Ultra-Thin Prestressed Precast Panel Technology

INNOVATE INSULATE INTEGRATE

altusgroup

CONTINUING EDUCATION AIA

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Learning Objectives

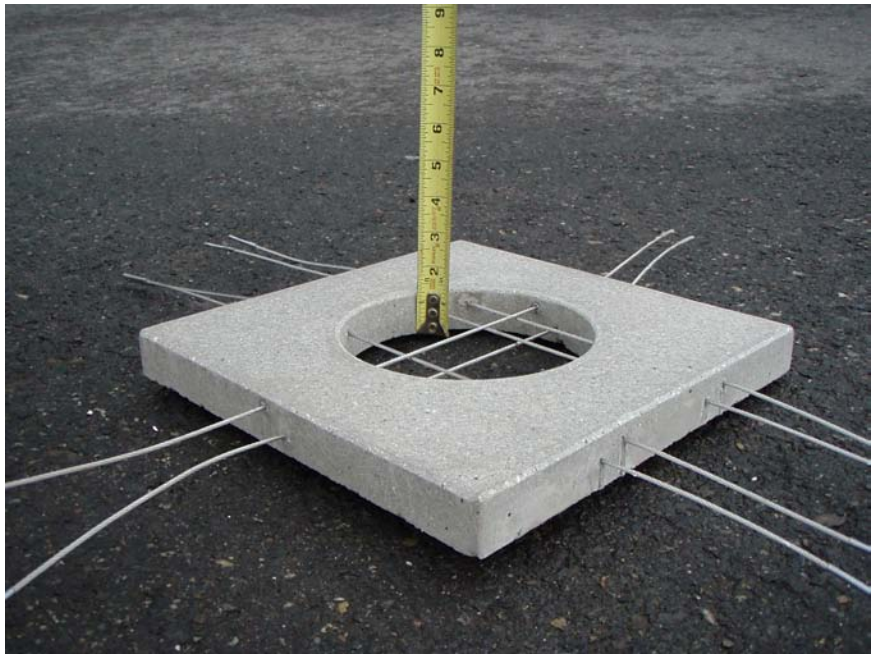
1. Explain the benefits for ultra-thin prestressed precast concrete in architectural applications
2. Outline the generic manufacturing process for the production of ultra-thin prestressed architectural products and design/cost considerations for the technology
3. Detail several possible economical connection and fastening system for ultra-thin prestressed precast cladding systems
4. Examine several ultra-thin precast architectural façade projects and case studies.

Technology

- Developed by engineer/entrepreneur Brian Blount
  - Former VP for Hoffman Structures (Portland, Ore.) who believed their was a better way to design, affix and build with thin precast concrete elements
- First introduced to Pacific Northwest in 2002
- Used in more than 200 design projects across North America by some of the leading architects, engineering firms and owners who desire a unique precast look

Heart of the Art

Enabling technology: thin, high-quality stainless steel prestressing

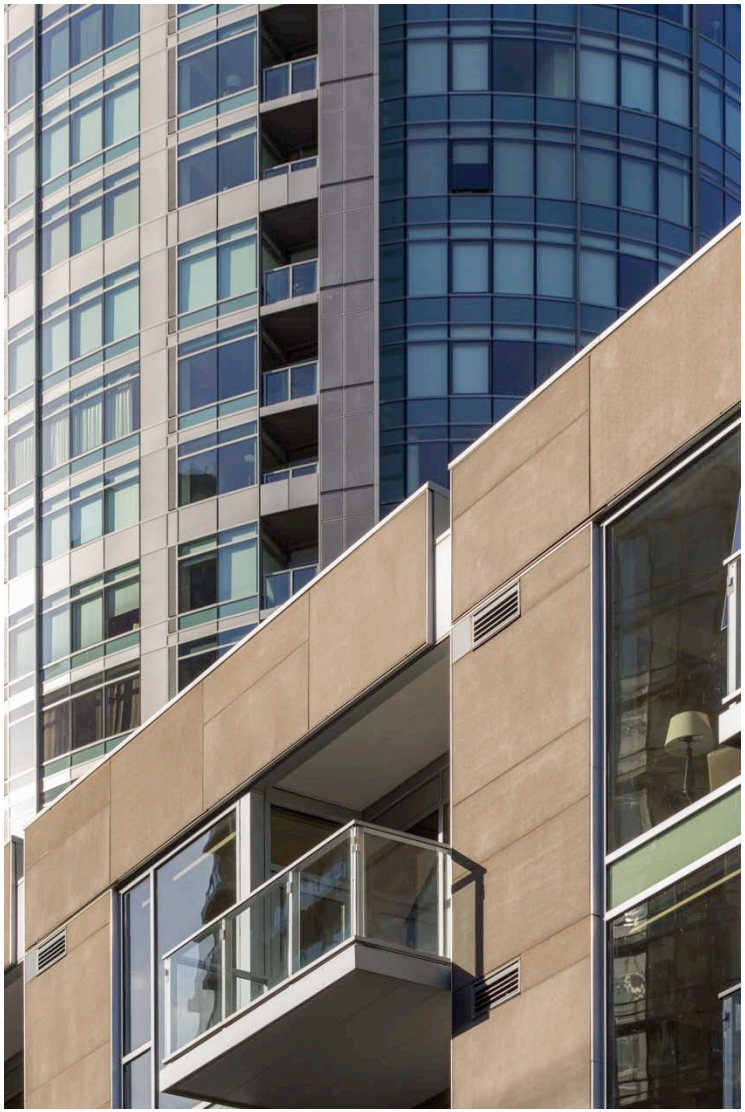


Why Use Stainless Steel Prestressing?

