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CRANE HOT LINE

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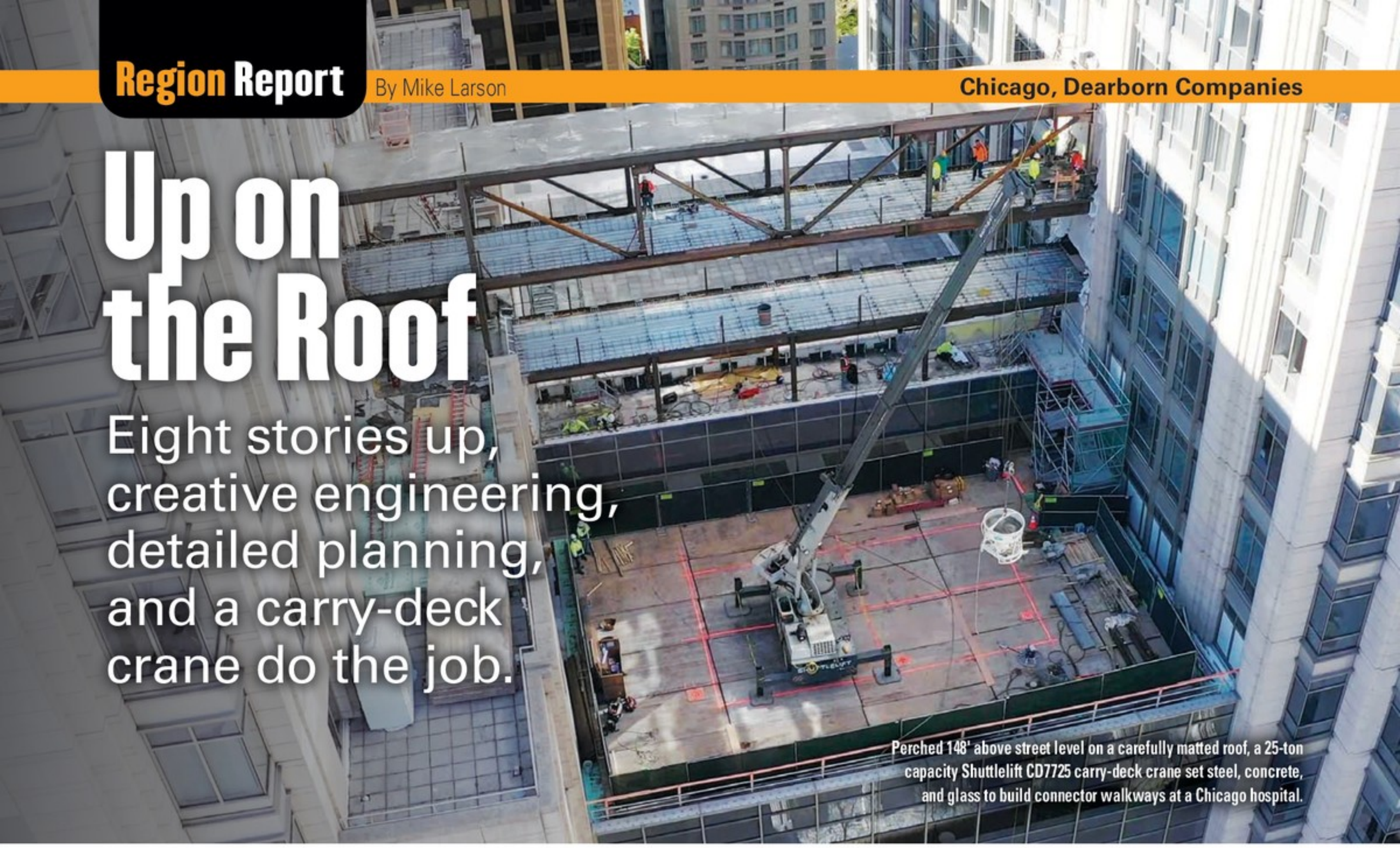
The RT Stuff

New 85-USt Rough Terrain Has it All

Crane Hot Line EXCLUSIVE

Up on the Roof

Eight stories up, creative engineering, detailed planning, and a carry-deck crane do the job.



