# KEYS TO THE SUCCESSFUL USE OF ACCESS EQUIPMENT FOR HIGH-RISE REPAIR PROJECTS

BY DAN TYLER AND MARK HOWELL

Overall, the key to any successful project is to complete it safely, at a high level of quality, on time, and on budget. The necessity for vertical access at greater heights makes high-rise projects unique and more challenging than other projects.

Because people have varying ideas about what a high-rise is, we begin with an official definition of a high-rise. According to Chapter 2 of the International Building Code,[1] a high-rise is a building with an occupied floor located more than 75 ft (23 m) above the lowest level of fire department vehicle access.

## THE KEYS TO HIGH-RISE REPAIR WORK

### SAFETY

Safety is key for all projects; however, there are special considerations regarding safety on high-rise projects. On a high-rise project, a comfortable and safe work platform is necessary and varies greatly depending on a variety of factors (Fig. 1). We will discuss access options and pros and cons of each later in this article.

Daily job safety audits (daily huddles) should be required to discuss changing conditions and address issues that come up unexpectedly. This is particularly important on high-rise projects, which present many challenging issues due to working at heights.

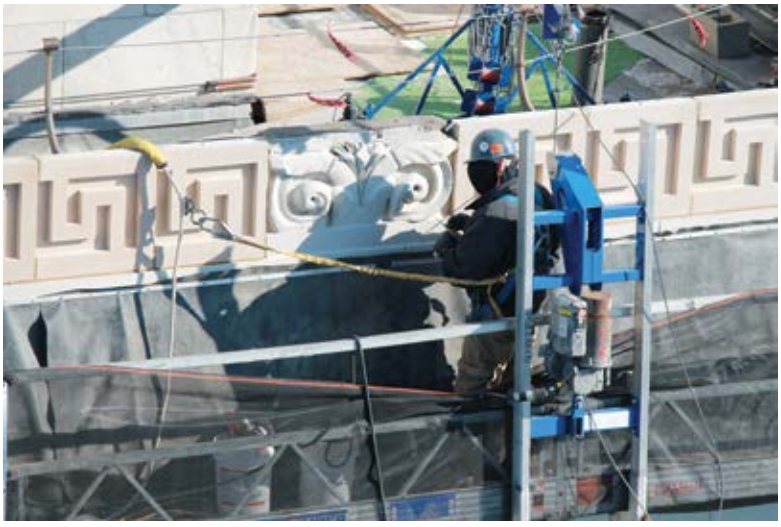


*Fig. 1: Worker on rig, tied off with full protective gear*

Protection and safe access are key. Even before a project begins, protection and access on a high-rise project is necessary to provide design professionals with viewpoints for inspections. In the case of inspections, select drops are used to get a sampling of existing conditions for the preparation of condition reports and repair specifications. Refer to Fig. 2 for a sample of investigation results and schedule of values from select vertical drops. After a project starts, protecting people and property; capturing and controlling dust, debris, and effluent material; and minimizing liability for all parties become paramount.

### QUALITY

To ensure that the highest quality standards are met, a number of considerations are particularly important on high-rise projects. Mockups, although most likely done on grade for practicality reasons, provide for a trial run of the work to identify any unforeseen issues affecting production, access requirements, aesthetics, and quality control. A quality plan prior to construction, along with regular quality audits, helps to understand the complexity of the work scope and anticipate any changing dynamics on the project.

When evaluating the most effective and efficient way to manage a high-rise project, integrating scope layers and understanding how they affect access could be the difference between a smooth running, on-time and on-budget project, or one that does not satisfy the needs of the parties involved.

