

# **Tilt-Up Building Construction Overview**

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## Safety Warning

Construction is a very dangerous occupation. Every step in this procedure should be taken with the utmost adherence to safety. Make sure every member of your crew is aware of the risks and is outfitted with appropriate attire: hard hat, safety goggles, steel-toed boots, safety vest, work pants, and a sleeved shirt. Panel tilting is especially dangerous since each panel weighs many tons and is transported by a crane in close proximity to the workers.

## Introduction

This manual will guide project overseers and lead carpenters through the key processes involved in constructing a tilt-up building. This document is not intended to explain every step involved in building commercial buildings, but offers guidance to key processes in building tilt-ups.

## Preparing the Project



### Check Blueprints, Create Panel Drawings, and Send Submittals

#### Blueprints

Make sure you are working with the most current set of plans. Read through plans and look for differences between structural and architectural drawings.<sup>i</sup> Pay careful attention to concrete, reinforcement, and welding specifications. Check imbed<sup>ii</sup> connections. Check also for possible problems with drawings, such as:

- Slab dowels coming out of the panels will make building stacker panels<sup>iii</sup> problematic.
- Panels may not fit onto step footings if dimensions are off.
- A casting bed slab<sup>iv</sup> or stacker panels may have to be built if there is not enough room on the slab to build panels.

### Submittals

Submit your referrals for information requests (RFI's), concrete mixes, and panel drawings to the general contractor for approval. Submit a set of panel and structural drawings to your tilt-up vendor. These documents are needed for panel erecting, engineering for brace point and pick point locations, and any added reinforcement needed to stand the panels.

Submit a set of panel drawings for rebar detailing to your rebar supplier. Order specialty items as soon as possible, such as:

- Imbed connections.
- Door frames.
- Reveal strip.<sup>v</sup>

### Panel Drawings

Draw panels to scale on eight-by-eleven inch pieces of paper. Spread them over the slab on the drawings to determine how they fit. Create a panel pick layout that allows space for tilt braces.<sup>vi</sup> If possible, avoid moving or pinching panels. This task becomes more difficult with smaller slabs. Use structural drawings for panel-to-panel, panel-to-slab, and panel-to-footing connections. Structural drawings should have panel dimensions, but confirm door and window locations with architectural drawings. Confirm all reveal strip sizes and locations with the general contractor or architect. The general contractor should supply all locations for:

- Roof imbeds.
- Mezzanines.
- Mechanical openings.
- Down spout openings.

### Evaluate Jobsite Before Construction

Complete a site evaluation before starting the project. Questions to ask in evaluation:

- Is the site level for crane access?

- Are power lines in the way?
- Are buildings nearby?
- How heavy is traffic during work hours?
- Are there any extra hazards on the job?

## Building the Structure



*The image on the left shows a crew of workers pouring a concrete slab. The person at the top of the picture is controlling the pump, which releases the concrete. Other workers spread the concrete around with mud rakes and level it out with grading rods. The workers at the right of the picture smooth out the cement, preparing it for a hard trowel finish.*

## Build and Pour Footings

Build footings level to avoid using extra shim packs.<sup>vii</sup> Lay panels out on the footings for imbed locations and footing steps.<sup>viii</sup> Build footing steps one to one and a half inches back from where the panel will sit.

## Build and Pour Slab

The slab should be poured flat with a hard trowel finish. In order to utilize the entire slab for panel building, block out all column footings and utilities two inches below the slab. Seal slab with a tilt-and-seal material. Check specifications to see if there is a certain bond breaker or sealer that must be used with your specific slab.

## Build and Pour Panels

Start building your panels:

- Prefabricate doors, windows and headers that are needed for building panels.
- Use your panel layout to chalk out the panels.
- Chalk out the reveal layout.
- Lay out the panel picks and brace points.
- Spray three coats of bond breaker inside each panel before you build. Make sure the surface is clean and dry.

- Install rebar and imbeds. Check engineering book for added rebar.
- Clean out the panels.

