Building in Tight Urban Spaces
For a successful project, make project partners of all stakeholders, have a clear understanding of legal issues, and carefully manage site logistics.

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A new building project in an infill or crowded city setting means logistical complexities not encountered on an open greenfield site. Laydown area, material deliveries, construction site traffic, and water and power hookups must be carefully coordinated according to site constraints. Traffic, subways, buses, crisscrossing sewer pipes and power lines, sidewalks full of people, and tight lot lines all require careful management.

Close collaboration among all stakeholders—structural engineer, construction manager, architect, contractor, and product manufacturers—is essential to bring a clear understanding of site restrictions to all of the team members. Lack of communication brings misunderstandings. For example, odorous materials or coatings that produce overspray or other hazardous conditions should be under careful control. Site deliveries of bulky materials need to be carefully scheduled to avoid traffic tie-ups. Noisy equipment and procedures have to be conducted with an eye to keeping neighbors happy.

Good collaboration also includes making neighbors and local governmental agencies into project partners. Topics such as deliveries, storage, and worker parking are important to address early in the planning stages. Well-informed neighbors are less likely to complain as work progresses. They may even become helpful allies in keeping the site secure or preventing vandalism.

The key to keeping neighbors happy is to provide a lot of information. That may include community meetings, posts on local Web sites, full cooperation with local media sources, and good old face-to-face meetings.

Phil Moses, Principal and Vice President of INTECH Construction in Philadelphia, describes the intricacies of working with neighbors during the construction of the Curtis Institute of Music Lenfest Hall in Philadelphia, designed by Venturi, Scott Brown and Associates. This project, inserted mid-block in one of the city's oldest and most prestigious neighborhoods, preserved two existing historic façades and abutted old buildings on either side.

"To the east side is an apartment house. To the west side is an attorney's office. To the north, across Locust Street, is St. Mark's Church. And to the south, along Latimer Street, were various small businesses, all of whom depended on continuous access" he says. "Even before the project started, we were all about communication."

To keep these various groups informed and engaged, INTECH held presentations and monthly public forums. They told the neighbors about the job—what to expect day-to-day and long-range. Meetings were convened ahead of any significant milestone in the work which might impact the neighboring community -- including demotion of the existing buildings, placement of the mat foundation, and erecting and dismantling the tower crane.

“This was a very tight site with no room for laydown,” he adds. That meant a constant stream of delivery trucks at certain points during construction. During the snowy winter, INTECH’s trucks plowed the narrow streets and even carted trash to dumpsters—all in an effort to keep the project’s neighbors happy.

At one point, a young couple scheduled a wedding at St. Mark’s at 3 p.m. on a Saturday, while the builders scheduled the foundation pour to start Friday night. The trucks arrived all night and into the following morning. Finally, by about 1 p.m., the crew began cleaning the streets and neatening the site. By 2 p.m., when the horse trotted down the street pulling a carriage with the bride to be, all was tidy.

Getting Started

The first hurdle in the project planning process is understanding exactly where lot lines begin and end. Boundaries are often unclear. Throughout the 19th and early 20th centuries it was common practice to build bearing walls right up to the property lines. Shared or party walls, in which the framing was inserted from both properties into a bearing wall mutually owned and maintained by the two sides, were common. As properties were renovated, it was not unusual for a new liner wall to be constructed alongside the original to carry different, perhaps heavier, loads. Later still the adjoining property might be demolished and replaced, including the original party wall. As a result, the property line is not at the center of the remaining wall, but several inches or a foot away. Legal issues of this sort can tie up construction progress for years.

The next step is often the demolition of existing structures. The engineer’s definition of demolition is “the purposeful introduction of structural instability.” In translation, that can mean things don’t always fall in the right places at the right times—unless there is careful planning.

Many steps precede the actual wrecking process. Utilities must be shut off; asbestos, lead paint, and other toxins must be identified and addressed before the demolition activity scatters them among neighboring buildings. An experienced demolition engineer or contractor should review the structural system and plan the demolition procedure and sequence for the safety of the crew and public. Temporary shoring may be needed to prevent a cascading collapse.

