

Mind the Gap: Waterproofing Considerations in Property Line Construction

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THE ICONIC “PAINTED Ladies” in the sitcom *Full House*, brownstones in New York City, and row houses along the Venetian canals are all famous examples of property line construction. Construction along property lines has been done successfully for centuries, yet modern performance requirements and construction practices of lighter and thinner assemblies challenge designers and contractors with forming the exterior enclosure mere inches from neighboring buildings.

In modern construction, building code requirements and performance expectations form the basis of design of the exterior enclosure. Key building code requirements that affect property line design include fire resistance, design for earthquake displacement, occupancy classifications, height and area limitation, hazardous material considerations, and water drainage. Each component of the exterior enclosure, from below-grade waterproofing, along the building separation, and at the exterior wall (**Fig. 1**), requires additional considerations on a project-by-project basis.

Project-specific key parameters that affect property line design and construction are:

- Agreement (or disagreement) between neighbor and owner.
- Condition of the neighboring building (such as lightwells, existing leaks, deteriorated cladding, encroachment beyond the property line, open-air garages, and the like).
- Future-proof requirements: Anticipating whether a neighboring building is to be constructed or slated to be demolished concurrently with the new building's construction.
- Separation size: Size of the separation is defined by the design earthquake displacement of both the new construction and neighboring building (ASCE 7-22, Section 12.12.2).¹ Whether the separation is too

narrow for a person to enter (approximately 12 in. [305 mm] or less) or wide enough for construction access (approximately 24 in. [610 mm] minimum) impacts the design, construction, and maintenance considerations.

All the above parameters affect the infill building's design, yet the neighboring agreement, the condition of the neighboring building, and future-proof requirements are beyond the control or jurisdiction of the design team for the infill building. The design team should be aware that all design details that interface with the neighboring building may be subject to change at any time due to unexpected field conditions, updates or revisions to the neighboring agreement, or lack of information from the neighboring building owners.

We will conceptually discuss the below-grade waterproofing, the strategy along the building separation, and the exterior-wall implications for construction along the property line, followed by how key parameters from the neighboring building can potentially foil each strategy.

BELOW-GRADE WATERPROOFING

Due to the lack of access to over-excavate at a property line wall, pre-applied “blind-side” below-grade waterproofing is required along the

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property line and all the considerations common to blind-side waterproofing apply.

One additional below-grade waterproofing membrane consideration along the property line is when the neighboring building also has a basement. During construction of the new building's basement, the neighboring building's basement wall may be exposed as part of the excavation. The owner must be cognizant of the risk of exposing and potentially damaging the neighboring building's below-grade

waterproofing. For the infill building, a key consideration is that the backfill at the below-grade separation between the two buildings may not be compacted due to the limited space or purposely filled with geofoam to provide a separation layer. There is a family of below-grade waterproofing membranes designed to swell, such as those with bentonite clay, that rely on confining pressure which non-compacted fill or foam may not provide. The project team should review the backfill requirements with the

waterproofing membrane manufacturer if the specified below-grade waterproofing membrane relies on confining pressure.

Along the property line, the below-grade waterproofing must be terminated with limited access to the exterior, and often there is no access to install a traditional termination bar. Instead, the membrane may need to be folded into the concrete wall at a pour joint or terminated onto a sheet-metal flashing inserted into the concrete pour joint (Fig. 2). Since the detailing affects the concrete pour joint, especially if the termination occurs at a concrete shear wall, the structural engineer must review the structural impact. Furthermore, it is critical that the future backfill height be finalized to locate the waterproofing termination detail at the correct elevation.

AT THE BUILDING SEPARATION ABOVE GRADE

At the building separation along the property line, the three strategies are to do nothing, provide bulk-water diverter flashings, and provide watertight flashings.

Do Nothing

Doing nothing simply means treating the interface as if there is no adjacent neighboring building. This may seem like a simple solution, but in practice, it requires consideration for risk management, site drainage, exterior-wall design (see "Exterior Walls" section below), and overall building maintenance.