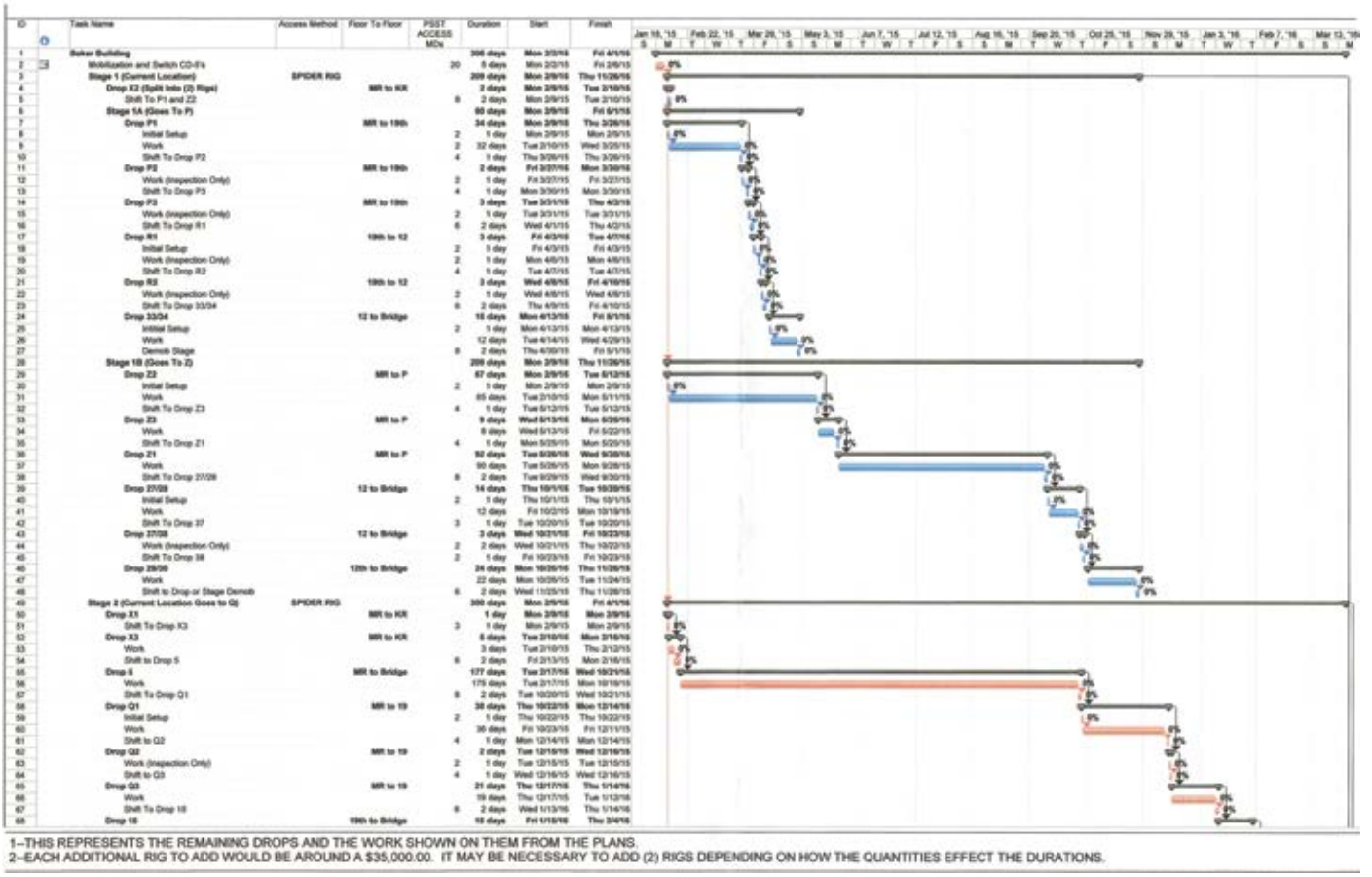
The knowledge and proper training of all people on a high-rise project will strongly determine the project's success. Thinking through all scenarios will reduce punch list and remobilization costs, positively affecting the success of a high-rise project.

