Pre – Fabricated Concrete Elements

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Emirates Filigran LLC is a leading manufacturer of pre fabricated concrete elements located in Ras Al Khaimah, which is well known for its high quality natural mineral resources.

EMFIL elements are produced in CAD/CAM controlled precast concrete plants using the most modern hi-tech methods to achieve optimal quality standards. The complete steering and production control processes are done by computers and robots, which eliminates even the minimum chances of error. The computer controlled production in EMFIL factory makes it possible to make elements in any shape as required for modern architecture, that to in the highest quality standards.

Our fleet of vehicles assures a timely delivery to site, where the elements can be offloaded from the delivery trailer and fixed directly, avoiding process delay and Storage places.

Our products comes with a guarantee which states that both the raw materials used as well as the production processes involved are subjected to extensive Quality checks and control.

Using the most modern computerized systems and fully automated production process, we promise accuracy, quality and complete customer satisfaction.
EMFIL WALL

Prefabricated Concrete Double wall
EMFIL Double Walls

EMFIL Double wall consists of two shells about 5 to 7cms thick, made of reinforced concrete, which are combined with each other by means of lattice girders. An empty space remains between the shells of at least 7cm which shall vary depending on the total required wall thickness.

Any tie steel joining the wall to the foundation or other adjacent EMFIL Double walls or half floor units is placed in the cavity prior to concreting. After assembly of the precast segments the EMFIL Double wall elements can be grouted with in-situ concrete. As soon as the filling core is hardened, the total cross-cut has the effect of a monolithically manufactured in-situ concrete wall.

All additional components like cellar windows, fire retardant doors, door frames, electrical wiring conduits and splitting boxes are installed at the factory.
General advantages of EMFIL Double wall system

- The EMFIL Double wall has the effect of a homogeneous in-situ concrete wall.
- Provisions for cellar windows, fire retardant doors, door frames and electrical wiring conduits and splitting boxes is done at the time of casting itself.
- Both surfaces are smooth, so no plaster is required and is ready to be painted immediately.
- The components are delivered "just-in-time".
- No investment costs for form work.
- Labor costs are considerably lower.
- Formwork transport, as well as erecting and dismantling the form work can be avoided.
- The fast progress in construction makes it possible to keep the pre-financing costs much lower.
- Pre-casting takes place in work sheds and therefore weather conditions are irrelevant.
- No deadlines for dismantling of formwork.
- Less construction site equipment required.

EMFIL Double wall manufacture is based on an automatic production system, therefore overall lengths and prescribed reinforcement is always exact.
EMFIL Insulated Double walls

Cross section of an insulated EMFIL Double wall
Advantages of EMFIL insulated Double wall System

The integral insulating layer of EMFIL Double wall panels produces a variety of benefits:

- Superior insulating properties.
- A high thermal mass unmatched by any other material, including wood and steel.
- Excellent R – values.
- Minimal penetration to the integral insulation layer, ensuring no breaks in the thermal protection compared with wood or steel systems.
- A thermal mass that modifies large daily swings in temperature.
- Elimination of air infiltration at joints between panels due to a secure, consistent envelope.
- Durable composition precast panels to produce savings over the life of the building.
- Solid exterior Double layers ensure insulation remains in place over time, allowing no settling or shifting that could reduce efficiency.
Lifting and Erection

Lifting points are cast during manufacturing for a safe, fast and easy method of handling and installation.

Our fleet of vehicles assures a timely delivery to site where the stairs are taken by a crane directly from the delivery truck.

The concrete element taken from the delivery truck is directly positioned into the place with minimum manpower.
EMFIL SLAB

Prefabricated Concrete Slab
Chapter - 2

Contents

- Product Description and Application
- Advantages of EMFIL Slabs & Production
- Computer Integrated Manufacturing system
- Technical Details
**Product Description and Application**

EMFIL, the proven quality ceiling, is a precast slab with a statically incorporated layer of in situ concrete in accordance with DIN 1045. The 5 to 7 cm thick precast concrete element contains the bending resistant reinforcement required for both assembly and the longitudinal and lateral bending tensile reinforcement in the finished construction in the form of lattice girders. All required recesses, ceiling apertures, electrical sockets, drip noses, slopes, fixtures, etc, are taken in to account. The prefabricated slab acts as shuttering during the building phase, and after the addition and hardening of the in situ concrete is effectively a single slab. The EMFIL prefabricated slab contains reinforcement lattice girders for bracing and counteract thrust.