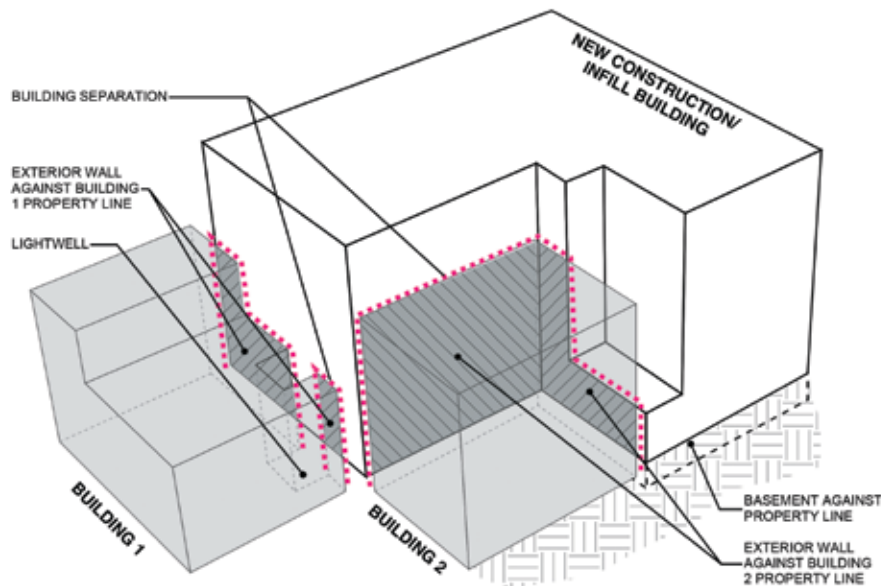


Figure 1. Building separation diagram of a new construction building along the property line of neighboring buildings.

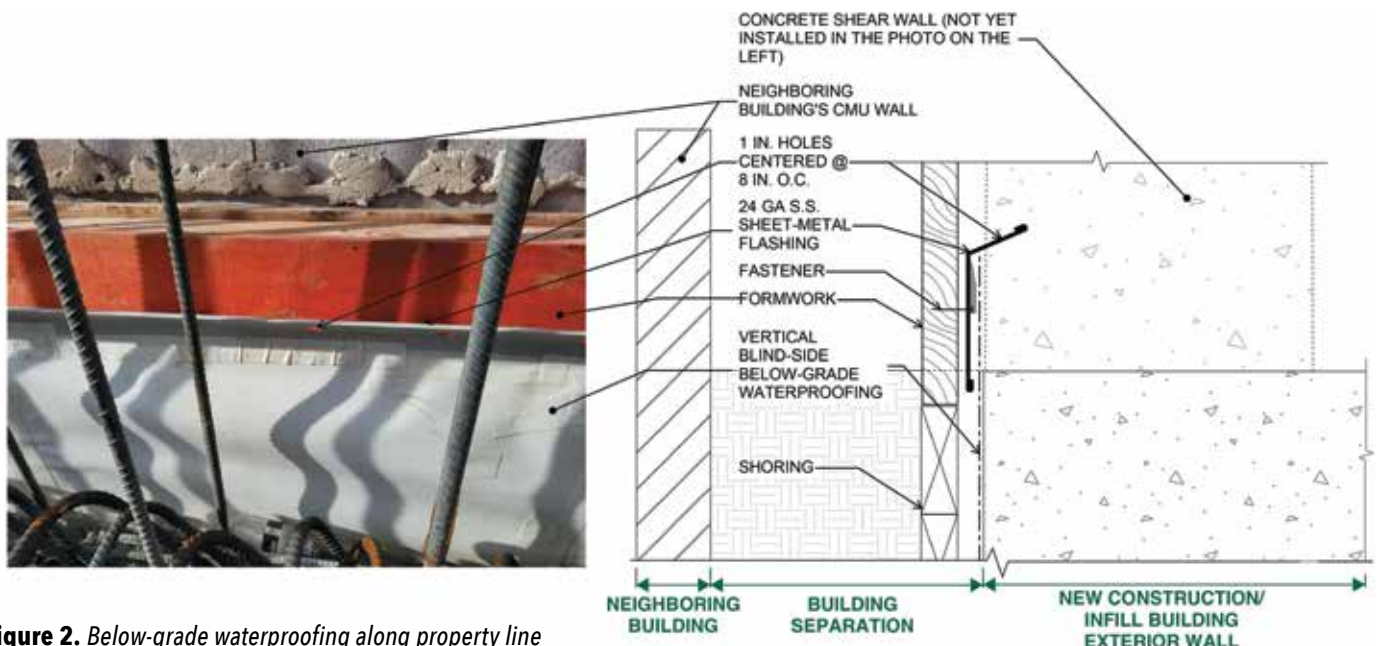


Figure 2. Below-grade waterproofing along property line construction.