### ON TIME AND BUDGET

Any successful project begins with a thorough investigation and intelligent budget followed by quantified bid documents and a production-based estimate (Fig. 2). Thoroughly preplanning (building the project on paper first) will prove to be well worth the extra time to perform (Fig. 3).

| STAGE 1 | | | | W2 | | | W3 | | | W1 | | | 16/17 | | | 15/15 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item # | Repair Type | Unit Price | Prod | Quantity | Total | Dur | Quantity | Total | Dur | Quantity | Total | Dur | Quantity | Total | Dur | Quantity | Total | Dur |
| 11 | C1- Garden Spandrel Repair (LF) | $ 548.00 | 3.50 | 14 | $ 7,672.00 | 2.00 | 12 | $ 6,576.00 | 1.71 | 14 | $ 7,672.00 | 2.00 | | $ - | - | | $ - | - |
| 12 | C1 - Ornamental Spandrel Repair (LF) | $ 632.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 13 | C2 - Corner Repair (LF) | $ 965.00 | 1.40 | 210 | $ 202,650.00 | 65.83 | | $ - | - | 312 | $ 301,080.00 | 97.50 | 30 | $ 28,950.00 | 9.38 | | $ - | - |
| 14 | C2 - Corner Repair (LF) @ Angle | $ 136.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 15 | C3 - Crack Repair, Type 3 Rust and Seal (LF) | $ 25.00 | 50.00 | | $ - | - | 50 | $ 1,250.00 | 0.50 | | $ - | - | | $ - | - | | $ - | - |
| 16 | C4 - Crack Repair, Type 4 Garden Wall (SF) | $ 136.00 | 14.00 | | $ - | - | | $ - | - | 7 | $ 952.00 | 0.25 | 7 | $ 952.00 | 0.25 | | $ - | - |
| 17 | C4 - Crack Repair, Type 4 Ornamental (SF) | $ 182.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 18 | C5 - Crack Repair, Type 5 Arch Pinning (EA) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 19 | Parapet Reconstruction (LF) | $ 1,575.00 | 0.70 | 12 | $ 18,900.00 | 8.57 | | $ - | - | | $ - | - | 42 | $ 66,150.00 | 30.00 | | $ - | - |
| 20 | Parapet Wall Expansion Joint Component (LF) | $ 105.00 | 8.00 | 10 | $ 1,050.00 | 0.63 | | $ - | - | | $ - | - | 40 | $ 4,200.00 | 2.50 | | $ - | - |
| 21 | PR--Rebuild Pilaster Masonry | $ 255.00 | 5.00 | | $ - | - | | $ - | - | | $ - | - | 190 | $ 48,450.00 | 19.00 | 95 | $ 24,225.00 | 9.50 |
| 22 | MRP - Masonry Pier Repair (LF) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 23 | MRP - Flashing at Base of Column (LOC) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 24 | MRS - Masonry Stubs Repairs at East Upper Roof (LOC) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 25 | Guardrail - East Upper Roof Remove and Repair Existing Railing (LF) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 26 | CR - Cross Masonry Repairs (LF) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 27 | CR - Cross Concrete Repairs (EA) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 28 | Pan Flashing at Crosses (EA) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 29 | Copper Screen At Crosses (EA) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 30 | Loose Lintel Replacement (LF) < 48" | $ 225.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 31 | Hung Lintel Replacement (LF) > 48" | $ 367.00 | 3.00 | 6 | $ 2,202.00 | 1.00 | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 32 | Shoring - Inverted Angle For Lintels | $ 150.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 33 | Shelf Angle Extension Plate | $ 75.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 34 | General Face Brick Replacement (garden wall bond or common bond) | $ 125.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 35 | Brick Replacement – at ornamental areas, patterned brick (incorporating brick slivers) | $ 175.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 36 | Brick Replacement – at Ogee | $ 175.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 37 | Isolated Face Brick Replacement – at Ogee | $ 75.