In some cases, a façade or structural elements are saved. In such instances, a supporting frame will be installed to preserve these parts while allowing the remainder to be removed.

Getting the structure down is one matter; getting all the debris off the site is quite another. The sheer volume of materials to be trucked away will tie up traffic. Additionally proper planning can result in a significant portion of the materials (steel and other metals, concrete) going to recycling rather than landfills.

Preconstruction Surveys

Fragile finishes, such as plaster, terra cotta, and terrazzo in neighboring buildings may be damaged while taking down old buildings and erecting new ones. It is becoming routine practice to conduct a preconstruction survey on site and on neighboring sites to form a record of displacements—something that's valuable in case of unhappy neighbors. The information can be crucial in discussions about cracks and their causes.

A preconstruction survey is a review of any properties adjacent or close to a site where construction is about to begin. The goal is to identify exterior damage, structural settlement, and other pre-existing conditions before work begins. This protects the property owner and the contractor.

Surveys typically include photos and notes on the location and type of damage. When cracks are detected, the size, type, and direction are noted. Other telltale evidence of building shifts includes doors that won't close, water where there was none previously, and gaps around windows, doors and walls. Sometimes the owners of neighboring buildings are uncooperative and don't want to let you into their premises with a camera in hand. Explaining how this documentation can protect their interests may lower the concerns.

Vibration and crack gauges are often installed as well for the duration of the project, especially in historic or otherwise valuable buildings. These are typically checked at certain stages during the construction process. Follow-up surveys are done once construction is completed.

During the construction of the Curtis Institute of Music Lenfest Hall, there were some damage claims, Moses says. But that's to be expected on any urban site--especially one that requires over two years of construction time, he adds.

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New Meets Old

New foundations are often threaded through other older foundations, as well as underground waterways, transit lines, utility lines, and other infrastructure. Gathering records for the site from public agencies--water, power, gas, and transit departments--is a time-consuming and often frustrating exercise; they have little incentive to do the internal research necessary.

Encountering these lines and other hidden "features," such as abandoned wells and unknown utility lines, is not unusual. Philadelphia, for example, is filled with streams that were buried as part of urban development.

While excavating for University of Pennsylvania's New College House, a city-block-sized student housing complex in Philadelphia, contractors encountered more water than anticipated. Water tables shift and move; streams change course. "It wasn't a huge problem in the end. We upped the dewatering and paid very close attention to the waterproofing application," according to Zach Baron, senior project manager for INTECH Construction.

The University of Pennsylvania, together with the contractors, did a lot of community outreach and worked closely with Drexel University, whose property borders the site. There were quarterly meetings to discuss logistics.

Hazardous chemicals are also common in urban settings. Old manufacturing sites had different disposal standards than what we have today. And nothing is static underground; materials don't necessarily stay where they are put. Digging holes for foundations is one of many factors that change underground pressures and cause shifts in liquid and vapor flow. Methane gas may migrate from nearby landfills, for instance, or radon may appear where it was previously undetected.

A soil analysis is necessary to reveal hidden pollutants. When they are encountered, it's essential that the waterproofing material be tested for its ability to withstand degradation by aggressive chemicals.

Surcharge Loads and Undermining.

To maximize usable interior space, columns are often placed within or adjacent to the perimeter walls of a new facility. This leads to two concerns at the foundation level: surcharge loads and undermining.

Surcharge loads exert extra pressure on the lower foundation when another foundation is above it and nearby. It's sort of like when someone steps on your foot: the pressure under your foot is doubled. In this case, it means lots of new weight on new or existing foundations.

Undermining means digging out the soil under an object. This term comes from the mining industry--if you cut into the bottom of a cliff face or rock wall, for example, the rock above has no support and tumbles. In the construction world, it means digging under a building so that it loses its base. If you cut a deep trench alongside an existing footing, the soil will slough off into the trench and the footing loses its support.

The structural engineer needs to investigate the vertical and horizontal relationships of the new foundations to those of surrounding structures to avoid placing surcharges on either--the new or existing foundations. If the construction drawings of adjacent buildings are lost, one might need to make inferences from the height of the building and the depth of its basement, to be confirmed by probing or other means prior to excavation.