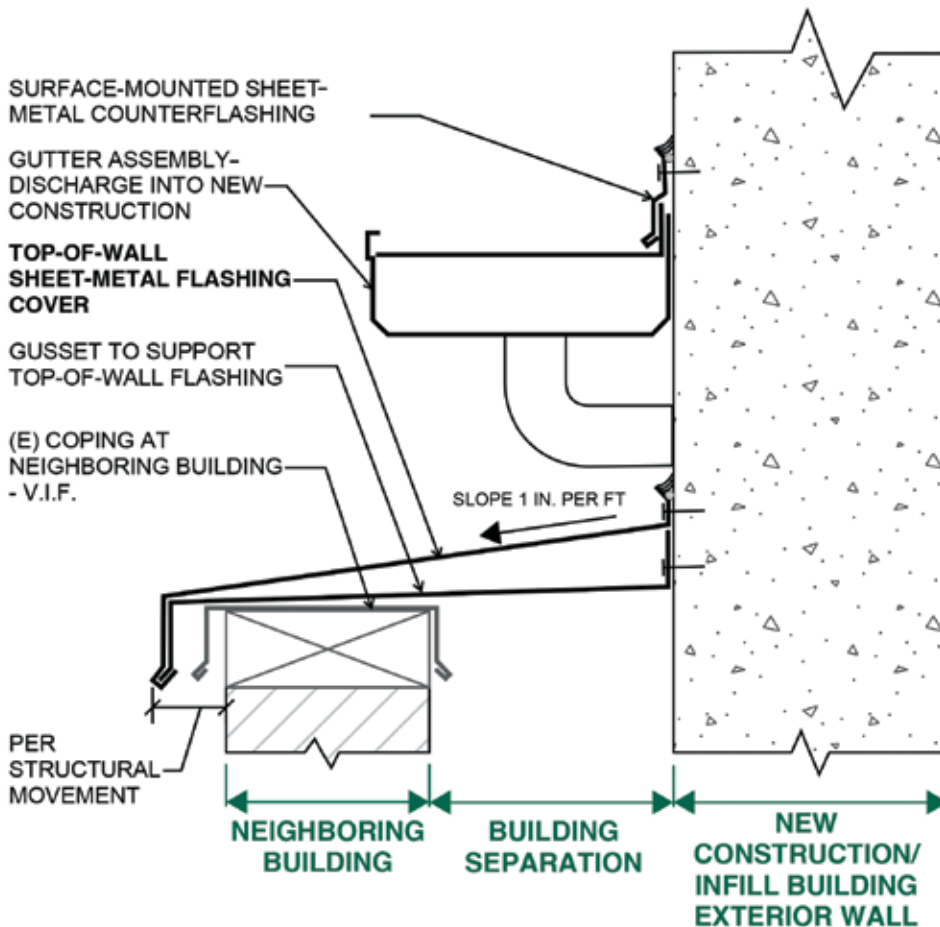


Figure 3. Top-of-wall bulk-water diverter flashing.



Figure 4. Integration of bulk-water diverter flashing with the neighboring building.

Risks

The code-required property line separation between the two buildings creates an open space within the gap. Any gap less than approximately 12 in. (305 mm) in an urban environment prompts a maintenance challenge since a person is unlikely to fit into this gap. By doing nothing at the building separation, the gap along the property line cannot be accessed to retrieve debris or deter vermin from entering or nesting.

When the interface between the two buildings is treated as if there is no adjacent building, rainwater that reaches the wall surface drains down to the ground. Exactly how the water is managed once it arrives at the ground has proven to be tricky and complicated on numerous projects. The slope for site drainage along a property line between two buildings is to match the finish grade at the end of the buildings. By the time finish grading is scheduled toward project completion, the infill building is nearly complete and access within the gap is very limited.

Based on past projects where the new construction did not have a basement, most of the gaps are not graded and are left with a combination of native soil and construction debris. Instead of directing the rainwater out of the neighboring gap, the rainwater percolates down to the soil. A key risk management consideration for ownership, especially if the neighboring building has below-grade space, is that the change in the condition along the property line created by the construction of the infill building could be attributed by the neighboring property owner to their leakage. It can be contentious and difficult to determine whether this leakage already existed but went unnoticed or whether this is new leakage due to increased weather exposure and accumulation.