- Concrete is strong in compression and weak in tension
- Prestressing places concrete in compression, making it stronger and more resistant to cracking
- Prestressing is proven and globally accepted in precast since mid-1950s in many precast applications
- Stainless steel and concrete have similar thermal expansion characteristics and do not create interior stresses
- Stainless steel aerospace cables have proven corrosion resistance and tensile performance, allowing for thinner precast sections

Application options

- Exterior facades
- Architectural rain screens
- Ventilated façades and sunscreens
- Décor, accent walls and interior elements
- Louvers and fins
- Retail storefronts
- Marine decking
- Stair treads
- Mechanical screens
- Pavers
- Tactile strips



Ultra-thin precast exterior walls

"***All the things architects like about precast concrete; without all the things they dislike about precast concrete.***"

Available with most typical precast finishes, form-liners and aesthetic systems. Very durable

Eliminate concerns about weight, bulk, lack of versatility after installation, shipping costs

Why a Rain Screen System?

- Methodology for enclosing a structure with an external protective material over a building's insulation layer and a waterproof membrane layer
- Often, the protective layer is installed with an air cavity behind it in an effort to efficiently manage moisture and water migration through the wall assembly
  - Commonly referred to as a *ventilated cavity drainage system*
- A growing trend and design philosophy within the architectural, engineering and building construction community

Primary Benefits

- Lightweight
- Durable
- Natural aesthetics
- Easy to ship long distances with low cost
- Easy and simple to erect with general installation techniques
- Adjustable – move or add openings after installation

Lightweight

Lower-cost superstructure with smaller and less expensive cranes or lifts for installation, reduced shipping expenses and more usable space

Flexible and Adaptable

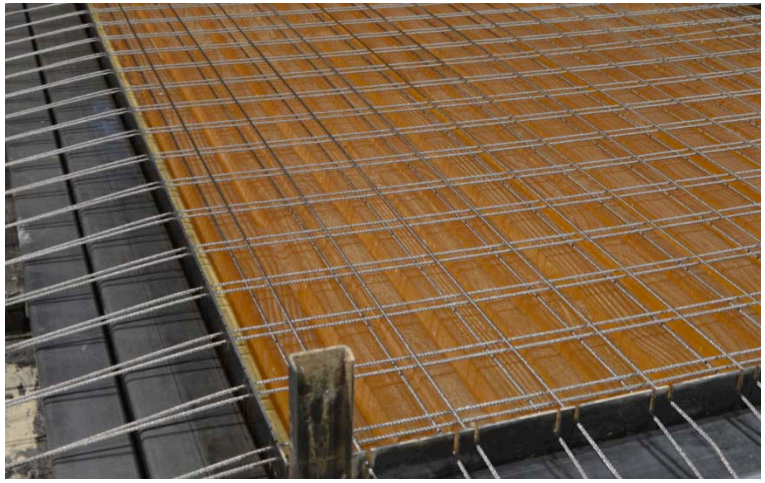
Modular configuration allows you to remove, cut and penetrate panels with ease

Ideal for changing factory designs and process plants

Resilient

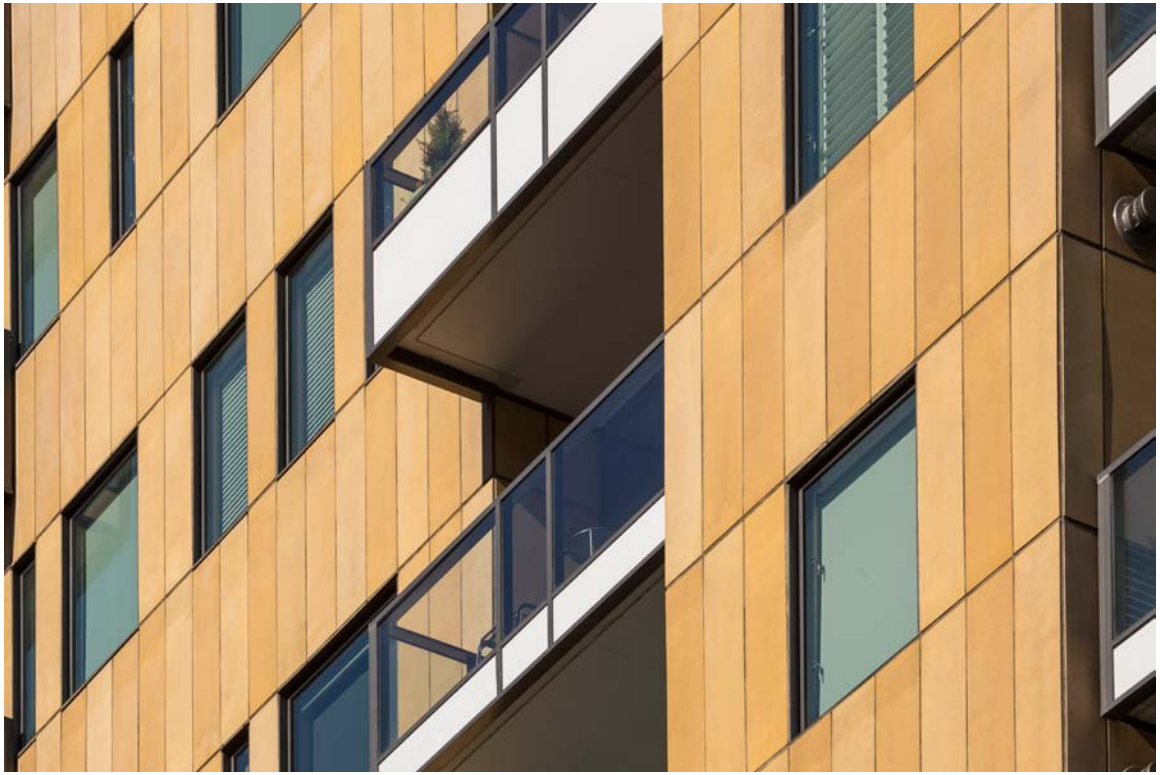
Stainless steel prestressing minimizes the possibility of corrosion, deterioration and associated problems of staining and rust marks, among other issues

