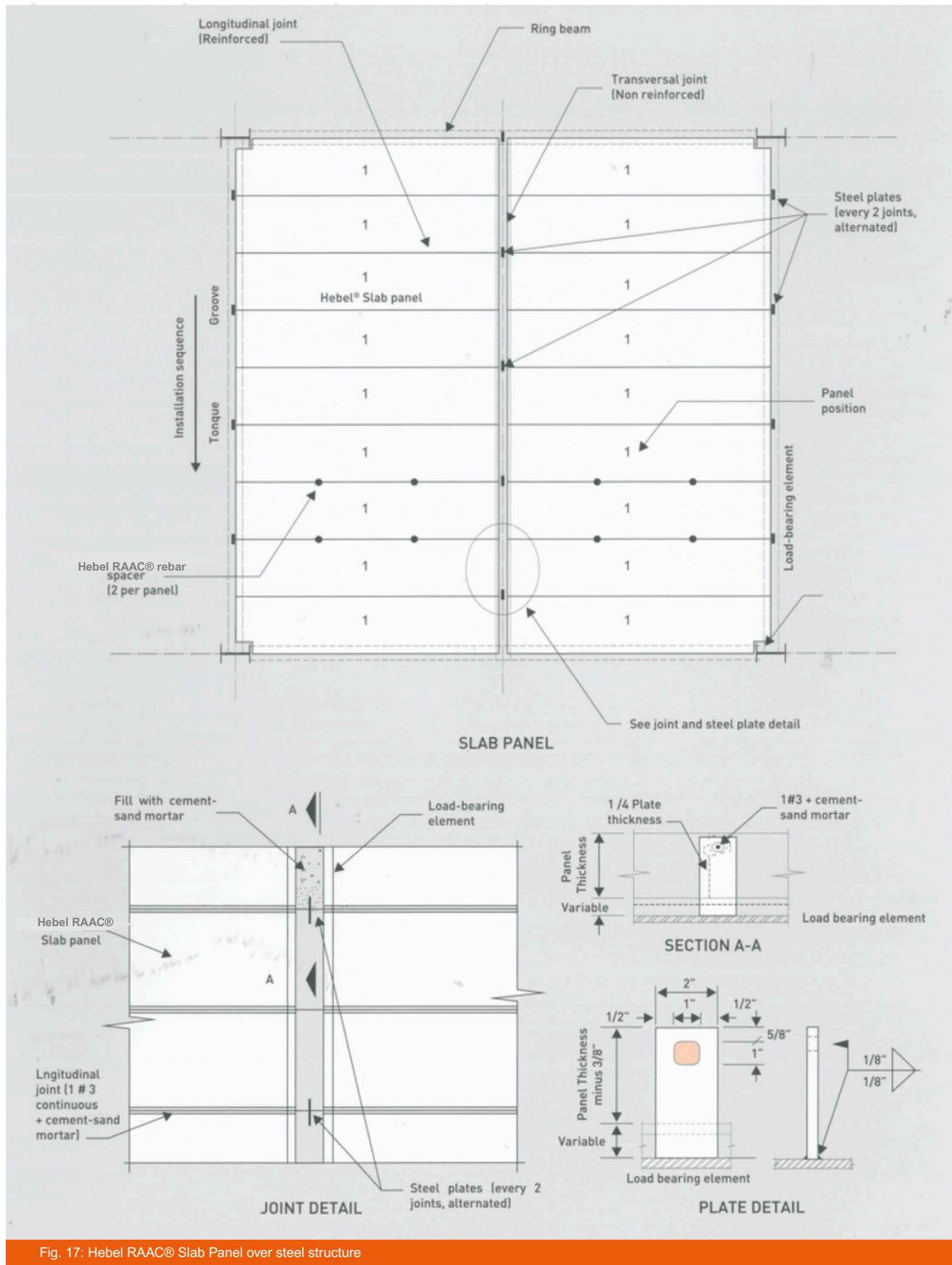




Fig. 18: Filling Longitudinal joints with cement-sand mortar

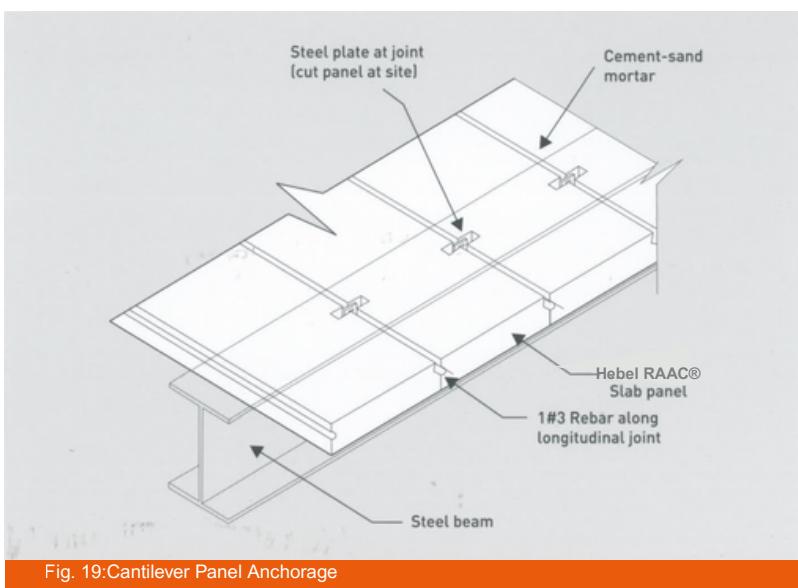


Fig. 19: Cantilever Panel Anchorage

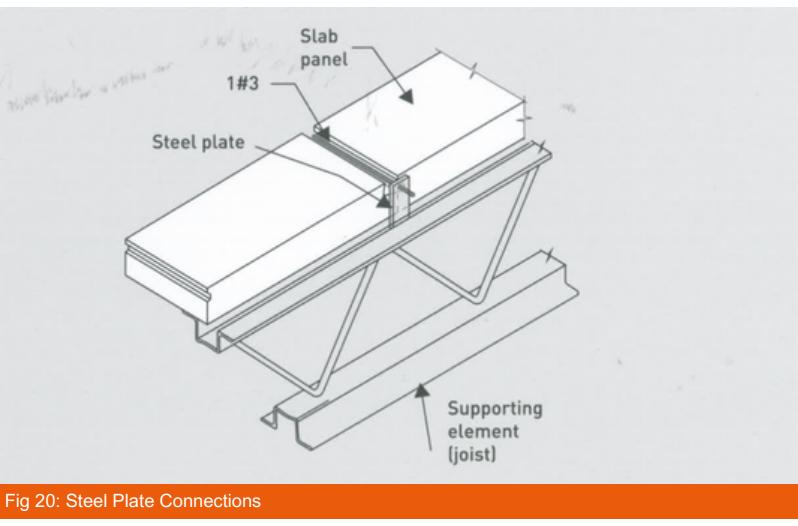


Fig 20: Steel Plate Connections

When Hebel RAAC® panels are installed on a steel structure, steel plates must be welded [every 2 longitudinal joints, alternated] to the structure for connection [see Fig. 17 to 21].

