



## A MASSIVE MODERN MASTERPIECE

The many hours of construction and design labor that went into U.S. Bank Stadium culminated in a work of art. **BY BOBBY HART**

TO simply call U.S. Bank Stadium the largest public-private construction project in state history is accurate, though it doesn't put things in proper perspective. Even an exterior critique of the 1.75-million-square-foot facility doesn't quite do it justice, considering a third of the building is below ground.

To truly appreciate it, you have to see it through the eyes of Leo Pidde, the stadium's facility manager who also worked at the Metrodome for nearly three decades. Same site. Different world.

"I don't know if you want to compare it to the Metrodome—it doesn't really compare," warns Pidde, who was manager of building services at the 900,000-square-foot dome, which could fit inside the new structure with room to spare. "This building is on steroids compared to the old building. When we walk into the concourse on the east side, it's 80 feet

wide. The Metrodome's was 24 feet wide. The average of the main concourse as you walk around is about 40 to 50 feet wide."

### BUILT BY THE BEST

The stadium, designed to seat 66,400 and expand to 72,000 for special occasions such as the upcoming 2018 Super Bowl, is made of over 100,000 cubic yards of concrete supported by nearly 18,000 tons of structural steel.

The massive size of the stadium is impressive in itself, but perhaps the more shocking feat is that it was constructed in two and a half years, six weeks ahead of schedule. The stadium's construction manager, Mortenson—the same locally-based construction company that built the Target Center, Xcel Energy Center, TCF Stadium and Target Field—used 4-D technology to plan the construction and stay on schedule, building the stadium virtually in 3-D and adding the dimension of time to project any scheduling challenges.

And the only thing that could keep such a challenging schedule

on track was a team of talented, tireless workers. “I think the best of Minnesota’s construction capability has been on show on this project,” says John Wood, Mortenson’s senior vice president. “[We completed] the project in just over [two and a half years], one of the shortest durations for an NFL stadium, and for that to be done through working through two difficult Minnesota winters just sort of adds to the achievement.”

From the groundbreaking on Dec. 3, 2013 until Mortenson turned the keys over to the MSFA June 17, 2016, more than 8,000 workers worked approximately 3.8 million hours on the project, with as many as roughly 1,500 workers on-site at one time.

Of all the companies that worked on the stadium, 90 percent (roughly 315) were based in Minnesota, and more than 20 Minnesota companies or individuals were brought on as design subcontractors in areas such as interior and exterior design, landscaping and structural engineering.

Approximately 240 ironworkers from Danny’s Construction, LeJeune Steel Company and Iron Workers Local 512 worked 240,000 hours on the roof’s steel. Other Minnesota contractors included Bald Eagle Erectors, E&J Rebar, Woody’s Rebar, InterClad, Viracon, Local 535, Gopher Stage and Lighting. Minnesota-based Viracon produced all the glass.

Beyond creating local jobs, the project not only met, but surpassed aggressive equity hiring goals for women and minorities. “So far, I think that’s the most rewarding piece of this project,” says Michele Kelm-Helgen, chair of the Minnesota Sports Facilities Authority (MSFA), on creating work for local companies, minorities and women. Minority- and women-owned businesses accounted for 28 percent of the work, 8 percent more than the goal, while minorities and women accounted for 45 percent of the workforce, surpassing the goal by 7 percent.

## SHIP-TOP SHAPE

Through nothing short of a herculean effort, construction staff shaped U.S. Bank Stadium. But into what shape, exactly? A shard of ice? A ship? “These are things that can’t be interpreted literally into the design,” admits Bryan Trubey, executive vice president, director of sports and entertainment at HKS Architects. “They influenced the design but are interpreted in abstract form, so when people say it looks like a Vikings ship or it looks like a shard of ice or it looks like this or that, those for us all prove that we’ve developed a form that people liken to other things in that region and in that place. Those things heavily influenced us.”

When drawing up the plans for the stadium, HKS took into account many factors, including the local geography, history and anthropology.





Every angle and material has a purpose.

“There are really no two sections of the building that are the same because of the shape and angles and how they hung the lights is even different,” says Pidde. “There are a lot of straight walls, but they’re very, very short. Just as you see them on the outside of the building, they sort of mirror them inside with the angles and planes.”

The stadium has seven levels, including two general admission 360-degree concourses connected via 35 escalators, 14 elevators, stairs and a continuous ramp.

