BEDROCK
concrete construction specialists

"Tilt-Up Construction"

- David Kitching.

"Have you ever driven past a construction site and seen massive cranes lifting huge panels of concrete in the air? Have you watched with amazement as a new commercial building seems to spring into place, almost overnight?"

What you have witnessed is tilt-up construction, an innovative method for building office buildings, retail centres, warehouses, distribution centres, call centres, manufacturing facilities and other commercial and industrial structures with amazing speed, safety, and cost benefits.

Tilt-up concrete columns being erected.

SO WHAT IS THE DIFFERENCE BETWEEN TILT-UP AND OTHER TYPES OF CONSTRUCTION?

In traditional forms of wall construction, the walls can be built with blocks or blocks faced with brick. For some types of buildings, the exterior wall is made up of structural steel columns with heavy gauge metal studs covered with sheeting. Regardless of which traditional approach is used, building the exterior walls is a time-consuming, multi-stepped process. A tilt-up building's walls are cast **horizontally in large slabs** of concrete called panels. The panels are then

lifted, or **tilted up**, into position around the building's perimeter. This means the tilt-up structure's exterior wall is virtually finished when it is tilted into place.

Tilt-up construction (also called tiltwall or tilt-wall construction) has a long history, but its widespread use is a relatively new phenomenon in South Africa. In spite of this, tiltwall construction is fast becoming the method of choice for constructing **modern warehouses, call centres, distribution centres, retail stores, office and storage buildings and other types of industrial and commercial facilities**.

TILT-UP CONSTRUCTION: AN OLD IDEA WITH NEW INNOVATIONS

Large complex multi-storey panels positioned and braced.

The basic principle behind tilt-up construction - **constructing walls horizontally**, on the ground, and then lifting them into place - is not a new idea. Evidence exists that some buildings constructed during the Roman Empire and the Middle Ages used this approach. More recently, American settlers in the 1800s gathered for "barn raisings" where they constructed the wooden walls for their buildings and tipped them up into place.

The 20th century marked the true beginnings of modern tiltwall construction. The development of **reinforced concrete** in the early 1900s allowed builders to create tilt-up commercial structures as we think of them today: One- to three-story structures built with walls comparable in thickness to those created with other methods of construction.

Even with this innovation, tilt-up construction did not gain wide acceptance until after World War II, when the **mobile crane** was first developed. The mobile crane allowed builders far greater ability to lift the massive panels into place, regardless of where the job site happened to be. At about this time, **ready-mix concrete** was introduced to the industry, making tilt-up an even more viable alternative.

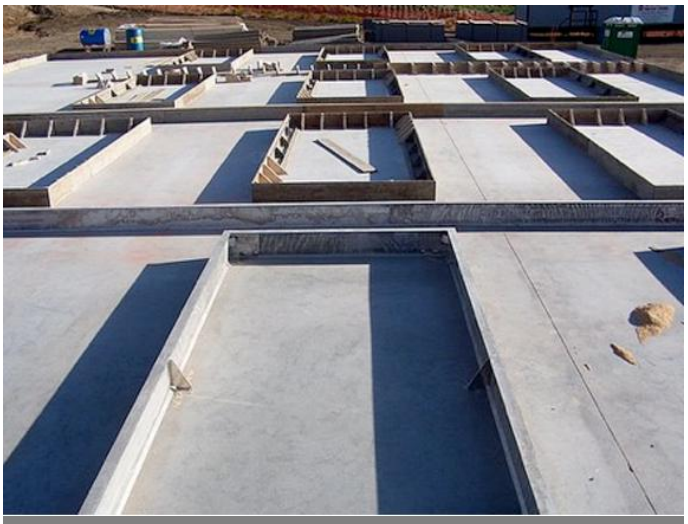
These new technologies occurred at precisely the right time. The late 1940s brought about a post-war boom in the construction of manufacturing and industrial facilities across the United States. Innovation, timing, and the need for large, warehouse-styled buildings opened the door for tilt-up construction. These three factors combined to encourage general contractors to embrace tilt-up as an economical means of delivering quality projects that meet even the most demanding specifications and schedules.

Over the years, industry experts have continued to refine and enhance the tiltwall process, allowing general contractors and design-build construction managers to drive greater capabilities and creativity in its use. In 1986 the Tilt-up Concrete Association (TCA) was created in the USA to establish processes

and standards to ensure continued growth in quality and acceptance for this method of construction.