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 38 | Isolated Face Brick Replacement (garden wall bond, common bond and ornamental areas) | $ 40.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 39 | R - Localized Brick Re-Pointing (SF) | $ 33.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 40 | RL- Localized Brick Pointing (LF) | $ 14.00 | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 41 | Masonry Stabilization Pins | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 42 | Sealant – Window Perimeter | $ 12.50 | 100.00 | | $ - | - | | $ - | - | | $ - | - | 380 | $ 4,750.00 | 1.90 | 190 | $ 2,375.00 | 0.95 |
| 43 | Probe (opening with Temporary protection) | $ 350.00 | 3.00 | 3 | $ 1,050.00 | 0.50 | | $ - | - | 2 | $ 700.00 | 0.33 | 4 | $ 1,400.00 | 0.67 | 1 | $ 350.00 | 0.17 |
| 44 | Probe (masonry closure of probe opening) | $ 400.00 | 3.00 | 3 | $ 1,200.00 | 0.50 | | $ - | - | 2 | $ 800.00 | 0.33 | 4 | $ 1,600.00 | 0.67 | 1 | $ 400.00 | 0.17 |
| 45 | Sheet Metal Coping Replacement | $ 105.00 | 12.00 | 12 | $ 1,260.00 | 0.50 | | $ - | - | | $ - | - | 42 | $ 4,410.00 | 1.75 | | $ - | - |
| 46 | 1-2-3 Tape – Sheet Metal Copings | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 47 | Stone - Dutchman Repair Install Dutchman at spalled stone location | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 48 | Stone - Crack Injection Inject grout at stone cracks | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 49 | Stone - Staple Repair | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 50 | Stone - Deep Patch Up to 2-inches depth | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 51 | Stone - Shallow Patch Up to 1-inch depth | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 52 | TF1 – Stone Repair 1: Stone Repair at Lintel | $ 675.00 | 1.00 | | $ - | - | | $ - | - | | $ - | - | 4 | $ 2,700.00 | 2.00 | | $ - | - |
| 53 | TF2 - Stone Repair: Façade & Sills | $ 350.00 | 2.00 | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 54 | SR – Stone Pointing (SF) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 55 | SRL Stone Pointing (LF) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 56 | Sealant at Pre-cast Concrete Copings | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 57 | Type I Steel Repair (Reinforcement of existing steel member with slot weld connection) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 58 | Type II Steel Repair (Repair of Column Web & Flange) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 59 | Type III Steel Repair (Repair of Rusted Beam Web & Flange) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 60 | Type III Steel Repair (Repair of Rusted Beam Web and Flange) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 61 | Type III Steel Repair (Repair of Rusted Beam Web and Flange | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 62 | Type IV Steel Repair (Repair of Spandrel Beam at column connection) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 63 | Concrete Patch Repair up to 3" | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 64 | 1/5 Staples Install stainless steel staples (1/2" x 6" x 1/8" U-shaped flat bar) | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| 65 | Repair of Overhead Concrete Encasement Beam | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| | | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| | | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| | | | | | $ - | - | | $ - | - | | $ - | - | | $ - | - | | $ - | - |
| | | | | TOTALS | $ 235,984.00 | 79.32 | | $ 7,826.00 | 2.21 | | $ 311,204.00 | 100.42 | | $ 163,562.00 | 68.11 | | $ 27,350.00 | 10.78 |