The structure of the building is all built around one key focal point, a 989-foot-long single-ridge steel truss that runs the length of the building and provides the primary support for the roof. That super truss climatically protrudes to the stadium’s highest point at about 270 feet from ground level and 313 feet above the field (or approximately 30 stories), known to the construction crew as the “prow.”

HKS pitched this single-truss design not only for the modern look, but also for maximum functionality. “We developed a roof form that likened the same roof forms of traditional structures built in this climate for thousands of years in steeply pitched single-ridge roof lines,” Trubey says. “It’s one of the things that gives it a very aggressive and progressive look, but then we also tilted the ridge line so the roof floats away from the ridge line but the front of it facing downtown is much higher than the part facing east. It’s just one of the different mechanisms we used to take that traditional roof framing concept, which is really more residential and meeting hall scaled, to a monumental scale, but have it look appropriate for the building and have it be a big part of the beautiful form of the building.”

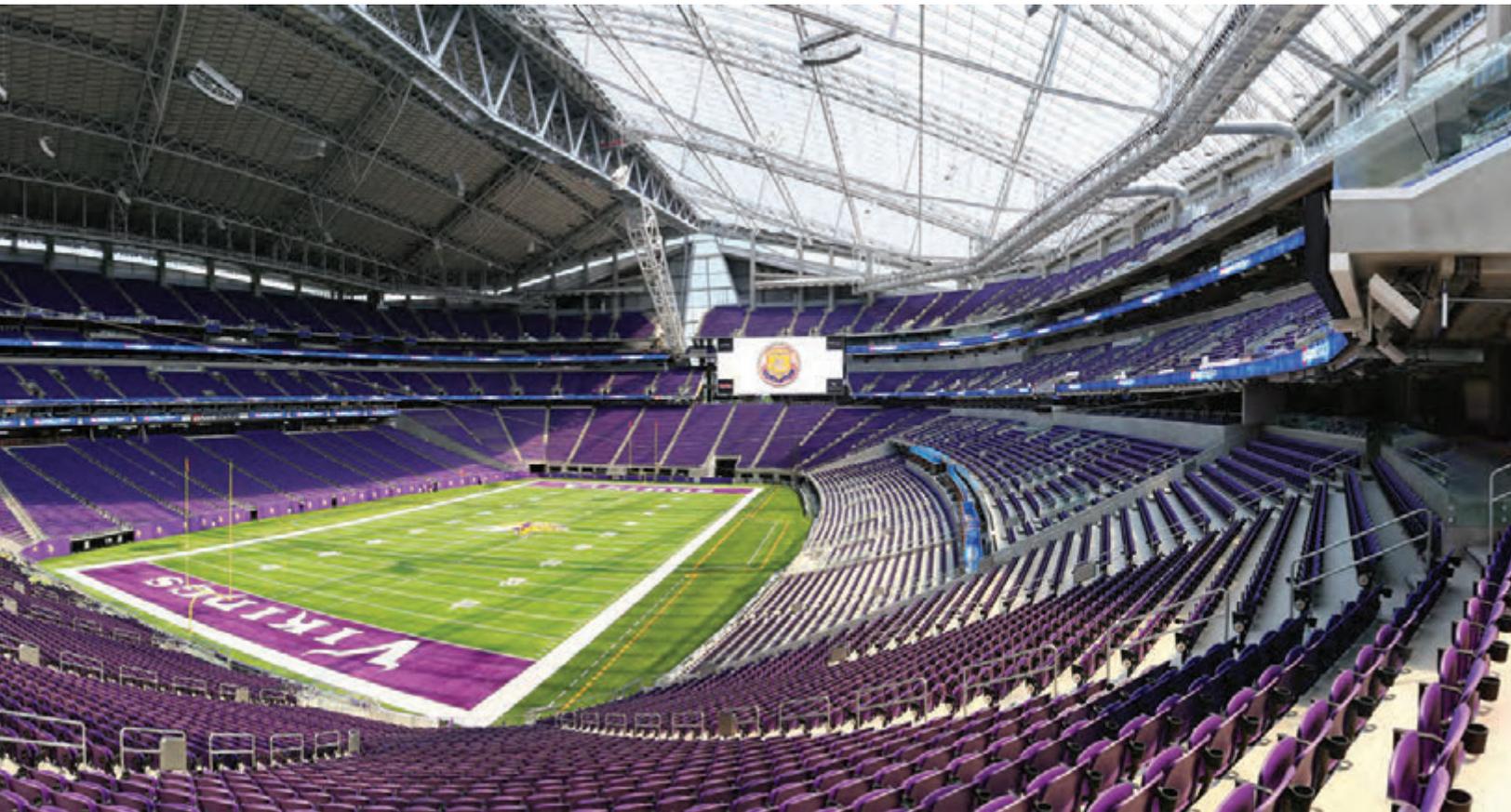
### CLEAR FLEXIBILITY

Transparency plays a vital role in the stadium’s design. The largest ethylene tetrafluoroethylene (ETFE)—a lightweight, durable, self-cleaning and transparent material—roof in the nation combined with 200,000 square feet of glass throughout the