Tiltwall has since been used in buildings as large as **160,000 square meters**, with individual panels reaching as high as **28 meters** and **weighing 150 tons**. The TCA reports that 15% of all industrial buildings in the U.S. were created using tilt-up construction. It is growing at an annual rate of almost 20% and is used in over 6.1 Million square meters of new building construction each year. In Texas and other sunbelt US states, tilt-up accounts for as much as 75% of new one-story commercial building construction. Builders in Mexico, Canada, Australia and **South Africa** are also using tiltwall construction on an increasingly frequent basis.

WHAT IS TILT-UP CONSTRUCTION? HOW ARE TILTWALL BUILDINGS CONSTRUCTED?



The tilt-up panels are poured into formwork that provides the exact size, shape and openings to meet the design specifications. The largest panel used for a tilt-up construction project weighed over 70T.

The design of a tilt-up building incorporates the detailing of the columns and/or the wall panel elements to provide all the functional and architectural features of the building. Typically this would be door and window openings, special cut-outs and shapes and architectural texturing and mouldings.

Temporary ground slabs are cast with a high quality surface finish onto which the building components are cast. Specialised formwork is produced to precise dimensions as demanded by the detailed design. Purpose-designed lifting inserts and stay anchors are positioned and cast into the elements.
The several casting beds required for the project are strategically positioned to align with the overall project plan and to enable efficient use of the crane.

The panel casting sequence forms an integral part of the project schedule and the tilt-up production plan ensures a continuous erection process. With good access and planning, as many as 30 panels a day can be erected thus giving early release of the building to the subsequent trades. This efficiency of construction translates into significant cost and time savings on a project.

The cured elements are lifted or “tilted up” by cranes onto pre-prepared foundations or floor slabs and fixed to structural columns or stayed with temporary, tubular, adjustable braces to concrete ground anchors or to the floor slab. Foundation-mounted panels have starter rebars that are tied in with the foundation reinforcing extensions and the panels are then cast in. This method would apply to pre-cast columns also. There are several variations to this process. After erection, any imperfections are rectified and braces removed after the foundation tie-in concrete has cured. Joints are caulked and finishes applied if required.

PRECAST CONCRETE, TILT-UP CONSTRUCTION AND TILTWALL: WHAT IS THE DIFFERENCE IN THESE TERMS?

Several terms - **tilt-up panel construction**, **tiltwall construction**, **precast concrete building** construction, and **site-cast construction** - are used to reference new or non-traditional concrete building processes. Do they all mean the same thing? If not, what are the differences?

As previously stated in this article, tilt-up and tiltwall are two terms used to describe the same process. For a tilt-up concrete building, the walls are created by assembling formworks and pouring large concrete panels directly at the job site. The panels are then tilted up into position on prepared foundations or the building floor slab. Because the concrete tiltwall formwork is assembled and poured directly at the job site, no transportation of panels is required. One major benefit of this is that the size of the panels is limited only by the needs of the building and the strength of the concrete panels themselves.

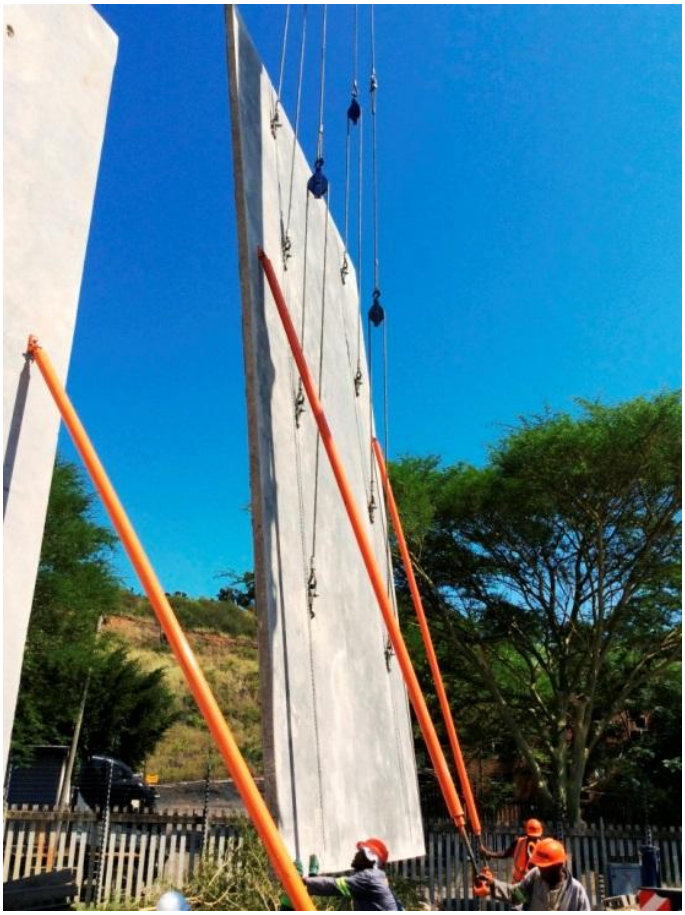
Tiltwall panels can sometimes be **extremely wide and/or tall**. Tilt-up panels have been measured at just over 20 meters across and almost 28 meters from top to bottom. Thus, architects and tilt-up concrete contractors have a great deal of flexibility in planning and creating their buildings.