The necessary supports (props, joists) are indicated by the EMFIL factory on standardized by the carrying run of the conveyor diameter and the diameter of the diagonal and the axis- center distance of the lattice girders used. CAD is used to work out the positioning of the auxiliary yoke, paying attention to the permitted cut sizes of the lattice girders for assembly. The permissible moments and lateral forces are independent of the girder diameters and the assembly height of the lattice girders. The thickness of the precast slab as well as the diagonal diameter of the lattice girders determines the bending load capacity as well as the lateral load capacity. In addition to the net weight of the ceiling, assembly loads of 1.5 kN/m² or 1.5kN (under the most unfavorable conditions) are taken in to account.

If the positioning of the assembly yoke is carried out per assembly plans, bending during the addition of in-situ concrete is limited.

In its final state, after the hardening of the in-situ concrete, EMFIL quality slabs-acts like a monolithic reinforced concrete ceiling. The statically and constructively calculable combination of the precast element and the in-situ concrete is secured by the roughened surface produced during manufacture of the elements, which guarantees an optimal bond between the concrete element and the concrete added.
The CAD/CAM production of this system – EMFIL – means that all the required reinforcement and constructive details are attended in accordance with the relevant norms and permits. Thereby all possible projections and loading demands can be economically produced in systematic prefabrication. In the final state there are no technical differences to a monolithically produced ceiling.

Due to the equal values of the precast slab with added in-situ concrete like traditional in-situ concrete ceiling, they meet the same standards for

- Fire protection requirements
- Thermal insulation
- Sound insulation

**Applications**

The EMFIL quality ceiling can be used in all current construction methods using reinforced concrete. In addition to the optimal technical solutions, it also offers advantages of economy and construction time.
EMFIL advantages, which you can count on

- EMFIL slabs completely saves the material cost and labour charges for shuttering and scaffolding works.

- EMFIL slabs are light weighted and therefore easy to handle and fix.

- EMFIL slabs are produced according to DIN 1045 standards.

- CAD/CAM production makes it possible to manufacture slabs in any shapes and designs with a high level of precision.

- With "just in time" delivery there are no delays in the construction process.

- The built in reinforcement excludes any possible mistake on site.

- Recesses for electrical and plumbing installations are made at the pre-production stage itself.

- A detailed draft plan ensures error free construction.

- The smooth underside surface means no plastering is required.
The Advantages of the EMFIL Slabs production

- When putting in data in the EMFIL CAD system an automatic check up of the measurement precision of the slab’s plan is carried out.

- As the transfer of data is carried out by computer, the error rate between the technical office and production is absolutely minimal.

- The data transferred to the robots guarantees that the precisely measured steel is integrated exactly at the right point.

- The concrete is applied automatically until the required thickness is achieved. The slabs then conform to the pre-established weight.

- After careful compression and curing (under the best conditions), the EMFIL slabs are stacked and loaded according to their assembly order at the construction site.

- Due to EMFIL’s own APS (Order Administration, Provisions, Software) the production and the delivery dates are set so that a delivery is made “just in time”.
**Computer Integrated Manufacturing System**

This stands for the complete steering and control of the production processes by means of computer and robots, which eliminates human sources of error.

This computer assisted production from EMFIL, the quality reinforced slab, is the perfect example to demonstrate the achievements of the EMFIL Quality Brand. This method of production creates the kind of limitless space in which drafters and architects can realize the most creative and individual forms. Every possible slab form is available, unproblematically and in no time at all.

Recesses, angles, the total range of form and shape of modern architecture can be made using EMFIL always to the highest quality standards. In our range of services we not only ensure an exact plan of the slab with the correct laying of the individual parts at the construction site, but also provide the static calculations for the slab on which reinforcement is based.