Perched 148' above street level on a carefully matted roof, a 25-ton capacity Shuttlelift CD7725 carry-deck crane set steel, concrete, and glass to build connector walkways at a Chicago hospital.

When Northwestern Memorial Hospital in downtown Chicago needed to build four connector walkways between two towers of the hospital, the project carried some big challenges and interesting solutions.

One challenge was that the glassed-in walkways would run between the towers at the 9th, 10th, 11th, and 12th floors.

Another was that the construction site was in the middle of the building and above the roof of an eight-story section.

A third was that the parts of the hospital beneath the construction had to keep running while the project took place.

Undaunted, the project's key contractors and engineering consultant, Dearborn Companies, solved each challenge and completed the project safely, on time, and in budget.

One key solution was preparing the 8th-floor roof and putting a 25-ton carry-deck crane on top of it to set steel, place concrete, and handle curtain wall for the walkways.

It may sound easy, but it took a lot of structural analysis, roof preparation, and lift planning to make it work.

All-Star Project Team

The project team included well-respected companies, all from metropolitan Chicago.

The general contractor was Power Construction Company LLC. The steel erector was Chicago Steel LLC. The crane supplier was Central Contractor Services, part of the ALL Family of Companies. Sterling Lumber supplied the crane mats. And Dearborn Companies was the construction engineering and heavy-lift consultant.

Dearborn is a 67-year-old engineering and nondestructive examination company that's expert in many areas, including ground conditions, rigging, shoring, 3D mapping, laser scanning, specialized heavy lifting and transporting, data collection and analysis, and complete end-to-end solutions to complex challenges.

On the Northwestern Hospital job, Dearborn began planning, scanning, and analyzing in October 2019. Its work continued for 21 months.

Broad Scope of Work

On the job, Dearborn's work included laser scanning and documenting existing site conditions, evaluating the best type of crane(s) for the job, reviewing the lift plans, structural engineering and safety planning for for the effects of the rooftop matting system and crane reactions on the building, designing and overseeing installation of rooftop scaffolding, designing the system for temporary removal of some facade panels, arranging with the DOT for the partial street closures, and many other vital tasks.

Picking the Pickers

One of the project team's first jobs was evaluating possible ways to lift steel, glass, and concrete from the street up to construction height and back between the towers where the connecting skywalks were going to be built.

The options included using a large crane working from street level, or putting a stiff-leg derrick, mini crane, or carry-deck crane on the roof of the 8-story section.

"Using a big crane from street level to do the whole project wouldn't work because we couldn't block Huron St. or the entrance to the hospital for the three months construction would take," said Dearborn President Michael T. Walsh, who also noted that there wasn't enough room to swing the boom to reach all of the places that would've been needed to construct the walkways.

"So a rooftop crane seemed like the best choice, but what type?" Walsh said.

He explained that a mini crane didn't have the reach and capacity to set the steel or handle a concrete bucket at the heights and radii needed.

"And the stiff-leg derrick would have required too much room, setup time, and cost," Walsh said.

The best option was using a large all-terrain crane to set matting on the roof of the 8-story section, then to place a 25-ton carry-deck crane onto the matted roof to build the walkways connecting the four floors above.

All of the project's stakeholders agreed that using a rooftop carry deck was the best solution.

Choosing the right cranes was a genuine team effort. "Central's Paul Urbanski, Power's Ryan Mack, and Chicago Steel's Darren Beatty were all key in selecting the cranes," said Walsh.

The team selected a Liebherr LTM 1450-8.1 as the ground-level crane and a Manitowoc Shuttlelift CD7725 carry-deck crane to work atop the roof.

