

### CONCRETE FLOOR SLAB & CASTING BED CONSTRUCTION



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### Quality Construction Begins at Ground Level

“Everything is built from the ground up”. Nowhere is this simple adage more accurate than in tilt-up construction. The very essence of tilt-up construction is contained in the procedure by which wall panels are cast on the floor before the building is raised. Because a tilt-up structure’s floor must also serve as a casting surface, it must be constructed with great care. Any fault in the floor surface will be literally “reflected” on the wall panels.

### The Subgrade

The fabrication of an excellent floor slab and casting surface starts with the subgrade. The subgrade must provide non-sagging support for the concrete slab. Because the floor slab must bear the weight of the heavy panels and the mobile crane, it is important that it be well supported at all points by a thoroughly compacted subgrade.

### Slab Strength & Thickness

The compressive and flexural loading of trucks and mobile cranes requires that the floor be of adequate strength and thickness. Another consideration is that in order to safely resist the downward and upward vertical and lateral brace loads, the floor should be designed with sufficient strength and weight to resist the applied brace loads with a safety factor of at least 1.5. The type and location of floor slab joints, slab thickness, reinforcing and leave out strips should be considered when determining if the floor slab is an adequate anchorage for the brace loads.

A floor slab with a minimum concrete compressive strength of 2,500 psi and a minimum thickness of 5” or 6” is normally required in order to develop the strength of the floor brace anchors. Several other parameters also must be considered which may require a thicker and stronger floor.

### Isolation Joints

Even with uniformly compacted soil beneath a concrete floor slab, floor settlement is likely to differ from that of the abutting wall and column foundations. To accommodate such differential settlement, it is necessary to isolate the floor slab from the walls and columns that have separate foundations. These isolation joints must permit both horizontal and vertical movement. Isolation joints around columns should be circular or diamond shaped so that corners meet the control joints.

Once the building pad is completed, the contractor begins slab forming which can be done several ways:

**Edge Forms** - Consist of “two-by” lumber of the slab thickness used around the perimeter and held in place with wood or steel stakes.

**Control Joints** - To accommodate concrete shrinkage, control joints should be provided to divide a large floor area into relatively small rectangular (preferably square) areas. In this way they create straight-line planes of weakness that open as the concrete shrinks and effectively prevent cracking. Control joints can be sealed and maintained more easily than random cracks.

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### Slab Construction Methods, Reinforcing and Finishes

**Interlocking Slab Sections** - Many Contractors use a metal keyed cold joint form to divide the slab into separate, interlocking sections. A keyed cold joint product greatly speeds up the fabrication of floor slabs and once installed helps maintain a crack free floor surface for years to come. It also compensates for subsoil compacting or movement and provides stable load transfer during industrial use. Assemblies for steel dowels may be used instead of a metal keyway.

**Formed Slab Sections** - Range in width from typically 15 to 25 feet. To avoid more expensive pumping, alternate lanes are poured from the concrete truck which travels next to the slab.

**Strip Pouring** - This creates “longitudinal joints” between long sections of concrete. To control shrinkage in long concrete sections, a transverse (perpendicular to longitudinal) joint is created by one of three methods:

- a) Placing “zip strip” to 1/4” the depth of the slab.
- b) Saw cutting
- c) Running a deep “V” groove across the slab “zip strip”, a thin strip of plastic inserted in fresh concrete usually just behind the screed, is the fastest, surest method of transverse crack control.

**Finish** - Care must be taken to produce the flattest and smoothest crackfree floor possible as tilt-up panels poured on the floor will mirror imperfections.

**Welded Dowel Assembly Reinforcement** - This is growing rapidly as an alternative method of slab reinforcement. Dowel assemblies greatly reduce cracking in surfaces by reducing corner load stresses. They also effectively distribute loads across the joints.

### Brace Inserts:

Cast-in-place Slab Brace Inserts - If used, must be placed prior to pouring the slab. Some contractors drive rebar into the subgrade next to the insert and tie it with wire to avoid tipping during the pour. An alternate to the use of slab brace inserts are Super bolts, MB Brace Bolts and the Slam Anchor. All are for securing the brace shoe to the slab after erecting the panel.

