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# CONSTRUCTION DIMENSIONS

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## KHS&S TALKS PREFABRICATION

## SUCCESSION PLANNING DOING IT RIGHT

## GYPSUM RECYCLING HOW CONTRACTORS CAN MAKE A PROFIT

# FOCUSING ON THE FUTURE WITH PREFABRICATION SOLUTIONS

## KHS&S is redefining the construction process.

**By Naomi Martin**

**WALKING THROUGH THE** corridors at KHS&S, one should not be surprised to hear someone say, "Prefab everything." While many companies focus on one specific form of prefabrication, KHS&S is pioneering the art of prefabrication offering multiple interior and exterior systems and solutions driven by leading-edge innovation and technology.

Several factors are fueling the initiative: labor shortages, quality control, ability to leverage technology and emphasis on sustainability.

# KHS&S HAS SEEN

a renewed increase of interest in prefabrication from architects, owners and general contractors. Incorporating prefabrication into a project requires a different mindset where clients must rethink the procurement process. Traditionally, an owner works with an architect to draw up the project plans, and design gets fully underway without taking advantage of prefabrication opportunities. When leveraging the opportunities for prefabrication, KHS&S must be brought into the conversation during the conceptual design stage to guide and determine the prefabrication solutions that best meet the project requirements.

While prefabrication may have a higher initial investment, there are significant savings in the long run. With improved upfront planning, elimination of on-site labor issues, trade stacking and reduction of rework, delays are mitigated, and schedules improved. Greater efficiencies translate to schedule and cost savings.

Prefabrication requires that more work be completed earlier in the construction process, but when planned and implemented correctly, there are substantial benefits:

- Accurate estimating
- Concise materials engineering
- Reduction in material waste
- Improved quality control
- Efficient assembly and installation
- Reduced labor and scheduling
- Improved on site safety
- Enhanced cost savings

The innovation and technology behind prefabrication. Prefabrication is focused on lean practices coupled with computational design and digital fabrication all wrapped together. The goal is to create a more sustainable, cost effective and efficient form of construction.

Computational design is based on computer software devised to automate processes using algorithms and parameters that apply logic and rules to construction. This back-end programming takes complicated elements and lets technology deal with the complexity to build and prefabricate components and systems with accuracy.


Once the drawings have been generated through computational design modeling, output files are submitted to the KHS&S prefabrication facility or vendors to construct. Since the digital fabrication process is driven by a computer, all pieces are constructed to exact measurements for extreme precision.

Components are then transported to the job site in kits to be assembled or are already fully constructed. Typical job sites located in city centers are busy and often cramped. Those located in rural areas may have difficulties securing materials, machinery and the skilled workforce. Prefabrication eliminates these problematic areas that raise cost and increase timelines.

### Prefabrication Solutions

KHS&S is currently prefabricating about 80% of all exterior construction and


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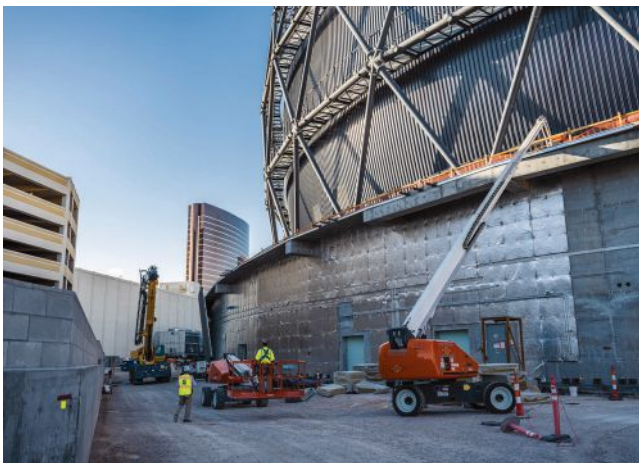