The LTM 1450-8.1 is a 550-USt eight-axle all-terrain crane with a 279' telescopic boom. It had plenty of reach and capacity to handle the mats, stockpile structural steel onto the roof, and even to set the 50,000-lb. carry-deck crane onto the roof 148' above street level at a 93' radius.

For its part, the Shuttlelift CD7725 can lift up to 25 USt and has a 71' four-section, full-power telescopic boom.

Planning and Prepping

"Normally, deploying a 25-ton carry-deck crane is pretty routine, but this job ranks among our all-time most challenging," said Walsh.

Those challenges included operational constraints, crane selection, and balancing the construction needs with the capacity and layout of the existing structure.

"The capacity and line speed of the Shuttlelift carry-deck crane were critical, due to the need to lift bucketed concrete and crates of curtainwall glass from the street. Central Contractors was invaluable in selecting cranes for the project," said Walsh.

The overriding operational constraint was the structural capacity of the roof, Walsh explained.

Dearborn laser scanned and analyzed the structure of the roof and the rest of the 8-story building, both from inside and outside, to design a way for the building to support not only the weight and movement of the carry-deck crane, but of the mats and material that also would sit on the roof during construction of the walkways.

"In order to have enough roof capacity to handle the deadload of the mats, the concrete pavers used to hold down the roof's waterproof membrane had to be removed and relocated to the opposite side of the building until the project was over," said Walsh.

Dearborn engineered a mat system that would cover the entire 3,500-sq.-ft. working area on the roof and distribute loads from the crane and its lifts properly through the building's structure.

They did it using 78 8'x16' Sterling TerraLam CLT 300 composite mats in three layers. "Their rigidity and relatively light weight made them the best way to minimize and distribute both static and dynamic loads," said Walsh.

He also noted that in addition to the crane loads, the mats had to distribute the loads from 100,000 lbs. of structural steel temporarily stored on the roof, as well as workers, tools, and two four-story scaffolds.

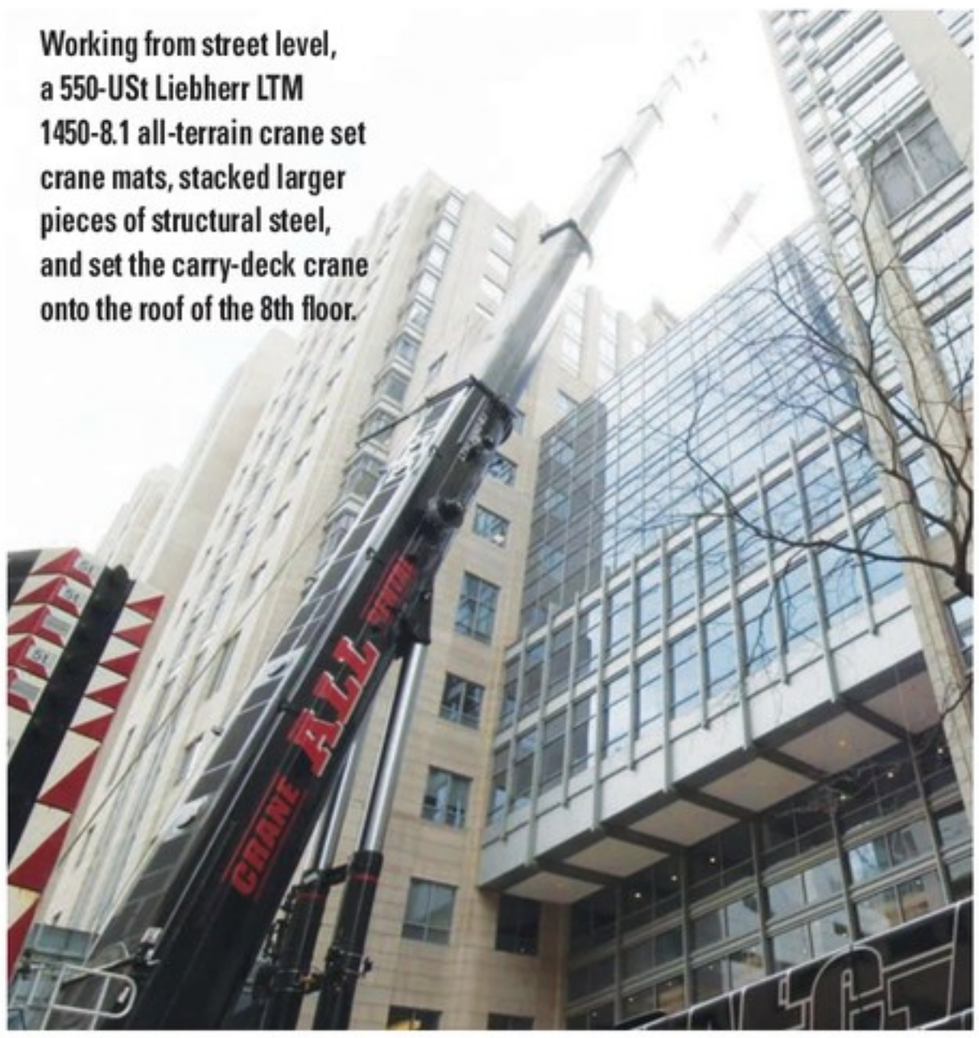
"In addition to that, the hospital's safety team required that the mats be able to withstand an end-on impact from a 4,000-lb. steel beam dropped from a height of 60'," said Walsh.