*Fig. 2: Sample of investigation results and schedule of values from select vertical drops*




1--THIS REPRESENTS THE REMAINING DROPS AND THE WORK SHOWN ON THEM FROM THE PLANS.
2--EACH ADDITIONAL RIG TO ADD WOULD BE AROUND A $35,000.00. IT MAY BE NECESSARY TO ADD (2) RIGS DEPENDING ON HOW THE QUANTITIES EFFECT THE DURATIONS.

*Fig. 3: Sample drop plan and schedule*

*Fig. 4: Multiple access methods used: swing stage on left and mast climber on right*

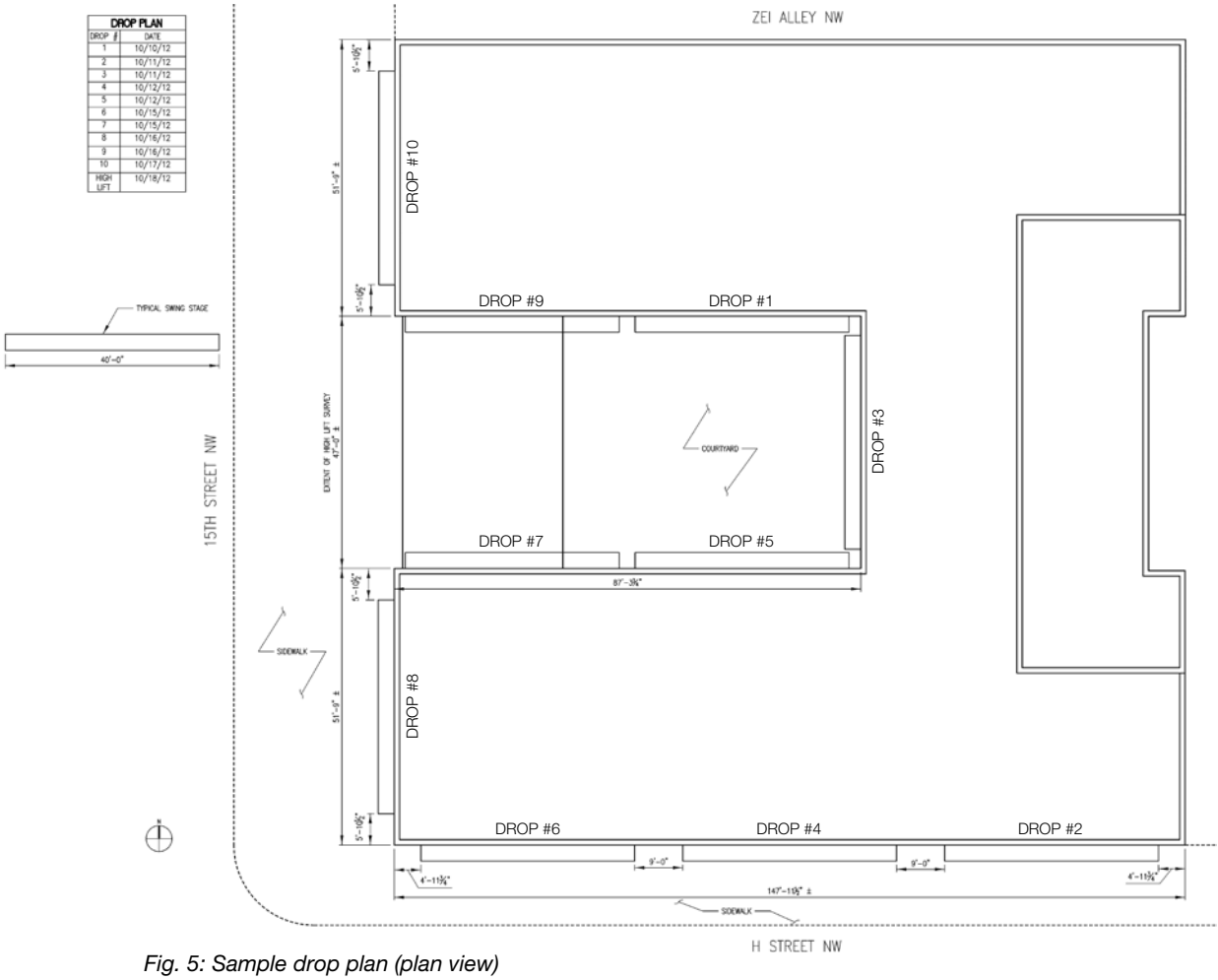



*Fig. 5: Sample drop plan (plan view)*

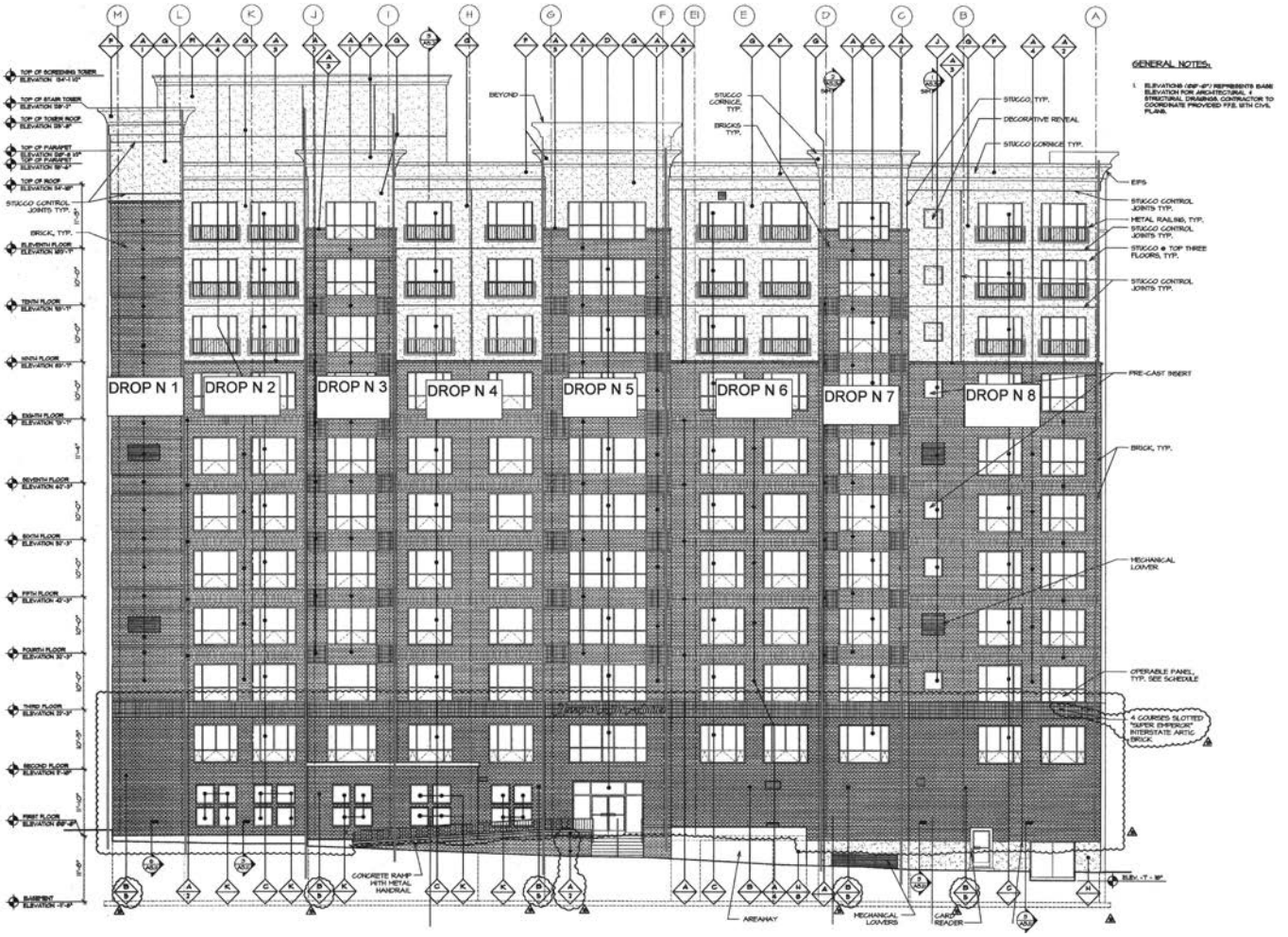



*Fig. 6: Sample drop plan (elevation view)*

Some high-rise projects involve multiple access methods (Fig. 4), so the sequencing of access requires careful planning, as does the careful sequencing of various work items. Once the project starts, production tracking helps keep the project on track.

Other considerations affecting an on-time and on-budget project is a full understanding of product limitations; material coverage rates, what innovative equipment and tools can be used; what impact the weather or season will have; and how best to integrate the asbestos, lead, or other hazardous material scope, if applicable.

## "DROP" THEORY

How best to work vertically on a particular high-rise project takes into consideration numerous aspects of the building, the work scope being performed, and the best economic choice of the access available. Of course, choosing the safest option for the circumstances is a given. When working on a high-rise building, drop plans (Fig. 5 and 6) are key because the best phasing and sequencing for a high-rise project is through the form(s) of access used and how the access impacts scheduling and cost estimating.

## FORMS OF ACCESS—PROS AND CONS

### BOATSWAINS CHAIR AND INDUSTRIAL ROPE ACCESS

Boatswains chairs and industrial rope access are particularly suited for inspections and condition assessments. It is important to check on local code enforcement for restrictions on use. Access is quick and inexpensive but work done from a boatswains chair or industrial rope access is limited. Minor work with little materials and tools/equipment is feasible but these access methods are not safe for more significant projects.