High-performance concrete provides strength in excess of 5,000 psi (35 Mpa) for enhanced durability



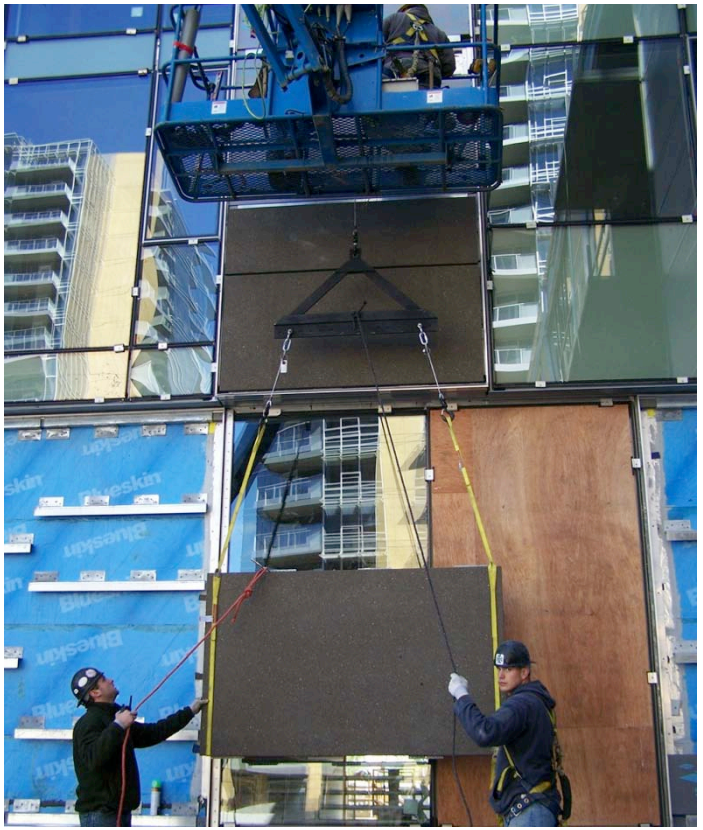
Aesthetic Versatility

Custom manufactured with exacting details

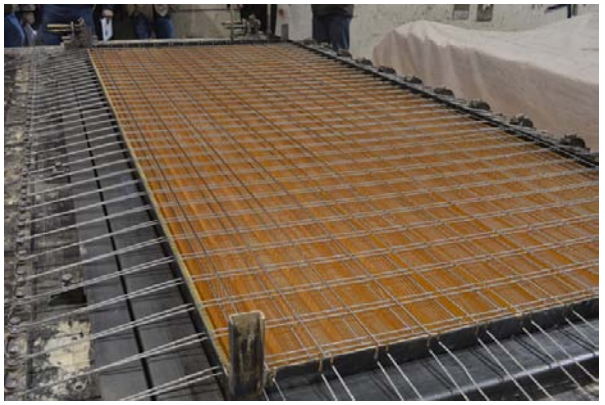


Installation

- Can use small cranes and hoists with small lifting loops
- Easily managed with two people
- Panels attach to structure using J-Channel and molded clips bolted to the back of the panel