Place steel plates after panel installation to ensure correct location.

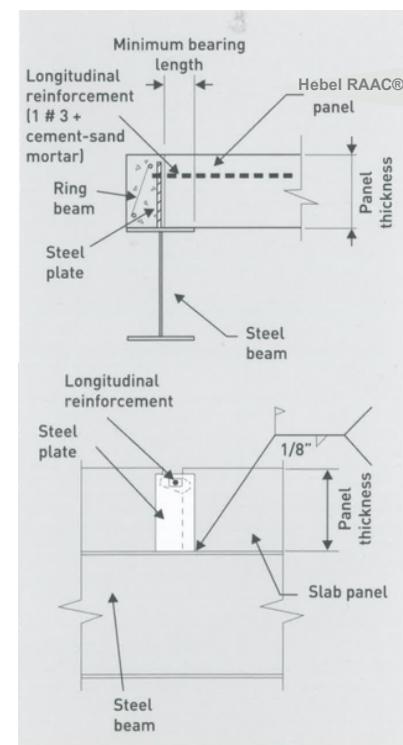


Fig 21: Steel Plate Details

3.5 Utilities Installation

Openings

Openings in floors and roofs for A/C ducts, staircases, roof windows, air exhausters, etc. are built using steel support. For more information, please call Xella Technical Department.