Double check panel dimensions, imbed locations, and reveal layout with the general contractor. Have them sign off on the panels. Schedule a rebar inspection at least one day before you pour panels. Be sure to have approved plans for inspection.

Schedule inspection, concrete, and pump truck for day of the pour. Be sure to have an approved concrete mix for inspection. Vibrate panels while pouring. Have someone on pour watch checking imbeds, pick points, and brace points. Hard trowel stacker panels.

## Tilting the Building



*The image on the left shows a tilt-up panel being hoisted off the ground by a crane. Many workers coordinate in moving this multi-ton concrete wall into its proper place. The long metal braces attached to the panels temporarily hold the walls in place until a welder fastens the weld plates together and the roof structure is completed.*

## Preparing to Tilt

Strip and clean panels. Expose imbeds, pick points, and brace points. Spread and install braces. Tilt book explains how far braces need to be extended. Three feet below the panel is typical. Number the panel layout on the footing. Lay out your panel spacing. Level panels by shooting in shim packs one to two feet in from panel edges. With heavy panels, plan to set a shim pack in the center. Tape and number shim packs to keep them in order.

## Tilting the Building

Expected equipment list for tilting:

- Ladders.
- Double jack sledge hammers.

- Roto-hammers.
- Impact wrench.
- Bolts and anchors.
- Burke bars.<sup>ix</sup>
- Large levels.
- Extra shims.
- Drill bits.
- Torque wrench.
- Braces.
- Forklift.
- JLG.
- Crane.

Conduct a safety meeting with the crew. Delegate tasks to each member of the crew:

- One person at each corner of panel. Additional people are needed with larger panels.
- One person at each brace. Instruct worker to carry the brace on hip and not on stomach.
- Two people drilling and setting bolts.
- One person moving equipment to the next panel.
- When the panel is ready to be released, one person will instruct the crane operator to lower the clutches.<sup>x</sup>
- Four people are needed to release the clutches. These are usually the workers on panels and braces.
- Two to four additional workers will be needed with stacker panels. Their tasks will be stripping and cleaning panels, as well as installing braces.
- One person is needed to operate a forklift and JLG. Make sure this person is wearing a body harness.
- The oiler typically signals the crane operator. However, the person in charge of releasing panels should also know how to signal the crane.
- Everyone helps move the crane.

Adhere to the following procedure when tilting each panel:

1. Set up crane. Put outrigger pads on a hard surface so they don't sink under weight of the crane.
2. Under supervision of the oiler, attach crane hooks to appropriate pick points on each panel.
3. As the panel begins to lift, use burke bars to make sure it doesn't slide.
4. As the panel lifts, pick up braces to keep them from sliding on the slab.
5. As the panel is high enough into the air, gently release braces and get out of the way.



6. As the panel is set into position, use burke bars to ensure it sits appropriately on the shims.
7. Lift braces as the panel is lowered.
8. Use level to align panels as close to square as possible. It doesn't have to be exact.
9. Once level, set down the braces and make a chalk mark.
10. Move the braces and drill holes with a roto-hammer on the mark.
11. Insert bolts and anchors and slide braces back into place.
12. Use sledge hammer to pound bolts into the slab.
13. Use impact wrench to fasten bolts.
14. Use torque wrench to tighten bolts until they click.
15. Use ladders and lifts to unhook crane.
16. Follow this procedure on every panel.

### Plumbing and Welding Panels

Use a theodolite<sup>xi</sup> to line panels. Make sure your welder is certified with the municipality where your job is located. Check plans for welding specifications and get a welding inspection. Ensure walls stay lined during the welding process.

### Pouring the Grout

Make sure inspector is onsite for grout pour. Use the approved grout mix to fill void under the panels. Most of the time you can pour grout out of a concrete truck. But with a large building you will need a grout pump.

### Finishing the Project



*The image on the left shows an erected tilt-up building from the outside. The patterns on the walls are the result of stylistic reveal strip. After painting and door installation, this large building will be nearly finished.*

## Sack, Caulk, and Pour the Closure

Sack<sup>xii</sup> panels and slab in preparation for paint. Caulk panel seams to waterproof the building. Use fireproof caulking to fireproof building if needed. Pour closure at the step footings.