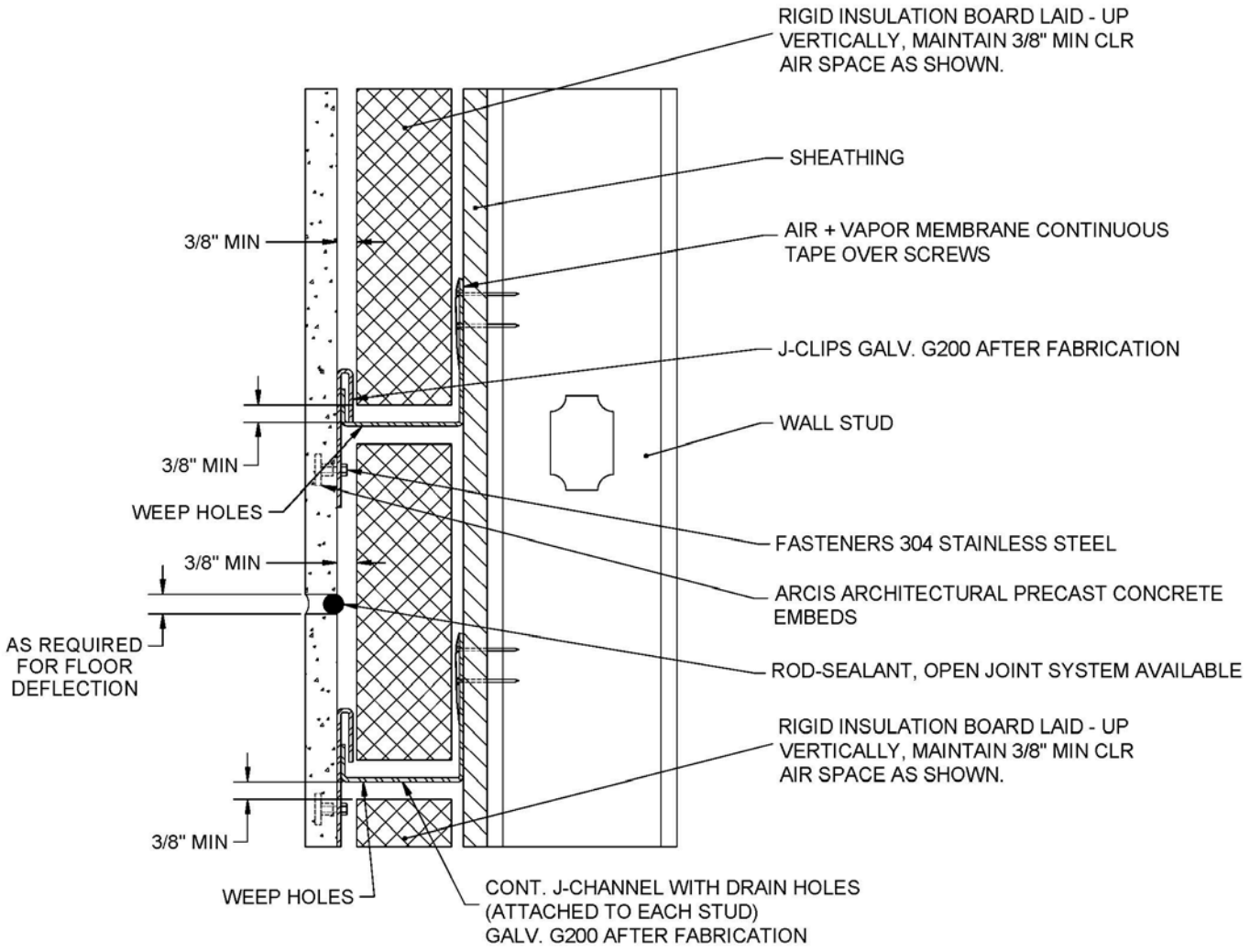


Specifications

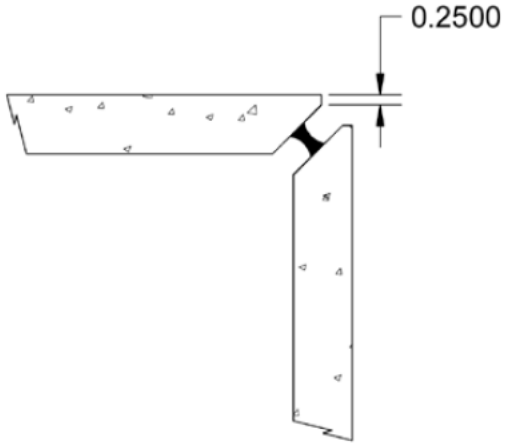


- Panel depths from 0.75” (19mm) to 2” (51mm)
- Maximum panel size is about 8’ x 13’ (2.4m x 4m) and larger.
- Smallest panel size: 20-30 Ft^2 range depending on panel orientation
- Final installed weights of 9.4 psf (46 kg/m^2) to 25 psf (122 kg/m2)
- Meets ASTM and PCI MNL 117 specifications (with tighter tolerances)

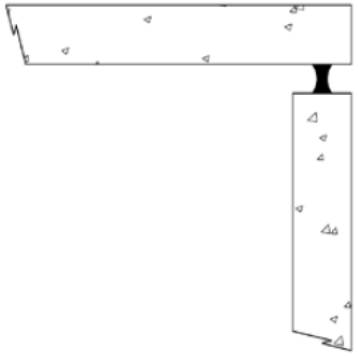
Panel Schematic



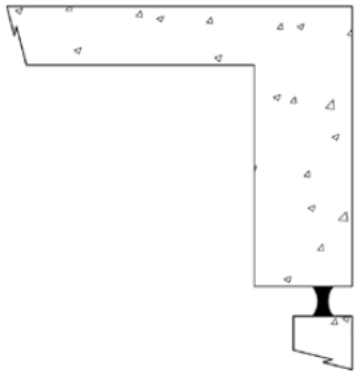
Panel Details - Joints



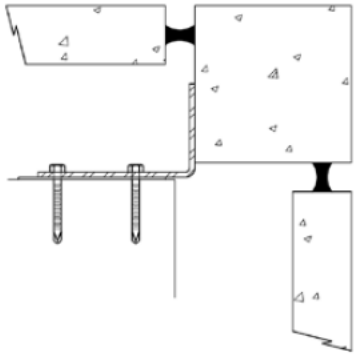
MITER JOINT WITH MINIMUM NOSE OF 1/4"