Electrical Conduits

Electrical conduits with a diameter $<1"$ can be lodged through longitudinal joints on top or bottom of the panels. For electrical conduits $>1"$ or several electrical conduits, longitudinal joints can be widened to lodge them. It is not recommended to chase on top and across the panel width—transversal chase—[see Fig. 16].

It is possible to define cut surfaces in Panels regarding installations. For more information, please call Xella. Technical Department.

Piping Lines

When required, PVC and other piping lines can pass through holes in the panels. The maximum hole diameter permitted in one panel is 6" or 12" in a joint between panels (W each panel).

If more than one hole is required, they must be aligned along the length of the panel. Only two longitudinal rebar in the bottom reinforcement of the panel can be cut [see Fig. 22 and 24] casting.



Fig 22: Sanitary Utilities

3.6 Panels Cutting

According to shop drawings, identify Hebel RAAC® Slab Panels to be cut. Permissible cutting length is indicated on shop drawings, otherwise contact Xella Technical Department. Along its length, Hebel RAAC® Slab Panel can be cut 1/3" the width.

Cutting Equipment Options

Power Cutter [gasolinepowered] 14" or 16" blade or greater [see Fig. 23].

Cutting Procedures

- Prepare a flat surface for the cutting site.
- Check dimensions of cuts to be made.



Fig 23: Power Cutter

c. For transversal cuts, wood pieces must be placed along the sides of the cut at the edges of the panel.

d. For longitudinal cuts, wood pieces must be placed at every 6 ft [max] for 6- to 12-in-thick panels and every 4 ft for panels 4 to 5 in thick.

e. Check for full contact between wood pieces and panel. Wedge if necessary.

f. Place a ruler as a guide and trace the cut dimensions.

g. Proceed with panel cutting, verifying that cutting dimensions comply with specifications. Transversal and longitudinal cuts must be made with the panel in a horizontal position.

h. Apply anti-corrosive paint at exposed reinforcement bar tips.



Caution: Wear protective helmet & visor, goggles, hearing and respiratory protection. Read equipment instruction manual. Inhalation of concrete dust above recommended exposure levels may be harmful. Wet sawing is recommended. Please consult the Xella Material Safety Data Sheet for further details.

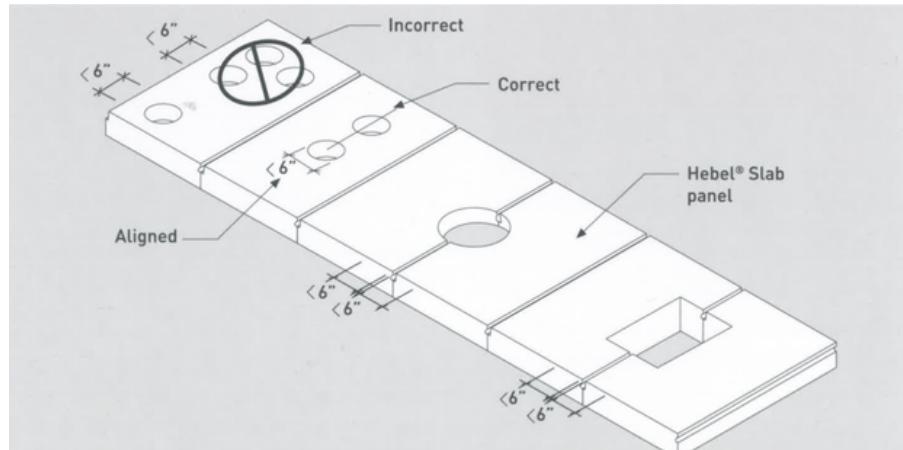


Fig 24: Maximum Dimensions of holes through slab panels