building, including 20 feet of clerestory glass below the roof to give it the floating effect, provide an outdoor feel in a climate-controlled environment. Triple-layer ETFE panels, which are pumped full of air and measure 10 feet by 300 feet, account for 60 percent of the roof, while the other 40 percent is metal deck and membrane roofing. Zinc covers the exterior, giving it the smooth, dark tone, which may subtly change over time, depending on weather. And when the heavy snow inevitably hits, diverters along with 40-to-50-foot-deep gutters that run the radius of the roof about 100 to 120 feet above ground await with a snow-melt system of cross-linked polyethylene (PEX) pipe designed by Uponor Inc. of Apple Valley.

Contributing largely to the transparency and the outdoor atmosphere on the west end of the building are the world’s largest pivoting glass doors made of 60,000 square feet of glass (2,000 pieces). Five of them stand from 75 to 95 feet tall, the largest measuring 50 feet wide and weighing 57,000 pounds, and they sure can move. It takes five to 10 minutes to open them with a hydraulic system, and they can open individually or simultaneously.

The doors open onto Medtronic Plaza, The Commons—4.2 acres of green space—and the Light Rail Transit station. “That whole space really lets events spill out into this outdoor area and have all this space for people to come and enjoy before events, after events and as a part of events,” Kelm-Helgen says.

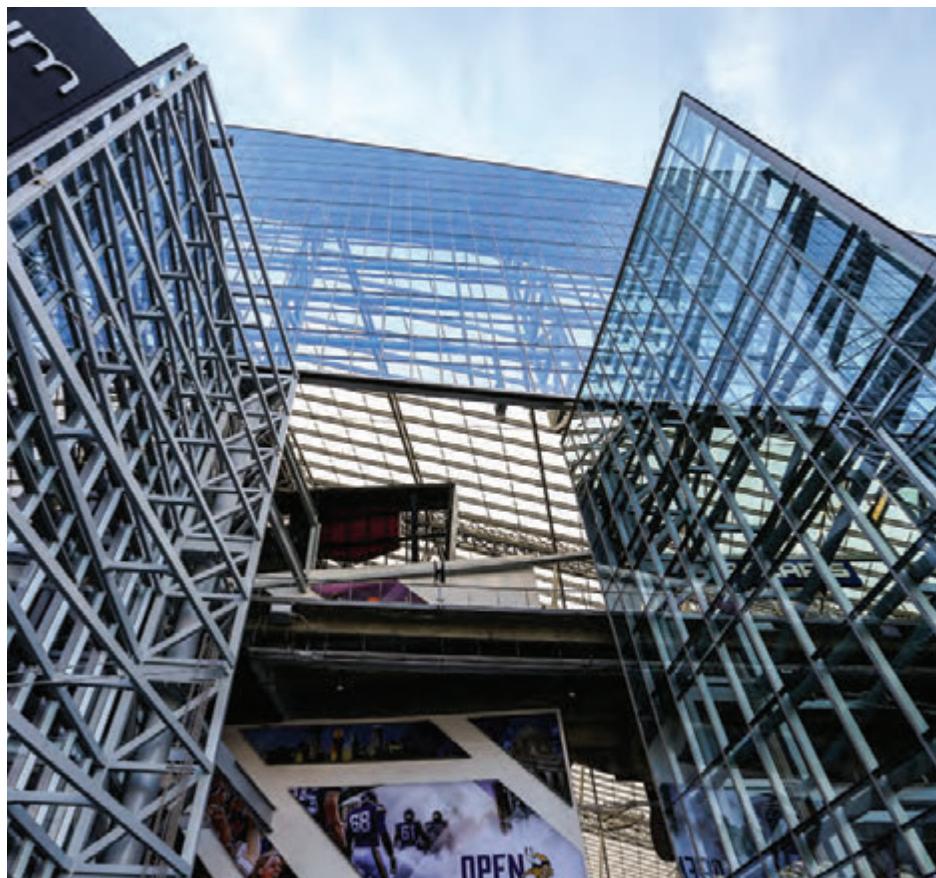
PHOTOS: MINNESOTA VIKINGS.