BUTT JOINT

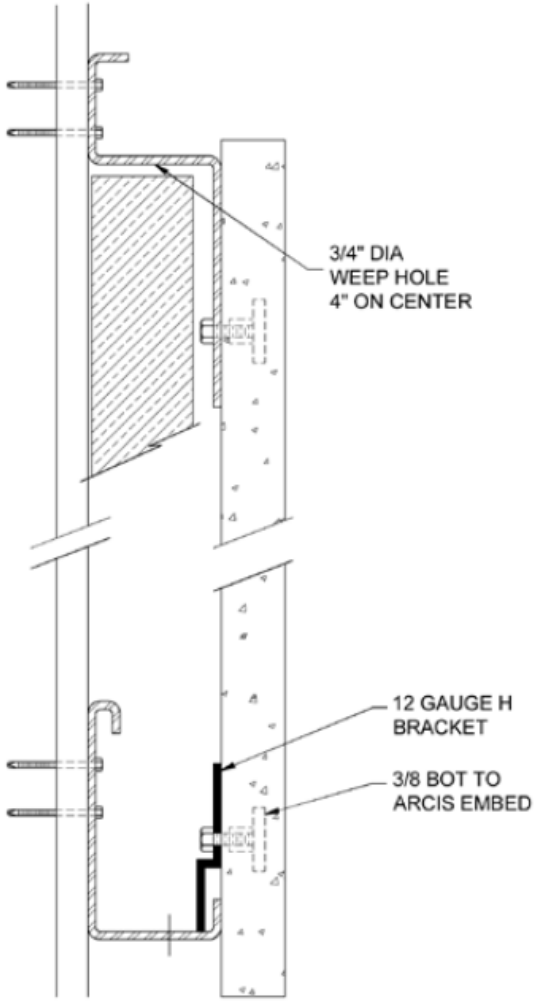


RETURN JOINT WITH PANEL RETURN

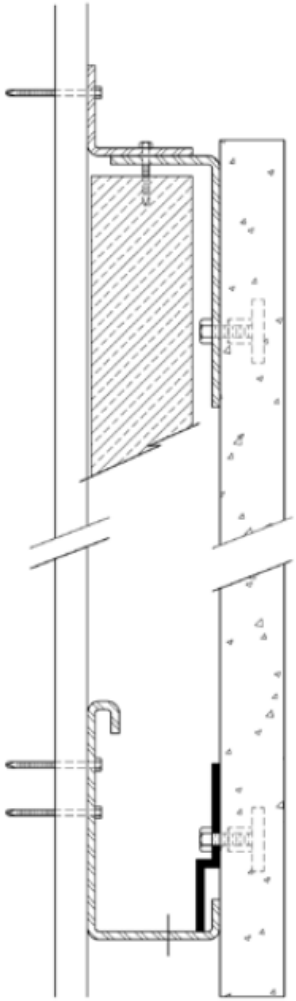


SEPARATE CORNER PIECE

Connection details – Top-hung bracket

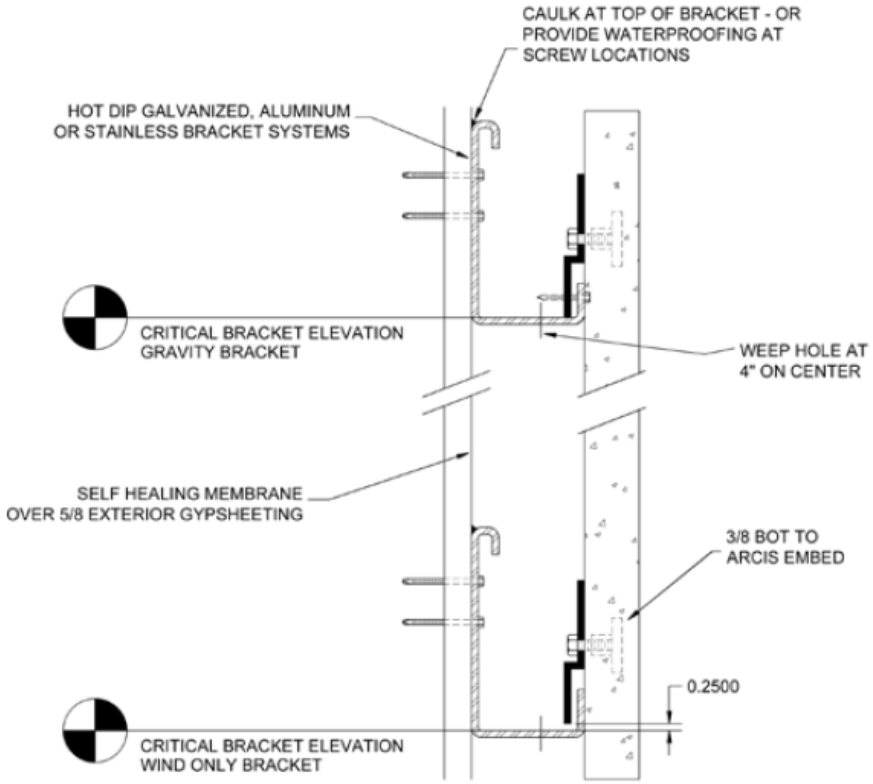


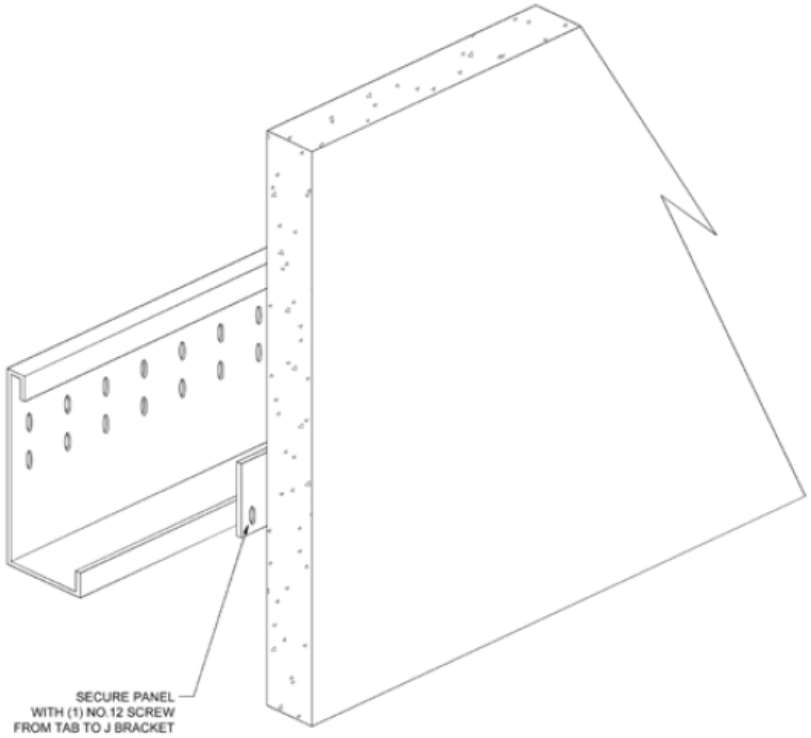
INSTALLATION WITH LIMITED
ADJUSTMENT IN TOP TIE BACK



INSTALLATION WITH ADJUSTMENT
IN TOP TIE BACK

Connection details – Standard J bracket





Installation and Construction Benefits

- Panels can be glazed into unitized curtain walls for efficient erection
- Select attachment systems allow for unlimited story drift and seismic movement
- Floor deflection can be accommodated with various attachment and structural designs
- Easy panel replacement should product be damaged during post-project completion

Shipping & Handling

Can be simply flat stacked and shipped coast to coast in high volumes with minimal expense