The precast concrete building process is similar to tilt-up construction, but it addresses the challenges presented by weather. For precast concrete buildings, work crews do not set up formwork at the job site to create the panels. Instead, workers pre cast concrete panels at a large manufacturing facility. Because the precast concrete panels are poured indoors, this activity can take place regardless the weather conditions. After curing, the precast concrete panels are trucked to the job site. From this point, precast concrete buildings are assembled in much the same manner as tiltwall buildings.

The fact that precast concrete walls are formed at a manufacturing facility resolves the weather issue, but presents a different limitation not found in tilt-up construction. Because the panels must be transported - sometimes over long distances - places a substantial limitation on how wide or tall each panel can be. For a precast construction project, the panels must be smaller and more manageable to allow trucks to haul them over the road to their final destination. This places greater design restrictions on architects and limits the applications where precast construction can be used.

Clearly, tilt-up or tiltwall construction and precast concrete are similar processes. Because tilt-up affords more **flexibility**, it is the method of choice in locations where the weather allows it. Precast concrete is a suitable choice in circumstances where environmental factors and the construction schedule preclude tiltwall as a viable option.

16m tall tilt-up concrete columns for a cold storage warehouse, Johannesburg.



The panel is lifted and tilted into position over the footing by mobile crane. Workers guide the panel and keep the braces from getting tangled in the lines. The process for putting up tilt-up panels goes quickly; an experienced crew, like this Bedrock work crew in Durban can tilt up as many as 30 panels a day.

WHY CHOOSE TILT-UP CONSTRUCTION?

Tilt-up construction provides **numerous advantages** over steel buildings or traditional construction for warehouses, call centres, distribution centres, retail stores, office buildings, storage facilities and other types of industrial and commercial projects.

Generally speaking, a one- to three-story structure larger than **4,500 square meters** with less than 50% wall opening space is an excellent candidate for tiltwall construction.

A selection of prestigious South African companies that choose tilt-up construction.

But what are the advantages?

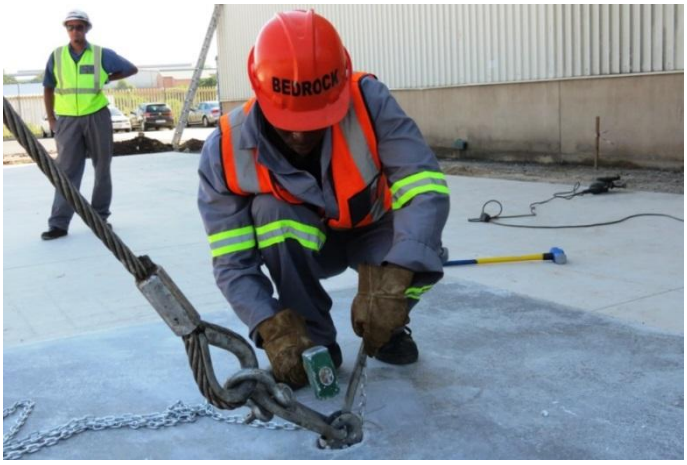
- **Savings in Construction Costs** – Tilt-up provides numerous construction cost savings. This method of construction uses locally available materials rather than ones that must be manufactured and shipped in. This means that raw **material costs are lower**, available when needed and less prone to price fluctuations. Tilt-up work crews are typically smaller than the crews used in traditional construction and are normally comprised of local labour. That translates to **reduced labour costs**. Because of the economies of scale, the larger the footprint for the building, the more cost effective the project.