Another large moveable feature will add to the space design and functionality: Nearly 6,000 retractable seats making up 34 rows on the north side allow for another 40,000 square feet of floor space that can be used for extra event space or even baseball games. “We worked with the retractable seating vendor [Irwin Seating Company] to make sure when retracted it took up the least amount of space as possible to maximize usable floor space,” says Curtis Schmillen, P.E., the stadium’s director of operations. “This also creates a space where a dinner or reception can be set up, but the field can be left open if guests wanted to play on the field as part of the event.”

Instead of being installed directly into concrete, U.S. Bank Stadium’s seats were installed on a rail system that allows the flexibility to remove them or move them closer together to allow for additional seating. This will come in handy for the 2018 Super Bowl and other major events when approximately 8,000 seats can be added.

“There’s more of everything,” says Pidde, marveling at the new world that surrounds him. “This is monstrous. I can’t get over how large it is.” ■





## TIME IS OF THE ESSENCE

**May 14, 2013** MSFA, the Vikings, HKS and Mortenson Construction reveal the new stadium's design.

**Dec. 27, 2013** One of three EarthCam cameras is installed, documenting the progress of construction 24/7.

**Jan. 18, 2014** Demolition of the Metrodome officially begins, making room for U.S. Bank Stadium.

**April 11, 2014** The first horizontal concrete is poured; the 277-cubic-yard deck will form the ceiling (or "lid") of the stadium's loading dock.

**April 17, 2014** All 850,000 total cubic yards of soil from the Metrodome demolition is removed.

**April 30, 2014** The 7,500-square-foot stadium Preview Center opens to the public.

**May 16, 2014** 33 tons of structural steel for the roof truss foundation are placed on-site.

**June 14, 2014** METRO Green Line opens, connecting St. Paul to the stadium via light rail.

**July 11, 2014** The Terex CC6800 crawler crane, the third largest crane in the world at 400 feet high, is assembled after 11 days; it is on-site for 15 months.

**Aug. 22, 2014** The Vikings and MSFA select SMG as the new stadium operator.

**Sept. 12, 2014** The second piece of structural steel that makes up the stadium's west "prow" is placed on-site.

**Sept. 30, 2014**  
*23% complete*

**Oct. 16, 2014** The first precast stadium concrete is installed, continuing through January 2016.

**Oct. 31, 2014** Installation of the ring beam, which will support the roof trusses, begins.

**Nov. 18, 2014** The largest piece of steel ridge truss, weighing 700,000 pounds, is placed.

**Nov. 21, 2014**  
*28% complete*

**Dec. 1, 2014** Bud Grant Way—the former Carew Drive—is unveiled.

**March 20, 2015** The steel columns for the five pivoting glass doors (which reach 95 feet) are placed on-site.

**March 25, 2015** The first of about 8,500 glass units that make up the exterior is installed.

**March 26, 2015** The Legacy Brick Program is announced; granite pavers are engraved with personalized messages, appearing in Medtronic Plaza.

**Feb. 5, 2015** The third of 11 queen's trusses is placed.

**May 26, 2015** Final concrete columns poured, "topping out" at more than 17,500 cubic yards of concrete and 1,200 columns.