Trucks generally weight limited - not volume

Additional Technology Benefits

- Uninterrupted building envelope with proper waterproofing method
- Skin placed after building envelope is complete; outside construction “critical” path
- Thin fascia can allow for greater rentable/useable space offset ($$)
- Savings for lateral systems in high rise construction can be significant for high seismic zones where weight reduction is critical and conventional precast can not be used ($$$)
- Possible insurance savings due to code and regional requirements ($)

Rehab Considerations (durable)

www.cbc.ca/news/canada/british-columbia/kelowna-condominium-spends-260-000-to-make-building-woodpecker-proof-1.3645684

Competing systems

- **GFRC**: Glass fiber reinforced concrete. Durability. Generally requires support structure
- **EIFS:** Low cost, low R-value and low durability exterior system using EPS and polymeric coating
- **UHPC:** High compressive strength concrete (>120Mpa), expensive and difficult to use, limited architectural precast look, smooth surface
- **Metal cladding:** Dings, corrosion and complex install
- **Natural stone:** Small sizes, weight and match
- **Cellulose cement:** Thin but limited structural use
- **Phenolic composite panels**: Weatherability, UV exposure, fading concerns, expensive

Projects & Success Stories

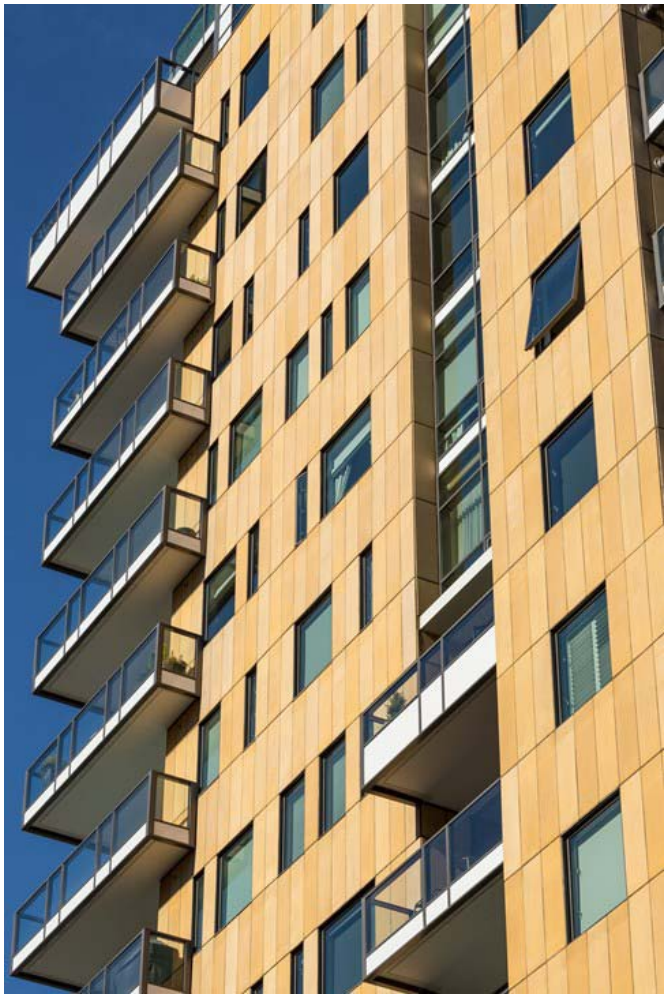
Let’s take a look at some successful projects and installations completed over the past few years