- **Fast Construction Schedule** – Tilt-up offers several opportunities to **"compress" the schedule** and deliver the building very quickly. Erecting the walls with tilt-up panels is **faster** than building walls using traditional construction techniques. The trades can begin work earlier in

the process on a tilt-up project, which allows greater overlapping of project phases. Because the building is made of ready-mix concrete from local sources, the project is less likely to be affected by transportation delays as well. All these factors provide for a **faster, more predictable schedule** with fewer opportunities for delays and associated cost overruns.

- **Safety** - Tilt-up is a proven, **safe method** of construction. The vast majority of the project takes place **on the ground** rather than on scaffolding or at height, reducing many of the risks normally faced by workers.

- **Aesthetics** - Tiltwall buildings are not prefabricated. Each one is custom-designed for the client's needs and preferences. A full range of building finishes, wall textures and adornments, colors, even curved walls, are available with this method. Tilt-up provides architects and designers with **virtually unlimited flexibility** in crafting a building that is functional, durable and aesthetically pleasing.



Once the panel is ready to be lifted the crew attaches the quick-release clutches to the lifting inserts.

The benefits of a project built with tiltwall construction continue long after it is completed:

- **Durability** - Tilt-up buildings are extremely durable. Many structures created in the 1940s are still in operation today, with little apparent wear. A testament to the **strength of tilt-up construction**, general contractors in earthquake-prone California now use this method for 90% of their one-story industrial building projects.

- **Fire Safety** - The concrete used in tilt-up panels meets the fire-resistance standards of even the most demanding building codes. For example, a 165mm concrete wall offers a **fire resistance rating** of four hours or more. Tilt-up panels are also frequently used in the building's interior as fire walls. Tiltwall buildings offer real protection and safety for their tenants' employees, property and ongoing operations.

- **Ease of Maintenance** - Tiltwall buildings require little in the way of ongoing maintenance, outside of periodic cleaning and repainting as desired. Concrete is impervious to insect or rodent infestation, so this problem becomes a relative non-issue as well.

- **Repairs and Expandability** - In the event a wall is damaged by, say, a forklift or truck, damages are typically more localized on a panel than in other types of structures, like steel buildings. Also, the modular design of the panels allows for **easier repairs and expansion** of the building.

- **Security** - Facilities that require positive security and management of the interior environment - prisons, classified manufacturing facilities, businesses with clean rooms - will appreciate the **strength and control** afforded by concrete and tilt-up buildings, when compared with, say, steel framed and sheeted buildings.

- **Reduced Insurance Premiums** - Because tiltwall buildings have superior fire resistance ratings and have been proven to withstand severe weather and earthquakes, these buildings typically enjoy **better insurance rates** than steel buildings or other types of structures.

- **Reduced Operating Costs** - Concrete provides excellent **insulation**, reducing the ongoing heating and cooling costs for the tenant. This insulation extends to **sound** as well as temperature. Workers in a tiltwall office building located in a noisy area will be less affected by the environment. By the same token, a manufacturing business that generates noise will have less effect on its neighbours and will find it easier to **comply** with local noise ordinances.

With a better understanding of these benefits, it's easy to see why many design-build contractors, construction managers and savvy developers and building owners are opting for tilt-up over steel buildings or traditional construction. Delivering value, speed and responsiveness, quality, durability, reduced construction costs, and ongoing cost savings in operating expenses, tiltwall construction is the best choice for a wide range of commercial construction projects.

Site-cast is the ideal solution for large concrete columns. Time and cost savings and safety are just some of the advantages over conventional building.

TILTUP CONSTRUCTION AND BEDROCK GROUP

Tilt-up construction is the core business of the Bedrock Group and fits our philosophy of delivering quality buildings, on time and within budget.

The company is taking tilt-up construction to the next level in Africa and leading the development of related technology in the region.

Bedrock Group is committed to the continued growth in quality, safety, standardisation and acceptance of tilt-up construction. As architects and builders become more informed on tilt-up construction, Bedrock believes that this construction method will become the method of choice for “big box” buildings in South Africa.

Bedrock Group will advise you if tilt-up is right for your project, and manage the process from design to completion with your specific needs, schedule and budget in mind.

Contact us to learn more about tilt-up construction or to discuss how Bedrock Group can help on your upcoming project.

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