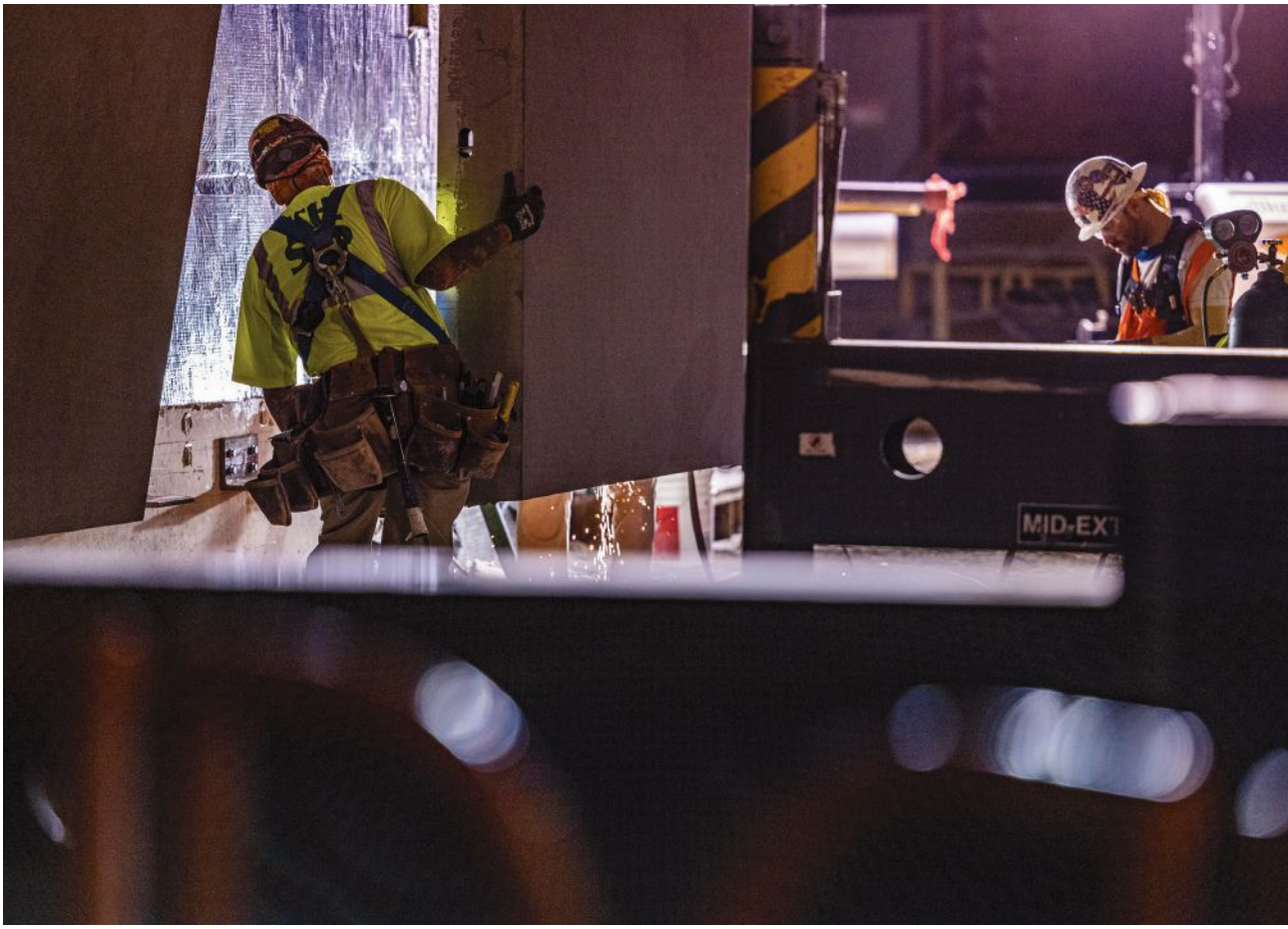
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expanding interior and exterior initiatives to add value to a project, standardize and streamline work and make tasks more efficient.