Success Story: Block 5

Portland, Oregon

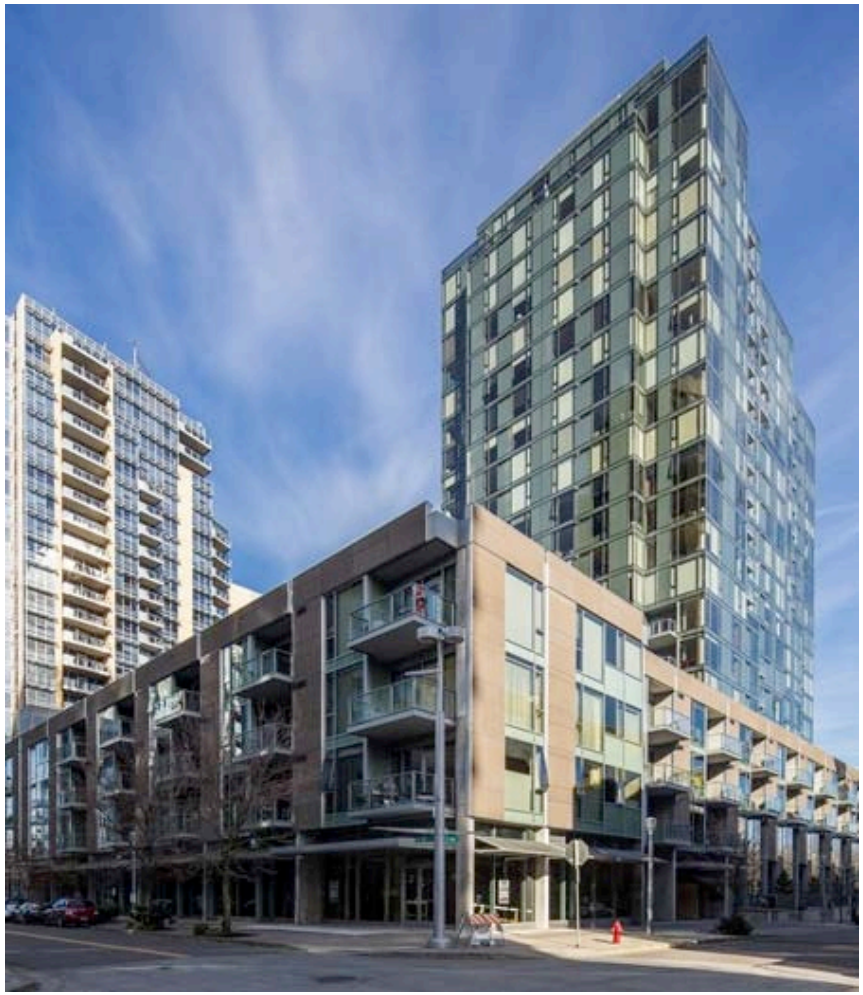
Success Story: The Casey

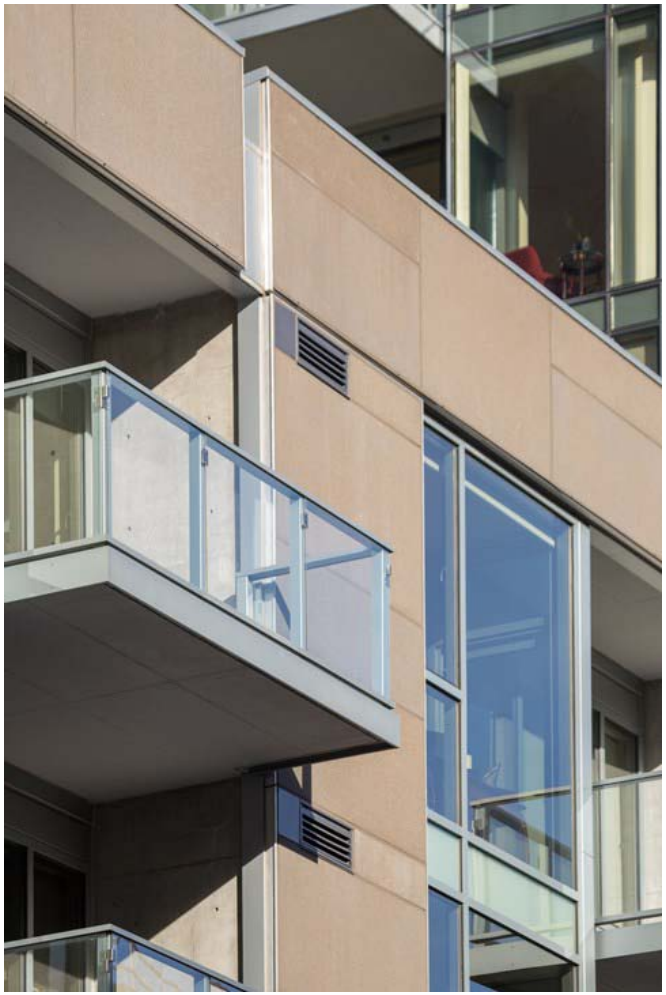
Portland, Oregon



Success Story: Atwater Place

Portland, Oregon





Success Story: Hotel 1000

Seattle, Washington

Success Story: Bay Area Hospital

Coos Bay, Oregon

Success Story: Reser Stadium

Oregon State University

Success Story: Linus Pauling Science Center

Oregon State University

Success Story: Women's Center

Grants Pass, Oregon

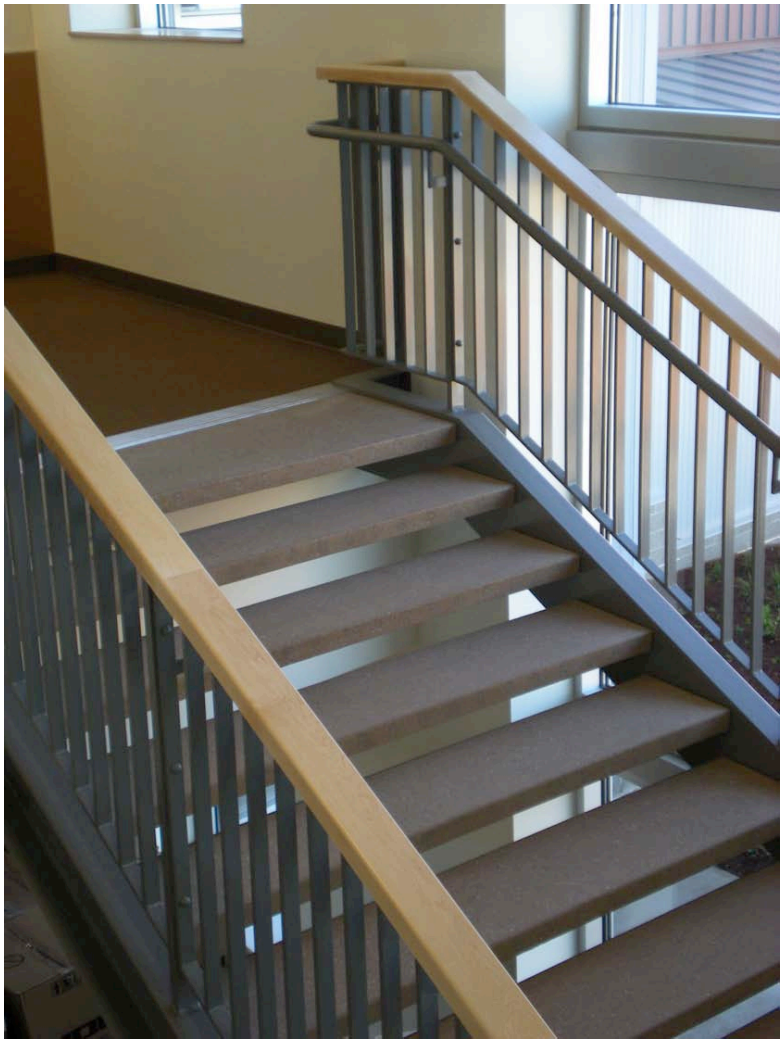
Success Story: Marine Floats

Success Story: Marine Decking