The computer gives this information to the production plant. Here the robot sketches the shape and recesses of each EMFIL quality slab on a thoroughly cleaned steel mould. This eliminates mistakes in the subsequent removal of the mould and the precast part. The robot then cuts and bends the required reinforcement and lays it precisely at the right point.

Consequently the concrete is exactly and fully automatically poured on. After carefully compressing the concrete on the vibrating table, the surface is roughened to ensure a good level of adhesiveness with on site concrete. The almost ready EMFIL slabs is then taken to the curing chamber where it hardness under exactly controlled conditions before it is then stacked in logistic packets according to the order of assembly.
General information
&
Installation method
General

The EMFIL quality ceiling is a precast ceiling of reinforced concrete in accordance with DIN 1045. It is comprised of large format, 4 to 6cm thick EMFIL Slabs with supplementary in situ concrete. The EMFIL Slabs have a smooth under side and generally contain the statically required reinforcing framework. The lattice girders, with their lower booms, form part of this reinforcing framework. The diagonals of the girders serve to accept the thrust in the join between the EMFIL Slabs and in situ concrete. Finally the upper booms and diagonals serve to provide the stiffness necessary during assembly.

The installation plan

An installation plan is produced for every ceiling (figure 1) it contains all of the specifications important to installation, in particular the positioning of EMFIL Slabs with positioning numbers on the floor plan, the arrangement of assembly supports, the reinforcing of the butt joint.

Figure 1. The installation plan
Unloading EMFIL Slabs.

The EMFIL Slabs are generally unloaded from the truck by a building site crane and positioned in the same process. The slabs weigh approx. 125kg/m² (standard thickness). The karabiners are hooked into the diagonals (figure 2a), not into the upper boom. Stabilizing suspension gear should be used when lifting the EMFIL Slabs. Thereby Stabilizing suspension gear of steel cables or chains (figure 2b) or one of a fixed framework with steel cables or chains should be used top guarantee equally distributed loading of the dead weight on the lattice girders. In either case the spacing of the suspension gear from the end of the slab should be approximately 1/5 of the total length of the slab.

![Unloading the EMFIL slabs](image)

Figure 2a. Unloading the EMFIL slabs

![Unloading the EMFIL slabs](image)

Figure 2b. Unloading the EMFIL slabs
The EMFIL slabs are generally loaded so that they can be immediately placed from the Truck, unless the truck necessitates a different order. In the case of temporary storage on the building site, the storage area must be level and capable of bearing the load. Two pieces of squared timber, each as long as the slab is wide, should be used as supports to protect the underside of the EMFIL Slabs. The spacing of the timber from the end of the slab should be approximately 1/5 of the total length of the slab. For EMFIL Slabs more than 4.5m long it is advisable to use three or, even better four pieces of squared timber as supports.

Assembly Supports

The assembly supports are emplaced before the EMFIL Slabs are laid. The spacing of the assembly supports may be seen on the installation plan. The yoke must always be at right angles to the lattice girders (even in the case of balconies). Figure 4 is valid unless less than 3.5cm of the EMFIL Slabs is supported (figure 3) or the EMFIL Slabs are supported less frequently than every 2nd lattice girder's lower boom-welding join, framing yokes are emplaced.

Figure 3. The Assembly Supports
Figure 4. Supporting the EMFIL Slabs

**Supporting the EMFIL Slabs**

The support depth of the slabs is specified in the installation plan. The supporting points on pilings or walls should be thoroughly cleaned. A mortar bed is required if more than 4cm of the slab are supported. Acceptable supports are obtained as follows:

1. A mortar bed is added if the support ends 1 to 2cm beneath the underside of the slab. When the EMFIL slab is laid on the piling it presses down into the fresh mortar bed. The EMFIL Slabs must be laid horizontally. If a slab is not laid down horizontally the mortar bed is pushed away so much on one side that complete support is no longer possible everywhere.

2. If the support ends 2 to 4cm beneath the underside of the EMFIL slab, the join must be shuttered and carefully filled with concrete by vibrating.