*Exterior envelopes and façades*. Having mastered the art of exterior EIFS panel prefabrication and installation offering clients a cost-effective and durable framing system, KHS&S expanded its offering adding GFRC to its arsenal of products to meet the growing demand for a lighter and more versatile exterior system.

Lightweight and durable, GFRC panels are ideal for more complex exterior projects and larger, repetitive panel façades. This high-performance cladding system can be molded into almost any shape and color for a range of applications.

Taking exterior prefabrication one step further, KHS&S is utilizing its exterior systems expertise to create fully finished panels with a rainscreen system incorporated into the design. While prefabricated rainscreen systems are preferred by architects and owners, they are intricate and challenging to prefabricate, and few companies have the capabilities. With KHS&S' innovative computational design and digital fabrication technologies, this comprehensive rainscreen system is now possible. Using this same technology, KHS&S is advancing additional forms of barrier and glazing systems.

*Interior walls and ceilings*. Saving time and reducing costly delays are two major reasons why KHS&S has become a trusted source for engineering and perfecting interior wall and ceiling prefabrication techniques that are in demand.

Light gauge, partial height walls and ceiling framing, prefabricated kits and panels have been used on KHS&S projects for years. The company is now an industry leader in prefabricating full height walls and complex architectural designs that require more challenging tolerances.

*Modular construction and volumetric prefabrication*. KHS&S were early adopters in modular construction utilizing entire bathroom units arriving as self-contained pods complete with tiled

# PROJECT OVERVIEW

## Four-Year Project, Largest Residential Development in Seattle

Onni South Lake Union encompasses double 42-story residential towers and a 13-story midrise, making it the largest residential project in Seattle's history. As the Canadian Onni Group's first project in Washington, the developer turned to KHS&S for their expertise in interior metal framing, drywall and finishing. A project of this scale spanning more than four years, by its nature, is challenging. KHS&S craftsmen pushed the limits of innovation managing multiple design challenges and changes and expertly resolving from past experience, flexibility and creative thinking. Despite the enormous difficulties of managing a $39 million project amidst the pandemic's relentless obstacles, the quality of the finished product illustrates how KHS&S demonstrated excellence in all work scopes for the largest residential job to date in the Washington region.

### Interior Project Scope

- Metal framing
- Drywall and finishing

### Exterior Project Scope

- Soffit framing
- Framing and support for brick wall

### By the Numbers

- 5.66 million square feet (130 acres) gypsum wallboard
- 632 miles steel framing
- 15 miles gypsum shapes
- 5 miles of plywood rips for sill backing
- 120 crew on site daily during peak times
- 292,365 work hours

### VALUE ENGINEERING TO INCREASE QUALITY AND PERFORMANCE

Utilizing KHS&S' expertise in value engineering, the team constantly analyzed building design, systems, equipment and materials to meet the required performance levels, quality and safety while remaining within budget. KHS&S tested and selected a more efficient ceiling system, moving away from the original spec drawings. After reviewing multiple options, a short span ceiling system was chosen as the pre-engineered solution fell within the width of each unit and eliminated a support brace. This system was quicker to install, had fewer components and a much stronger product. With 632 miles of steel framing, the QML automated laser layout system was used. Framing CAD drawings are plugged into the software, and two laser beams make a visible "X" at the correct point on the floor and ceiling, eliminating any miscalculations and increasing speed through automation.

### RESOLVING UNANTICIPATED DESIGN GAPS

The developer and architect designed the three structures following Canadian codes and construction's best practices. Throughout the project, KHS&S uncovered design gaps or incomplete designs that had to be resolved on-site. Many of the design changes were uncovered late in construction adding substantial


## REDUNDANT SAFETY MEASURES AND SAFETY INCENTIVE PROGRAM

No time was lost due to work-related injury, which is significant on a project of this scale. Workers were given the tools and knowledge to remain safe, including understanding the inherent risks of working at great heights. For the open interior shaft walls that extended down 42 floors, redundant safety measures were put in place. Planks covered the shaft opening on each floor, and every fifth floor an additional wood platform was secured so workers were never exposed to open shafts. Workers tied off with harnesses and retractable fall protection lifelines. A full-time safety director ensured all protocols were followed and recognized those who went above the necessary protocol. With the job taking place during the pandemic, a strict COVID-19 policy with testing, sanitization and distancing was adhered to maintain required 6-foot distancing.