### SOLO BASKET

Solo baskets can be limiting due to the capacity on the rig and type of work that can be done from this access; however, they do provide an alternative for certain types of work or when minimal amount of work is being done. Wind can affect this access type and debris can be captured, although the amount captured is restricted due to size and capacity of the rig. Other considerations include rooftop options to tie back the rig. It is necessary to have adequate roof and parapet wall capacity.

*Fig. 7: Swing staging with larger work platforms and ability to capture debris*

*Fig. 8: Mast climbers at various heights*

## SUSPENDED SWING STAGING

The capacity, ability to capture debris, and the type of work feasible is greatly increased using a suspended swing stage (Fig. 7) versus a solo basket. This access allows for corner access, through corner rigs, and a variety of work platform lengths most suited for the work scope and building being rigged.

Even more careful evaluation of roof and parapet wall loading, rooftop and tieback options, and overhangs in the way is necessary. A licensed design professional's review and approval stamp may be required, depending on your locality.

When planning and pricing a project using a suspended swing stage, the height, length, and rig travel time needs consideration.

## SCAFFOLDING

Scaffolding plans should include appropriate working heights for the scope of work and particular building, location of debris chutes, and whether ladders or steps should be used and where they are best located. The proximity to the wall and work can greatly affect safety and productivity. Tie-in to the building is important and can compromise the façade of the building, so pressure ties that do not damage the façade are available and should be considered. This option is important in the case of historic buildings.

Netting is often used around scaffolding for a variety of reasons, including added safety and debris capture by providing an added way to contain debris or accidently dropped tools or materials. On the negative side, full netting can make it dark and closed in for the tenants of an occupied building, and increase wind load.

## MAST AND MINI MAST CLIMBERS

The work platform space of a mast climber (Fig. 8) increases the capacity for workers, materials, and tools/equipment. Other advantages of mast climbers could include decreased project time/labor and more accurate access to work; however, mast climbers can be more invasive on a building façade and increase electrical needs, require waterproofing of the connections, and some feel that the project can be vulnerable to motor breakdowns and unexpected delays.

A licensed design professional's review of the shoring and approval stamp is required, particularly for subway and sidewalk vaults. As always, safety and weather are also considerations. Mini masts provide some of the benefits without the downsides, providing another alternative.

## HOUSE RIG

A well-maintained and functioning house rig can provide a time- and cost-effective option to other access methods. The building's schedule of other work performed from the house rig needs to be considered but is easily worked around.

## HOISTS

Hoists can complement other forms of access by providing another method of moving people, materials, tools, and equipment. There is an array of hoists available for all sorts of applications. One needs to carefully plan the best-fitting hoists for the needs of a particular project and access used.

## PROTECTING PEOPLE AND PROPERTY

High-rise projects require special attention for protecting people and property surrounding the project and occupying the building. Of particular concern is the capture of dust and debris created by the work, and control and disposal of water runoff and chemicals. These issues need to be addressed prior to the start of the project. Pedestrians should be protected from a variety of falling items, water, chemicals, dust, and debris by sidewalk canopies/bridges. Local codes and regulations need to be fully understood to know the requirements in the locality for protecting people and property. The specifications for a sidewalk canopy/bridge should consider whether you are landing or building access on it.

The need for protecting roofing, parapet walls, and mechanical units varies depending on the access being used and the scope of repair work. This is more of a concern when using any access that will be hanging from the roof versus the use of mast climbers or scaffolding.

Properly protecting people and property takes into account the effect of the work tasks, materials, and methods used on the building's windows, doors, and handrails, as well as vehicles and landscaping around the building.

## CONCLUSIONS

Although all projects benefit from successful planning, pricing, and implementation, high-rise projects present even more challenging situations from working vertically at various heights. On the positive side, the need to work vertically creates a logical and effective manner to sequence and plan the scope of work during the bid and execution phases of the project.

## REFERENCES

1. ICC, "2015 International Building Code," International Code Council, Country Club Hills, IL, 2014, 736 pp.

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