A gap of at least 3.5cm must be maintained between the EMFIL Slabs on the intermediary support (figures 5 &6).
Figure 5. Laying The EMFIL Slabs

**Laying EMFIL Slabs**

Ideally laying should be carried out directly from the truck. All EMFIL Slabs are marked on the installation plan with position numbers. When planning, one should make sure that the cranes load bearing ability at the maximum required extension is sufficient. The EMFIL Slabs should be placed horizontally on the supports (cf. "Unloading EMFIL slabs" regarding the mounting of elements.)

**Checking the lower view**

The butt joints between the EMFIL Slabs must always be level along the entire length. Before concreting one should verify that the slabs are lying on the supports across their entire breadth, to avoid any misalignment.

Figure 6. Reinforcing across 11.5 to 17.5cm wide supports.
Creating recesses

Openings desired in the ceilings are already made during prefabrication in the plant. All that is necessary on the building site is the shuttering of recesses and the edge of the ceiling up to the upper edge of the finished ceiling. If the openings for electrical wiring were not made during prefabrication, then they can easily be drilled from underneath after laying the slabs. Attention: drilling from above produces spalling on the underside.

Cleaning the surfaces of EMFIL slabs

The surfaces of EMFIL Slabs must be cleaned if they are dirty. Only clean surfaces allow bonding to take place between the EMFIL Slabs and in situ concrete.

Figure 7. Reinforcing across the joins.

Reinforcing across the joins

Joint reinforcing between the EMFIL Slabs is guaranteed either in the form of reinforcing steel mesh or individual reinforcing rods. The dimensions of the reinforcing are stated on the installation plan. The joint reinforcing must go beyond the butt of the plates by the amount \( l_0 \), specified in the installation plan.

Installation of Services

If services need to be installed in the ceilings these should be added before concreting.
Additional Reinforcing on the EMFIL Slabs

Placement is specified on the installation plan. Additional reinforcing is planned for replacements, laterally stressed slabs among others. The upper reinforcing of the ceiling is shown on a separate reinforcing plan. It is required as supporting reinforcing for continuous ceilings (figures 5 and 6), cantilever slabs etc.

Preparation for concreting

Before the in situ concrete is added, the following must be checked, whether:

- have been laid properly (direction of tension, recesses),
- the precast slabs are supported as they should be and are lying horizontally,
- the edges of the EMFIL Slabs are completely level along the entire length of the joins on the underside
- the reinforcing over the joins, the additional reinforcing and upper reinforcing as well as the services have been laid; if necessary the responsible stress analyst should inspect and confirm the reinforcing before concreting.

Concreting

The concrete must fulfill the prescribed quality and consistency standards and poured and compacted in a single building phase. The reinforcing may not be moved or pressed down before concreting. Aside from this the slab edges should be examined from beneath to see whether the slab edges are level. To prevent possible damage through overloading, the in situ concrete should be regularly spread without piles (additional load \( \leq 1,5 \text{ kN/m2} \) or \( \leq 1,5 \text{ kN per lattice girder possible} \).

After treatment of the underside

The underside of the slabs is smooth. If the slabs are not laid close enough to one another, cement can run through the joins. Therefore all joins and connections to walls should be cleaned after concreting.

Removal of assembly supports

The assembly supports can only be removed after the concrete has sufficiently hardened. Attention should be paid to the DIN 1045 stipulation.
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EMFIL
STANDARD DETAILS

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### VERTICAL DETAILS (WALL & SLAB)

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EXTERNAL WALL & ROOF SLAB

TOP OF PARAPET

ROOF LEVEL

PARAPET IN ISOMETRIC VIEW

ROOF SLAB INSULATION

UPPER RENFORCEMENT

IN-SITU CONCRETE

TRANSVERSE BAR

INSULATION

LATTICE GIRDER

LONGITUDINAL BAR

IN-SITU CONCRETE

PRECAST SLAB

5 cm SLAB ELEMENT

GIRDER

TRANSVERSE BAR

LONGITUDINAL BAR

VERTICAL DETAILS
(WALL & SLAB)

ROOF LEVEL

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PROPOSED PROPS HEIGHT

VERTICAL DETAILS
(WALL & SLAB)
CONNECTION OF 3 DOUBLE WALLS (30cm & 11cm WALL)
Emfil Slabs are prefabricated concrete elements that are later covered with an in-situ concrete layer. Together they behave as a monolithic concrete slab.