# Tilt-Up Manual

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### TILT-UP PANEL CONSTRUCTION



## PANEL ERECTION INFORMATION

As a general practice, architects and engineers who design tilt-up buildings do not supply panel erection information. Erection drawings are normally required by the contractor. When a job is to be engineered, a complete set of architectural and structural plans are needed. It is important to remember that complete information is essential for Engineering to function smoothly.

### Engineering for Panel Erection

In addition to tilt-up hardware, Meadow Burke Engineering services are an important part of the complete tilt-up package. The location of lifting inserts in a panel is critical for safe, quick erection. Meadow Burke Engineering produces erection drawings of panels illustrating their shape and the locations of openings such as doors and windows. Engineering calculations determine the center of gravity, panel weight, and stresses produced as the panel is lifted. Insert placement is calculated to minimize lifting stresses and ensure that the panel will hang plumb. The drawings will show temporary strongbacks bolted to the panel surface if required or where additional reinforcing steel is needed to increase strength where lifting stresses are excessive. The recommended method of rigging crane lines is detailed to ensure equal insert loading for fast, safe panel lifts. A panel layout sheet identifies each panel as it appears in the final design, if not supplied by the original plans. Brace design charts show allowable spacing and proper layout. The brace inserts are shown on panel details.

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**Crane Considerations** - Laying out panels requires careful planning by the contractor and crane company. One approach is to cut paper scale models of the panels and crane and arrange them on a scale version of the slab area. The layout is adjusted so that the crane can reach and set panels safely and still have room to operate. In general, crane capacity should be two to three times the weight of the heaviest panel. Another factor is the crane's reach. The further the reach the less weight it can handle. The crane company should be included in panel layout planning to ensure fast, safe building erection.

### Panel Casting Considerations

**Panel Size** - The weight of a panel is limited by the crane capacity, panel height by the available bracing, and panel width by the available rigging spreader bars.

**Panel Layout** - Panels are normally cast as close to their final position as possible. Adequate floor space must remain to allow reasonable freedom of movement for the crane and ease of access for the concrete truck or other placement equipment.

Special attention should be paid to the casting and placing of corner panels and the last panel. The last panel is often erected from outside the structure, unless the crane is to become a permanent part of the building. In some cases, stack casting or erection from outside the building will be the only answer to floor space restrictions.

## PANEL CASTING CONSIDERATIONS

**Stack Casting** - The slab area of the building is often not large enough to permit all the panels to be poured on its surface. In these instances, it is necessary to stack the panels using the top side of one panel as the casting surface for the panel poured above. Stack casting is also used on jobs where the panels are poured outside of the perimeter of the floor slab. This is common where structural steel columns must be set prior to panel erection making it impossible for the crane to work on the floor slab. Temporary casting beds are poured outside the building. Stacking panels keeps the casting area to a minimum.

Edge forms for stacked panels require special attention. It is more difficult to form panels as they stack higher. When there are only two or three panels in a stack, plywood is often used to build the full height of the edge form. A pour strip or line is used to establish the proper thickness for each panel.

**Brace Point Location** - Correct panel layout should ensure that as panels are erected the floor slab inserts are uncovered as needed. A down panel must not cover a brace point needed for a panel being erected. Any temporary solution to this problem is usually unsafe.

**Forming Panels** - After the floor slab is poured, the contractor begins building panel forms. The usual method is to snap chalk lines to determine the panel, layout and size. Forms are built using 2x lumber of the proper width for panel thickness and either wood braces or triangular metal brackets for support. Forms are placed and secured to the casting slab by one of the following methods:

1. Bolts can be drilled into the floor for anchorage.
2. Nails can be driven into the floor with power-actuated tools.
3. Edge forms on wood plates can be glued to the floor surface.
4. Edge forms can be braced against each other.
5. Glue down bracket systems.

**Panel Casting Methods** - There are numerous considerations that can affect the decision of casting a panel face up or face down. Generally, panels are cast with the inside face up. A few helpful considerations:

**Braces** - If bracing is to the inside, cast the inside face up so the braces can be installed before lifting the panel in order to lift the braces with the panel. If bracing is to the outside, consider casting the outside face up. Deadman brace anchors or MB Brace Badgers may be necessary.

**Architectural Appearance** - For better architectural appearance, cast with the inside face up so that the lift and brace insert patches will not be visible from the outside.

**Finishes** - If form liners are to be used on the outside, cast the inside face up to permit better flow into the liner.