Bulk-Water Diverter Flashing

Bulk-water diverter flashings trace the perimeter of the building-to-building separation to cover the gap. The flashing occurs both vertically and horizontally along the sides and tops of walls.

Figure 3 shows an example of a top-of-wall bulk-water diverter flashing. A flashing at the higher wall spanning across the gap and capping over the top of the lower wall has numerous advantages compared to the “do nothing” option. The bulk of the water flowing down the upper wall is either collected by a gutter above the flashing or directed by the flashing onto the lower roof instead of flowing down the wall and into the soil below. The exterior enclosure below the top-of-wall flashing is exposed to incidental water, but no direct weather or sunlight. The vertical flashing has a similar effect.

Table 1. Common shaftwall waterproofing and cladding ideas and pitfalls

Proposed Shaftwall Waterproofing Strategy	Pitfall(s)
Unroll sheet-applied membrane and hang cladding from the level above.	Insufficient anchorage: Waterproofing membrane and cladding are only attached at the top of each floor.
Pre-apply the weather-resistive barrier and cladding. Install sealant into the flanges of the shaftwall stud immediately prior to inserting the sheathing into the flange.	The installation method is solely reliant on smash seals with no means of tooling the sealant or field quality control. Traditional exterior-cladding installation is unachievable due to limited access.
Pre-apply the weather-resistive barrier and cladding. Install a strip of self-adhered waterproofing membrane centered at the shaftwall stud from the edge of the exterior sheathing prior to installing the next shaftwall stud (that is, reach over 16 or 24 in. [406 or 610 mm], depending on stud spacing, to add waterproofing membrane over the in-place shaftwall stud).	This method for installing the waterproofing membrane has been successfully implemented on a project, but the building code at the time was ambiguous for the requirement of exterior cladding. Traditional exterior-cladding installation is unachievable due to limited access.
Provide a 100% watertight flashing at the top-of-wall area to eliminate weather exposure. Leave the shaftwall without cladding and waterproofing.	See discussion below regarding the challenges of 100% watertight flashings. It is also important to note this approach is not future-proof; that is, if the neighboring building is ever demolished, the shaftwall will immediately become exterior exposed and susceptible to leakage.

Sheet-metal flashings are commonly used as bulk-water diverters. The sheet-metal gauge is sized to span the building separation and can be oversized to accommodate differential building movement based on the size of the separation.

Complications

A prerequisite for a top-of-wall flashing is an agreement between the neighboring owners allowing for a flashing that spans across the two properties. Without an agreement in place, a top-of-wall flashing is an encroachment.

The top-of-wall detailing is straightforward when the infill building is taller than the neighboring building. The infill building walls are designed to accommodate flashing attachment requirements. However, ASCE 7-22, Section 8.4 requires the new construction to contain a water collection system (such as a gutter) to prevent discharging its water onto the existing roof unless the existing roof is evaluated.

If the existing neighboring building is taller than the infill building, the flashing must be attached to the existing building, which can

become complex due to the current condition of the existing building's cladding. Non-veneer masonry walls such as concrete, concrete masonry unit (CMU), and brick cavity walls are suitable exterior cladding for attaching the new top-of-wall flashing directly to the surface (that is, "surface mount"). A surface-mounted flashing is the simplest solution to a top-of-wall flashing and should be utilized where possible. However, light-gauge metal- and wood-framed exterior-wall claddings, including veneer masonry, rainscreens such as metal, fiber cement, or terracotta panels are often not suitable for surface-mounted flashings because the cladding alone does not have the structural capacity to support the flashing, and the weather barrier behind the cladding should be weather lapped over the flashing. To ensure the flashing is properly attached to studs and to mitigate water leakage risk, the neighboring building's existing cladding must be locally removed to expose the underlying weather barrier (**Fig. 4**). Having access to studs ensures the flashing is solidly attached to a suitable substrate and allows the

installation of new waterproofing membrane to tie in with the existing weather-resistive barrier to direct water onto the top-of-wall flashing and out of the wall assembly.

Watertight Flashings

Watertight flashings can be pre-manufactured expansion-joint assemblies or enhanced sheet-metal wall flashings that shield 100% of weather exposure from the cladding below. The enhancements to make sheet-metal flashing watertight require either an underlayment below the flashing or additional flexible seals at the flashing's joinery.