## COORDINATION USING PULL PLANNING AND SCHEDULE PLANNING

KHS&S became the driving force at maintaining the schedule, coordinating material delivery and overseeing trade stacking using lean construction practices of schedule planning, pull planning and stand-up boards. These lean tools aided the team to analyze and determine new completion dates quickly, organize work crews and identify any anticipated added costs and delays.

Crews were established for framing, drywall and taping and remained together as they moved up the building. Pull planning practices using color-coded stand-up boards served as a visual aid of what materials were needed for each project area and how to be placed within the work area based on workflow. Taking the time to plan out precise material placement reduced waste and increased productivity.

### Connecting with the Community

KHS&S engaged local talent for office and project personnel. While attending a career fair with the University of Washington, KHS&S met with students completing their construction management degree seeking employment after college. Long-term relationships with trades in the Seattle market ensured an additional workforce was available from local labor. Situated across from OSLU is Recovery Café, a center for those transitioning from life's hardships. KHS&S attend a charity event to support the organization that provides healing and hope. The KHS&S team felt a personal connection to the Café as they could visually see the number of people being served knowing their charitable support was making a difference.

rework and repricing. KHS&S' design team was fully engaged throughout the project to address these unexpected challenges. Most solutions were configured and resolved on site by KHS&S.

One of the larger obstacles was a complete redesign of the soffits and ducts. Design change requirements rerouted the HVAC vents, which then impacted the window system. KHS&S quickly pulled field experts together to resolve and provide sketches on how to work around the modifications.

## PREFABRICATION AND REPETITION EFFICIENCIES

Using the PanelMax machine to prefabricate drywall assemblies off-site contributed to project success by increasing productivity. The machine also cut more than 5 miles of plywood rips and 15 miles of gypsum shapes. Each of the 1,179 residences required multiple three-dimensional corner pieces, which the machine could repeatedly produce. An on-site Panel Saw was continuously operated to cut plywood to the exact width of units. As efficiencies with the PanelMax machine and Panel Saw were perfected, a one- or two-second improvement saved substantial time over four years. Precut studs to specified size were then ready to install, reducing the need to cut thousands of studs for each floor.

shower, toilet, sink, fixtures, countertop and flooring. With walls, finishes, electricity and plumbing all coordinated into one unit, the pod is rolled into position and set in place.

Prefabricating repeat building components helps accelerate the construction schedule, improve quality, control costs and reduce jobsite waste by having multiple trade components constructed into a single modular unit. Hotels, hospitals and apartment complexes are geared toward volumetric prefabrication.

KHS&S is pushing modular construction to the next level working toward prefabricating entire multi-story buildings where structural components can be stacked versus slid into place. Engaging with companies such as Sonderpods who specialize in ADUs (accessory dwelling units), KHS&S is working to make this a reality.

*Alternate prefabrication solutions.* In 2021, mass timber products were adopted into building codes and quickly gained the attention of the industry and continue to make headway across the country.

Mass timber offers improved sustainability as a low carbon product. Additionally, incorporating exposed wood into the built environment connects people to nature even while indoors. KHS&S is expanding into mass timber structural prefabrication to provide a cost-effective and renewable alternative to steel and concrete.

A growing area of prefabrication includes the building of large-scale components flown into place to complete a primary structure. For example, the California Baptist University Event Center in Riverside achieved its full 100-foot height with a prefabricated cap at the top of the center's main tower. Weighing more than 6 tons, the section was prefabricated off-site, delivered to the site and flown into place by crane and secured. Through prefabrication, KHS&S safely and efficiently completed construction in a difficult-to-access area while eliminating the need for workers to assemble the cap while working on a steep rooftop.