Likewise, the contractor needs to be aware of the existing foundations to avoid undermining them. There are far too many instances of unsophisticated excavation subcontractors trenching alongside a bearing wall or column foundation, thinking an unbraced vertical cut will hold up under tons of load. Placing columns close to the lot lines may require offset foundations, or strapped footings if the governing authority does not allow foundations to intrude into the adjoining property. A better practice is to hold the columns several feet away from adjacent structures.

This was the case at the Museum of the American Revolution, designed by Robert A.M. Stern, in the Old City section of Philadelphia. The site is hemmed in by an active security driveway on the east and a utility building on the south. It is also an active historic and entertainment district, with a lot of pedestrian and street traffic. Safety of the public and traffic flow were important planning considerations.

To maximize the interior volume, the basement walls were located as close as practical to the property lines on all four sides. The building façade on the east and south sides cantilevers over the foundations to the lot lines, while the north and west sides are set back to allow generous sidewalks and a plaza.

While the basement slab is above the water table, it was nonetheless designed to be waterproof because historic artifacts are stored there. Blind side waterproofing was installed to keep all five sides of the basement dry.

With no room to excavate, waterproofing is complicated and tricky. At the same time, many building types are taking greater advantage of below-grade spaces to maximize site usage and save costs. Healthcare facilities, for example, are using below-grade space for imaging equipment. This helps control vibration while providing better shielding. Hospitality spaces prefer to reserve anything above ground for profit-making facilities, while below grade space holds back-of-house functions, workout space, and conference rooms. Below-grade is also perfect for "wine cellar" restaurants and pubs.

Another reason more buildings are going deeper is it helps them meet ASHRAE 90.1, an alternative to the ICC Energy Code. The 2015 version of the ICC code requires a 30 to 40 percent window to wall ratio. ASHRAE 90.1 allows buildings to include below-grade space in the window calculations. That means deeper below grade walls allow more glass above grade.

Regardless of the reason, simply excavating the site and taking the soil away can mean complicated site access (steep ramps) and fussy waterproofing details. In some cases it's necessary to use blindside or preapplied waterproofing (see "Marina Heights"). This is waterproofing membrane that is installed against the lagging, existing walls, even rock or rubble, and then concrete is poured against it. There may also be a mix of waterproofing techniques—negative waterproofing on existing walls and blindside on new walls, for example.

If multiple membrane types are used, the ability to tie the systems together to ensure a continuous water tight seal is critical. Membrane systems must not only be able to tie to together with proper detailing, they must also be manufactured from compatible materials. Whenever possible, dealing with a single manufacture to ensure compatibility and continuity may be beneficial.

Working Together

Once the base of the building is solid and the walls go up, new problems arrive—in the name of cranes. How and where these are placed is a mathematical equation on tight sites.

Contractors at the Museum of the American Revolution knew there was no place to park a standard mobile crane, necessary for the three-story structure. Instead, a short tower crane was used to keep the site access ramp clear. Naturally the ideal location was to place the tower at the center of the site, but this would require a significant redesign of a main building truss and other important design elements.

Through a collegial brainstorming session, it was agreed to shift the location slightly off center to allow the truss to slip by. The large foundation for the crane was incorporated into the column footings. Since the crane would now not reach one far corner of the site with its necessary load capacity, two of the precast panels were installed using a temporary mobile crane, located for a short time on a neighboring driveway.

Outside the box thinking and the willingness of the owner and design team to be flexible on details greatly improved the construction process.

Laydown is another complication. Often sidewalks are cramped and the only place to put anything is right on the site. On some projects, there’s barely room for an office, let alone a trailer.

The solution to all these problems is teamwork. That means early and frequent meetings. And it means keeping everyone involved informed at every step of the way. That’s easy to say and quite another thing to accomplish, especially when the budget is tight—as it always is—and time is short—another constant truism.

The definition of integrated project management includes this statement: It involves making trade-offs among competing objectives and alternatives to meet or exceed stakeholder needs and expectations. In the end it’s about compromise.