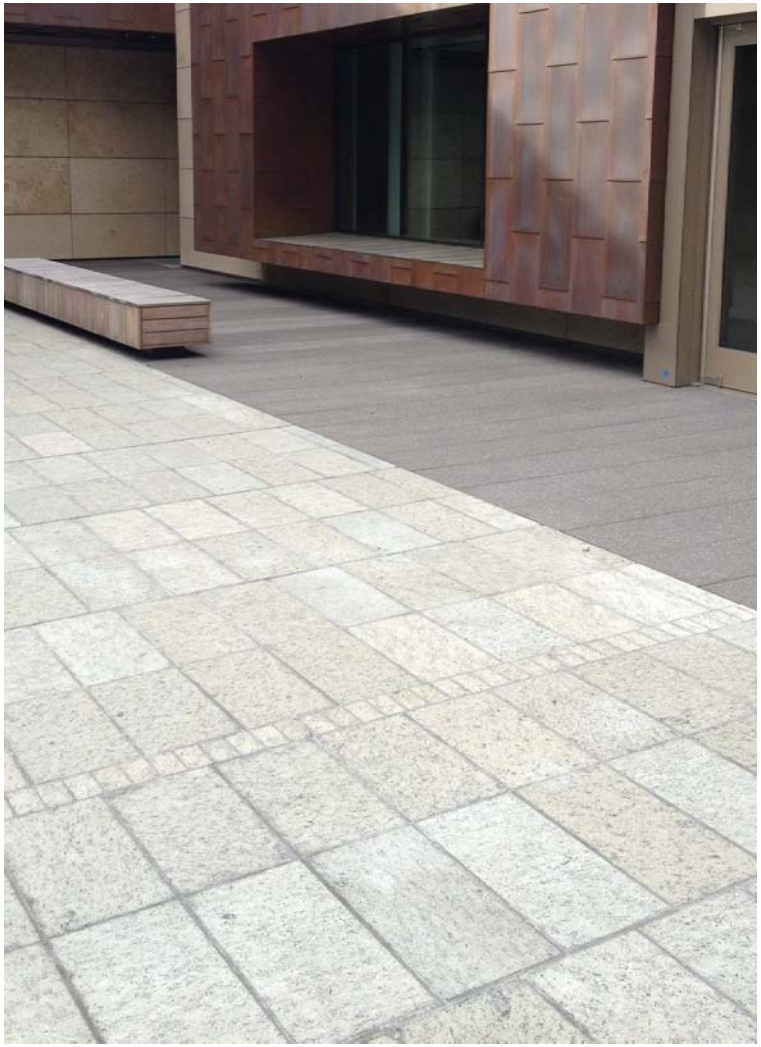
Success Story: Decking

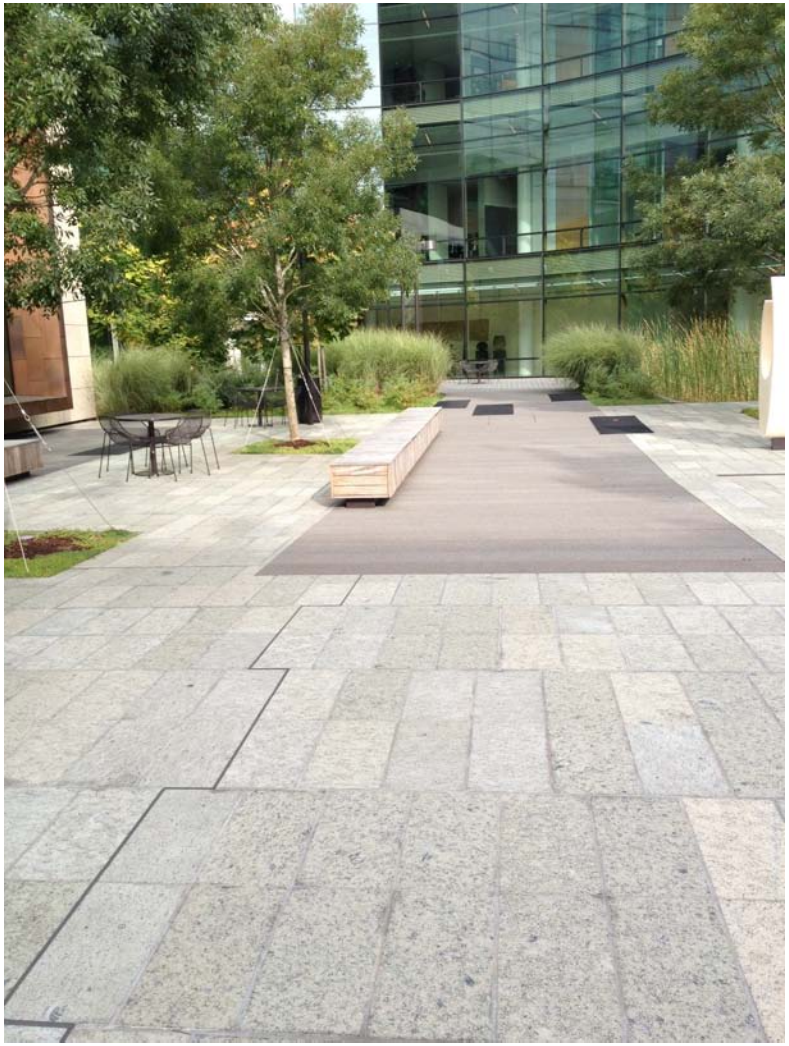
University of Washington

Success Story: Stair Treads



Success Story: Pavers





Summary

- Stainless steel prestressing enables thin, lightweight panels with durability of precast
- Natural aesthetics; precast versatility
- Easy to ship long distances with low cost
- Simple to erect with general installation techniques and minimal manpower
- Adjustable – move or add openings after installation

AIA/CES Credit

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