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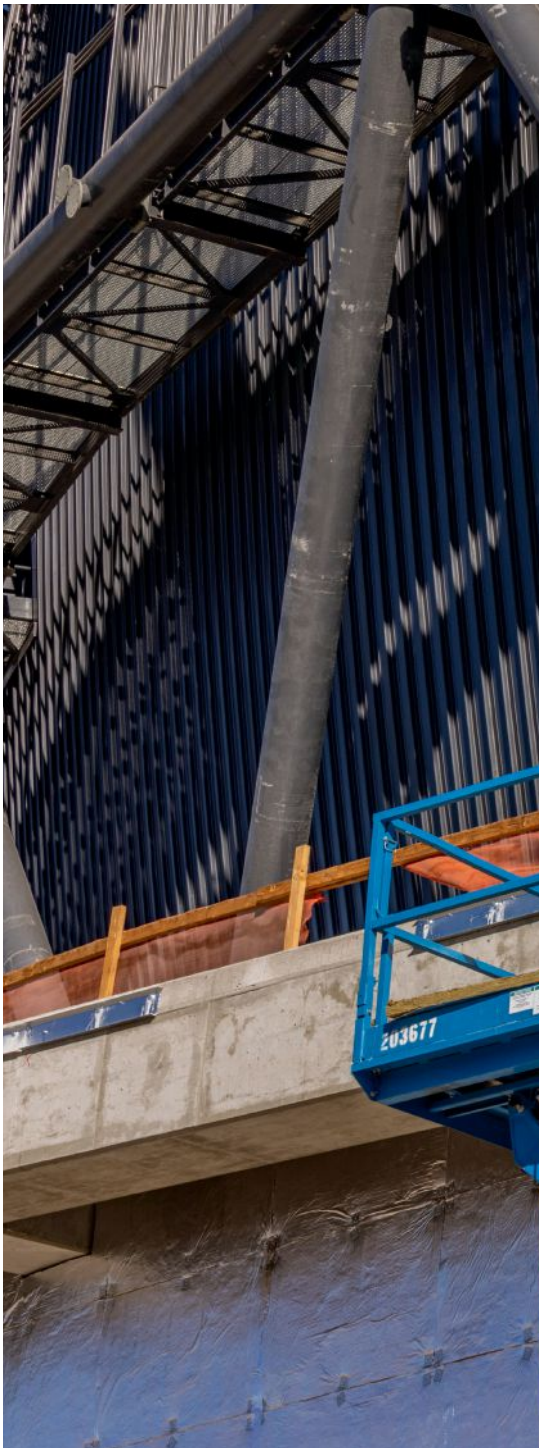


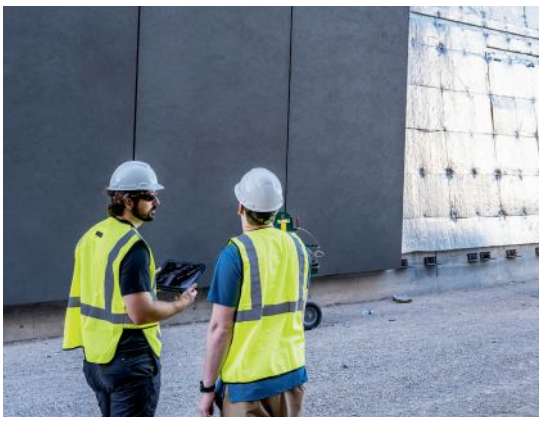

### Transforming the Construction Industry

Prefabrication driven by a technical revolution is the future of construction, providing the freedom to design and build complex structures using new fabrication manufacturing methods. More importantly, it improves the quality and precision of construction and reduces construction schedules leading to increased cost savings.

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