## Inspect and Clean Job

Walk the job with the General Contractor. Clean up and move out when the general is happy with the job.

## References

- ARH and Associates subject matter expert.
- <https://www.google.com/search?q=reveal+strips+for+concrete&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiXpoL2-43aAhVJ3GMKHbvmBqQQsAQIUg&biw=1082&bih=981#imgrc=RxssSatxNj1uM>:
- <https://www.google.com/search?q=what+is+a+theodolite&oq=what+is+a+t+heodolite&aqs=chrome..69i57j0l5.6486j0j4&sourceid=chrome&ie=UTF-8>

## Style Sheet

- 3/28/2018
- Title of Document: How To Build A Tilt-Up Building
- Style manual used: Microsoft Writing Style Guide. Accessed 3/28/2018
- Dictionary used: Webster's New World Dictionary, 4th Edition
- Serial or Oxford comma is used.
- Numbers are spelled out until number 9. After that, numerals are used.
- Keywords in headings, subheadings, and special use terms are capitalized.
- Hyphens (-) are used to connect two or more words (and numbers) into a single concept.
- Dashes can be used to indicate an interruption, particularly in transcribed speech.
- Acronyms should be spelled out in the first usage. After that, capitalization of the first letter in each word is acceptable. Example: Central Intelligence Agency; CIA.
- Abbreviations should be spelled out without periods. Example: PhD is acceptable. P.h.D. is not acceptable.
- Each keyword in a heading and subheading should be capitalized.

## Notes

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<sup>i</sup> The structural drawings are usually prepared by a professional engineer and are informed by the architectural drawings.

<sup>ii</sup> Imbeds are weld plates that are fused together to connect a building.

<sup>iii</sup> Stacker panels are concrete walls that are built on top of each other in order to save time and space in a project.

<sup>iv</sup> A casting bed slab is a temporary slab built for the sole use of building panels on.

<sup>v</sup>

[https://www.google.com/search?q=reveal+strips+for+concrete&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiXpoL2-](https://www.google.com/search?q=reveal+strips+for+concrete&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiXpoL2-43aAhVJ3GMKHbvmBqQQsAQIUg&biw=1082&bih=981#imgrc=RxssSatxNj1uM:)

[43aAhVJ3GMKHbvmBqQQsAQIUg&biw=1082&bih=981#imgrc=RxssSatxNj1uM:](https://www.google.com/search?q=reveal+strips+for+concrete&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiXpoL2-43aAhVJ3GMKHbvmBqQQsAQIUg&biw=1082&bih=981#imgrc=RxssSatxNj1uM:)

Reveal strip is the pre-fabricated lines and grooves in a concrete wall. This is primarily for aesthetics. The above link shows an example.

<sup>vi</sup> Tilt braces are large metal braces that temporarily hold a concrete wall erect. There are typically two or more braces inserted into each panel.

<sup>vii</sup> Shims are small pieces of hard plastic that are used to square a tilt-up wall. They come in various sizes.

<sup>viii</sup> Footing steps are concrete footings of different heights.

<sup>ix</sup> A burke bar is a large, steel, heavy duty hand tool that is used for a variety of uses in construction, including maneuvering concrete panels that are connected to a crane.

<sup>x</sup> Clutches fasten the panels to the crane. When the clutch is lowered, it disconnects the crane from the panel.

<sup>xi</sup>

<https://www.google.com/search?q=what+is+a+theodolite&oq=what+is+a+theodolite&aqs=chrome..69i57j0l5.6486j0j4&sourceid=chrome&ie=UTF-8> A theodolite is a surveying instrument that precisely measures angles in horizontal and vertical planes.

<sup>xii</sup> "Sacking" a panel or slab refers to filling air pockets and gouges in concrete with a quick setting concrete compound. The end result should be a smooth finish.