If the flashing along the perimeter of the building separation is 100% watertight, the walls below are not weather exposed, so they can be designed and constructed like fire-rated interior walls, thus reducing the cost of the project. Just as previously discussed for bulk-water diverter flashing, the complexity and efforts required for watertight flashings are based on the existing conditions of the neighboring building.



FIGURE 5A

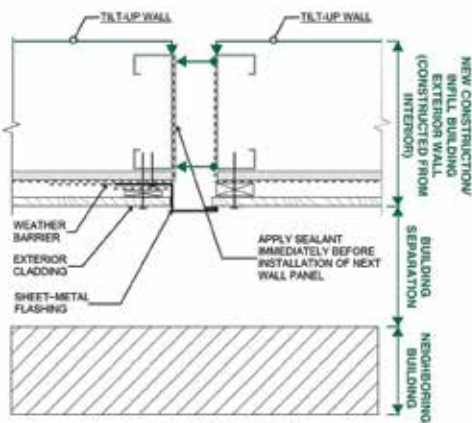


FIGURE 5B

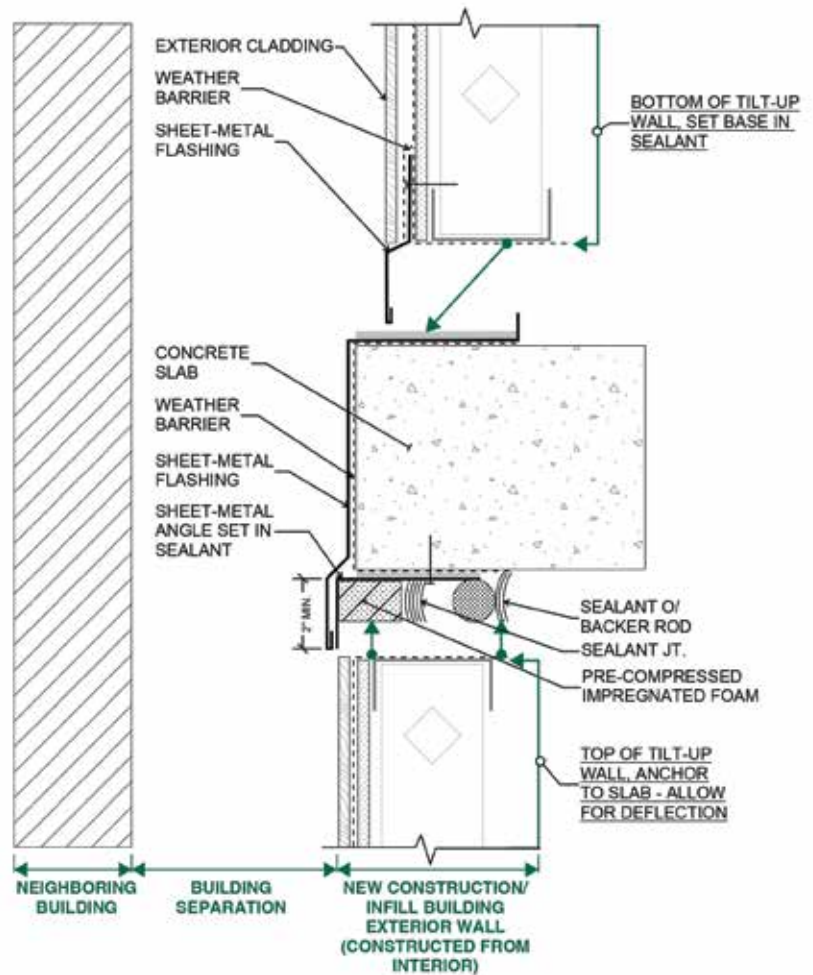


FIGURE 5C

Figure 5. A) Contractors lifting tilt-up panel into the property line wall opening. B) Plan section detail at tilt-up wall. C) Section detail at tilt-up wall.

Complications

An agreement between neighboring owners is also required to allow for potential modifications to the existing building to create a watertight flashing between buildings. Conditions that make a watertight flashing challenging include but are not limited to:

- Non-watertight neighboring wall: The discussion thus far has focused on the neighboring building wall being either exterior weather-exposed masonry or framed wall. However, the neighboring building wall could be a parking garage with openings or a rooftop terrace with a screen wall or planters. These are some examples of non-watertight neighboring conditions that make a watertight flashing impossible unless a portion of the neighboring wall is reconstructed.