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## PANEL CASTING CONSIDERATION

**Exposed Aggregate** - Exposed aggregate is usually cast down by using a sand bed or a retarder but it can be cast face up depending on the size and the technique to be used. Note: The use of Super-Lift Inserts will not allow more than a 1/2" diameter exposed aggregate on the surface cast up. Larger aggregate on the top surface prevents the Super-Lift Clutch from bearing properly on the concrete.

**Reveals** - When reveals are required on the outside face, cast the panels with the inside face up so that the reveals can be lightly fastened to the floor to hold them during casting.

**Offsets** - If beams, columns or haunches are to be cast monolithic with the panel, cast them up to reduce forming cost and to provide a uniform rotational surface at the panel base.

**Cranes** - If the crane is to be positioned on the floor, the panels are usually cast with the inside face up and the base of the panels toward the crane. If the crane is to be positioned outside the building, the panels can be cast outside face up with the base of the panels toward the crane. It is possible to cast with the opposite position from the above description. In those cases the panel is usually cast with the top of the panel toward the crane so that the lift inserts cannot be seen by the crane operator during lifting.

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**Ledgers** - If the ledgers are to be placed prior to erection, cast them face up and "wet-set" the bolts or studs during the concrete placing operation. This saves the labor of trying to lift the ledgers up the wall.

**Miters** - If the outside corners are to be mitered, cast the inside face up. If the inside corners are to be mitered, cast the outside face up. Failure to cast the correct face will require sliding the panel along the wall into the mitered corner. This may require transferring from face to edge lift inserts during erection.

**Building Frame** - If there is to be a steel or concrete frame in place at the time of lifting the panels, lifting rigging on the inside face may interfere with the frame. It may be necessary to lift with the outside face up or to lift with the inside face up and transfer to edge lift inserts during erection.

**Curved** - Curved panels are normally cast with the concave side up to increase the area of panel base in contact with the floor during rotation. However small, radius panels may be cast concave downward to have the two ends down for contact with the floor during rotation.

### PANEL CASTING CONSIDERATIONS

**Panel Detailing and Texturing: Wood Chamfer** - After the perimeter forms are in place and door, window, and other openings are in place, the panel is ready for the next step. Normally 3/4" wood chamfer is placed along the vertical edges of the panel and at top and bottom for a clean edge finish. Chamfer helps prevent leakage of concrete paste which results in a rough edge. Wood chamfer is also used to form designs on panels and to create a clean line for color changes if the building is to be painted or stained. Wood chamfer is used around form liners to create a smooth transition from one texture to another. Chamfer and reveal strips are normally glued to the concrete slab with a high strength, waterproof spray adhesive and are nailed to edge forms with finish nails.

**Surface Treatments** - Basic concrete finishes are steel trowel and broom finish. Several methods to create a more architectural finish are available from Meadow Burke Distributors such as form liner products and retarder for exposed aggregate, to mention a few.

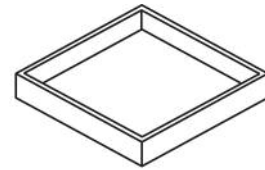
**Panel Reinforcement** - After panels are formed and bond breaker and other panel treatments are applied, rebar and inserts are placed. Typical building codes require that rebar occupy .0015 to .0025 of the overall area of the concrete in cross section. The placement of #4 rebar on 12" centers for an average 6" panel is common.

To insure proper strength, accurate placement of reinforcing is essential. Meadow Burke is a leader in manufacturing bar supports to facilitate the proper placement of reinforcement. Meadow Burke engineering drawings may call for necessary reinforcement around windows and door openings.

Inserts should be wired securely to rebar and the rebar fully supported around inserts. Location of the inserts in the panel should correspond exactly to their position on the engineering drawings. If for some reason they cannot be placed in their exact location, contact your Meadow Burke Distributor or the Engineering Department.

## Typical Panel Sequence

**Form**



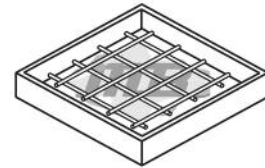
**Texture**



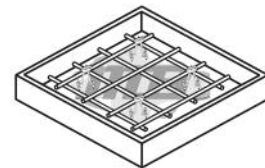
**Bond Breaker**



**Rebar**



**Inserts**



**Pour**