Dearborn also had scanning, analysis, and planning to do at street level in order to properly prepare for the set up and short-term operation of the 550-USt capacity LTM 1450-8.1 all-terrain crane.

The work included scanning with ground-penetrating radar to locate underground utilities, vaults, and voids; using ground-level laser scans to check for crane swing interferences with nearby structures; and checking ground conditions to determine the amount of matting needed to distribute loadings properly from the crane's outriggers.

Positive Performance

All the detailed planning and preparation led to a positive performance. In



Working from street level, a 550-USt Liebherr LTM 1450-8.1 all-terrain crane set crane mats, stacked larger pieces of structural steel, and set the carry-deck crane onto the roof of the 8th floor.

The all-terrain crane lifts the carry-deck crane to the roof. Careful planning made sure the ground was solid and the mats would keep ground-bearing pressure within the required limits.

three months on the roof, the Shuttlelift made all the lifts needed to construct the walkways without putting undue pressure on the roof.

During its work on the project, the Shuttlelift carry-deck crane: set 100,000 lbs. of steel. It also placed more than 100 cu. yd. of concrete, which it raised from street level to the walkway decks 1/2 cu. yd. (1,500 lbs.) at a time to minimize loading on the roof. It placed the concrete at a 30' radius.

It also raised 3,000-lb. pallets of curtain wall glass at a 30' radius from the street up 148' to the roof before placing the panels on the walkways.

The carry-deck crane did all of its work from six allowable hoisting positions on the roof. Two were for hoisting loads from the street to the rooftop; four were for placing steel, concrete, and curtainwall.

In each position, there was always one outrigger that wasn't bearing directly on the building's structural frame but only on the roof deck. Absolutely no hoisting was allowed near that outrigger.

The reaction forces of the other three outriggers were restricted and included a robust safety factor.

Power Construction monitored roof-deck deflection throughout the project, and even when the crane was setting 4,000-lb. beams at a 45' radius, the roof never deflected more than ¼".

Walsh said, "This really was an incredible team effort between Power Construction, Chicago Steel, Central Contractors, Sterling Lumber, the Northwestern Memorial Healthcare's facility planning safety team, its consultant, Klein & Hoffman, and us. ■

The CD7725 carry-deck crane lands 3,500 sq. ft. of composite matting from Sterling, placed in a three-layer design engineered by Dearborn, helped distribute loadings properly to the hospital roof.