- No parapets: If the neighboring building does not have a parapet, such as with a gravel stop detail, the top-of-wall flashing from the infill building will have to float above the existing roof membrane instead of capping over it. Water may be able to flow between the flashing and the roof and into the gap. Creating a watertight condition requires modification of the existing roofing membrane detailing.

The decision along the building separation to do nothing, add bulk-water diverter flashing, or add watertight flashing is complicated by legal terms, risk management, and existing condition of the neighboring building. To add to the complexity, the decision at the top-of-wall area also affects the exterior-wall assembly along the property line.

EXTERIOR WALLS

The Venetian row houses and New York City brownstones are masonry construction, allowing the installer to construct the masonry wall within the property line without exterior access. The lack of exterior access along the property line at contemporary framed walls creates constructability challenges, as these are typically constructed from the exterior.

A very simple solution to constructing an exterior wall along the property line is to do what the Venetians did hundreds of years ago and build it out of masonry. Masonry walls can be constructed from inside the property line, comply with code requirements for fire resistance, and are not required to have a weather-resistive exterior-wall enclosure when designed in accordance with code standards. This makes it the ideal wall type to construct

along a property line. Unfortunately, masonry walls weigh more than contemporary framed walls, and this additional weight impacts the structural gravity and lateral system designs. Reducing overall building weight optimizes the building's structural systems, and that can become the deciding factor for framed walls along the property line. The options of constructing a framed wall without exterior access include shaftwalls and pre-assembled walls.

Shaftwalls

Having access available to only one side of a framed wall is a common occurrence in elevator shafts, mechanical shafts, and air ducts. Numerous manufacturers have shaftwall assemblies that are intended to be constructed from one side and meet the code-required fire resistance. Framed walls along the property line are complicated due to being an exterior wall requiring a weather-resistive barrier and, depending on the governing code requirements, exterior-wall cladding. Both the weather-resistive barrier and the exterior-wall cladding must be installed from the interior, without exterior access. **Table 1** summarizes ideas often explored for waterproofing a shaftwall, along with the pitfalls.

A traditional shaftwall solves the challenge of constructing a wall with only one-sided access, but the need for a complete exterior wall with a weather-resistive barrier and exterior cladding requires alternative solutions.


Pre-assembled Wall

Precast concrete, unitized curtainwall, and panelized exterior insulation and finish systems (EIFS) are all examples of pre-assembled exterior-exposed walls. The concept of pre-assembled exterior walls can be adopted and modified for tilting a pre-assembled wall in place from the interior. These pre-assembled "tilt-up" walls are non-load-bearing walls that span between floor slabs (**Fig. 5**) and between load-bearing columns on either side. These pre-assembled tilt-up framed walls are not to be confused with typical tilt-up construction which are load-bearing exterior walls. Each tilt-up wall panel includes the framing, exterior sheathing, weather-resistive barrier, and exterior cladding. The size of each pre-assembled wall section is constrained by the installers' ability to manually lift and tilt the wall into place.

The detailing for pre-assembled framed walls at the top of slab, bottom of slab, and between panels requires special consideration for the one-sided construction from a fire resistance and waterproofing perspective.

The designer must recognize that the tilt-up panel-to-panel joints are unconventional with two studs back to back (**Fig. 5B**) and must obtain approval for the fire-resistant detail for the joinery from the authority having jurisdiction. In addition, the panel-to-panel joint requires a seal in the weather-resistive barrier that must not interfere with the fire resistance requirements. When exterior cladding is not required by the governing code, the installer can reach from the adjacent panel or from the floor above to seal the panel joint. When exterior cladding is required, the weather barrier seal will be a blind smash seal that relies on sheet-metal flashing at the slab above to shield the joint from exposure and deflect surface water. Figure 5 provides an example of a tilt-up wall assembly and the corresponding details that were approved and executed on a project that has been in service for several years with no reported issues.

CONCLUSIONS

For urban infill construction projects, designers and contractors must design and construct the exterior enclosure mere inches from neighboring buildings. Understanding the condition of the neighboring building is critical to the owner and designers of the infill building to evaluate the available options for a well performing exterior enclosure along the property line. 

REFERENCE

1. American Society of Civil Engineers (ASCE). 2022. *Minimum Design Loads for Buildings and Other Structures*, Standard ASCE/SEI 7-22. ASCE: Reston, VA.

ABOUT THE AUTHORS



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exterior-wall assemblies, roofing, and waterproofing. Li strives to create solutions with little to no compromise to finishes and aesthetics.

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