**June 12, 2015** The installation of 245,000 square feet of ETFE on the roof begins.

**July 20, 2015**  
*65% complete*

**July 21, 2015** The U.S. Bank Stadium exterior signage is installed

**Aug. 10, 2015** All 11 queens post trusses are installed.

**Aug. 14, 2015** The five operable doors for the west side entrance are set for installation.

**Aug. 18, 2015** The first of the purple stadium seats are installed.

**Sept. 9, 2015** The Terex CC6800 crawler crane is hauled off-site.

**Sept. 17, 2015** The last steel beam is placed; construction workers celebrate with a "topping off" party.

**Oct. 9, 2015**  
*75% complete*

**Nov. 13, 2015** ETFE panel installation is finished and the stadium is fully enclosed.

**Nov. 20, 2015**  
*80% complete*

**Dec. 2, 2015** Scoreboard and ribbon board installation begins.

**Dec. 17, 2015**  
*85% complete*

**Jan. 22, 2016** The Minnesota-made 13 HD LED video boards are completely installed.

**Feb. 19, 2016**  
*90% complete*



**March 25, 2016** Metallica tickets sell out in less than 10 minutes for the Aug. 20, 2016 grand opening concert.

**March 29, 2016** The stadium bowl seating is completely installed.

**April 15, 2016**  
**95% complete**

**April 28, 2016** The exterior west prowl videoboard is installed.

**May 10, 2016** Field turf installation begins.

**June 17, 2016** Construction is "substantially complete" six weeks ahead of schedule; Mortenson Construction symbolically hands the stadium's keys to MSFA and Minnesota Vikings.

**July 22, 2016** The official ribbon cutting and grand opening ceremony takes place.

**Aug. 3, 2016** The stadium holds its first sporting event: AC Milan vs. Chelsea F.C. as part of the 2016 International Champions Cup.

**Aug. 19, 2016** The first stadium concert is performed for a sold-out crowd by Luke Bryan, followed by Metallica on August 20, 2016.

**Aug. 28, 2016** The Vikings play for the first time in the stadium, a preseason game against the San Diego Chargers (23-10, Vikings).

**Sept. 18, 2016** The Vikings play their first regular season home game against the Green Bay Packers (17-14, Vikings) with an all-time home attendance record of 66,813.

## BY THE NUMBERS

# Old vs. New

SEE HOW THE HUBERT H. HUMPHREY METRODOME STACKS UP AGAINST U.S. BANK STADIUM.

By Morgan Halaska

Okay, we admit it's unfair to pit the Metrodome against U.S. Bank Stadium; that's like matching up a freshman team versus varsity. But looking beyond the point that, yes, U.S. Bank Stadium is indeed larger than its predecessor, the comparison illustrates a paradigm shift of sorts. It's a testament to not only how the times have changed, but also indicates where we now place our values. There's a focus on the foodie culture, a concerted effort to be green, and an increase in the quality and comfort of the public's stadium experience.

	METRODOME	U.S. BANK STADIUM
YEAR OPENED:	<b>1982</b>	<b>2016</b>
COST TO BUILD:	<b>\$55 Million</b>	<b>\$1.1 Billion</b>
STADIUM SQUARE FOOTAGE:	<b>900,000</b>	<b>1,750,000</b>
SEATING/CLUB/SUITE LEVELS:	<b>3</b>	<b>6</b>
TOTAL SEATING CAPACITY:	<b>64,000</b>	<b>66,400</b> (EXPANDABLE TO 72,000)
CLUB SEATS:	<b>243</b>	<b>8,200</b>
CLUB LOUNGES:	<b>1</b>	<b>7</b>
SUITES:	<b>87</b>	<b>131</b>
WHEELCHAIR & COMPANION SEATS:	<b>190</b>	<b>690</b>
VIKINGS HALL OF LEGENDS:	<b>0</b>	<b>1</b>
TEAM RETAIL STORES:	<b>0</b>	<b>2</b>
CONCOURSE WIDTH:	<b>24 FEET</b> (AVERAGE)	<b>32-50 FEET</b>
RESTROOM FIXTURES:	<b>435</b>	<b>979</b>
GENERAL CONCESSION POINTS OF SALE:	<b>313</b> (231 FIXED)	<b>430</b> (336 FIXED)
VIDEOBOARDS/TOTAL SQUARE FOOTAGE:	<b>2/646</b>	<b>2/12,560</b>
HI-DEFINITION TVS:	<b>280</b>	<b>2,000</b>
LED LIGHTING:	<b>NO</b>	<b>YES</b>
WIRELESS INTERNET:	<b>NO</b>	<b>YES</b>
ELEVATORS:	<b>3</b>	<b>11</b>
ESCALATORS:	<b>0</b>	<b>33</b>
INTERIOR PEDESTRIAN RAMP:	<b>0</b>	<b>1</b>
PREMIUM PARKING SPACES:	<b>546</b>	<b>2,500</b>

## Notable Figures

U.S. Bank Stadium is almost double the size of the Metrodome.

The new videoboard is 13 times larger than the Metrodome's.

U.S. Bank Stadium is about 30 stories tall at its highest point.