Emfil Slabs are usually 2.50m wide, up to 10m long and 5 to 7cm thick. The single elements are provided with bottom reinforcement and offer a very smooth surface on the underside. Filigree girders give the relatively thin slabs the necessary stiffness for handling.

Emfil Slabs are light (standard slabs 125 kg/m²) and therefore easy to handle. Site cranes put the elements in position. Lifting gear is connected to the lattice girders. Temporary supports are placed to carry slab weight and in-situ concrete.

After placing the Emfil Slabs electrical piping and plumbing works is done and upper reinforcement applied. Concrete is then poured on to the slabs to obtain the required floor thickness and structural stability.

www.emfil.com
Support girders are placed in position. Some *Emfil Slabs* are already laid. Basement walls are “Emfil Walls”. *Emfil Slabs* are placed on to the inner shell of the Double Walls, therefore no girder along the walls.

Large *Emfil Slabs* can be produced and laid due to their low weight per m² (in this case the slab is 5cm thick and weighs 125kg/m²). Light cranes can usually handle villa sites. Handling is safe as 4 hooks are connected to the lattice girders.

The under side of *Emfil Slabs* is as smooth as the outside of the “Emfil Walls” seen in this photo. Some *Emfil Slabs* at the left side are equipped with additional lattice girders to take care for specific structural requirements.

A precast stair element is placed into its final position. Especially of interest is the easy integration of this *Emfil Stair element into the structure based on *Emfil Slabs*. Good to see are *Emfil Walls* at the left side.
Emfil Slabs are well suited to complement pre-engineered steel structures as the concreted floor works as a monolithic unit, which can stiffen each floor level. Composite bond is achieved by shear studs welded onto the beams.

Advantages of Emfil Slabs

1. Emfil Slabs are CIM-Products (Computer Integrated Manufacturing). This stands for the complete steering and control of the production process by means of computer and robots, which eliminates human error and guarantees repeated high levels of precision.

2. Emfil Slabs offer the designer nearly unrestricted ground plan possibilities. All necessary recesses are made at the correct places in the factory.

3. Emfil Slabs can be spanned in x and y direction reducing floor thickness and reinforcement. Fire resistant (F90) specification for x and x-y directional spanned floor is assured.

4. Emfil Slabs speed up the building process. Usual construction steps are reduced to half. Contractors highlight especially savings in plywood and elimination of moving shuttering in and out of each floor.

5. Post processing of Emfil Slabs undersides is basically limited to filling of joints and paint. Plaster is not required.

6. Electrical- and other parts can be installed before concreting which saves time and hides these parts within the ceiling.

7. Emfil Slabs are well suited to complement pre-engineered steel structures as the concreted floor works as a monolithic unit, which stiffens each floor level. Composite bond is achieved by shear studs welded onto the beams.

8. Emfil Slabs are light compared to any other precast concrete floor element. Handling of Emfil Slabs is easy and safe. Gear hooks are connected to the lattice girders.

9. With “just in time” delivery there are no process delays. No storage place will be required when the site is ready to offload directly from the delivery trailer to the final place.

10. Emfil Slabs are supplied all over the Emirates. Trailer loads vary between 120 and 240 m².

After fixing the upper reinforcement concrete is filled up (in this case 15 cm thick) to the required floor height. Statically the concrete floor acts as a monolithic unit of (here) 20 cm height.
Electrical - and other parts are installed before concreting, which saves time and hides these parts within the floor structure.

Emfil Slabs offer the designer nearly unrestricted ground plan possibilities. All necessary recesses are made at the correct places in the factory.

Emfil Slabs speed up the building process. Usual construction steps are reduced to halve. Contractors highlight especially savings in plywood and elimination of moving shattering in and out of each floor.

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