

Disegno dal Vero by R. Fonti

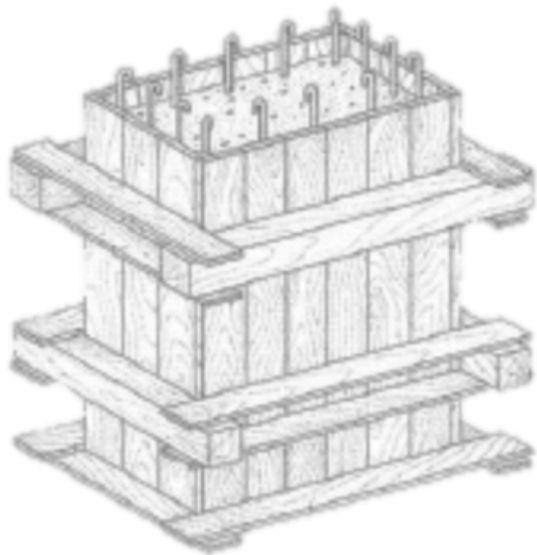
SPACE TO DRAW

## Description of manufacturing processes: Overview

Board-formed concrete is a process of patterning concrete that leaves a timber grain on the finish. This end effect is also referred to as off-form concrete. It is possible to obtain this by two different processes. These are:

1. concrete left exposed from the actual process of building concrete members at the building site and,
2. rendering walls - of different kinds – simulating an off-form concrete finish.

The two techniques and related steps of production are reported in the following sub-sections.



A formwork



Different types of timber boards

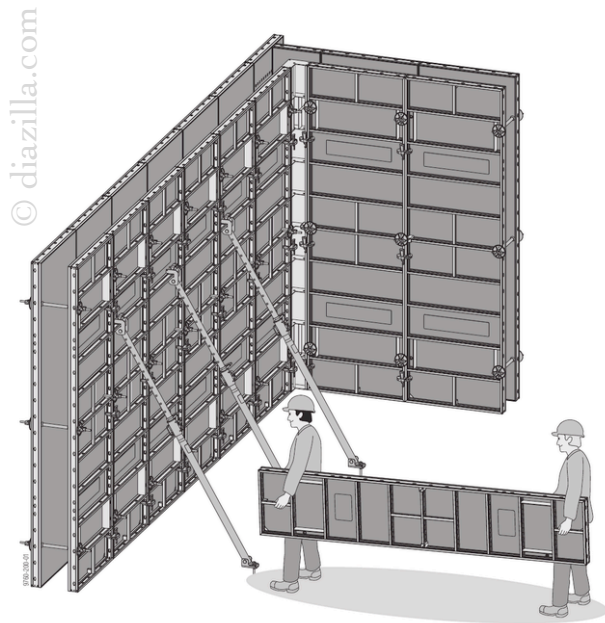


Plywood for shuttering

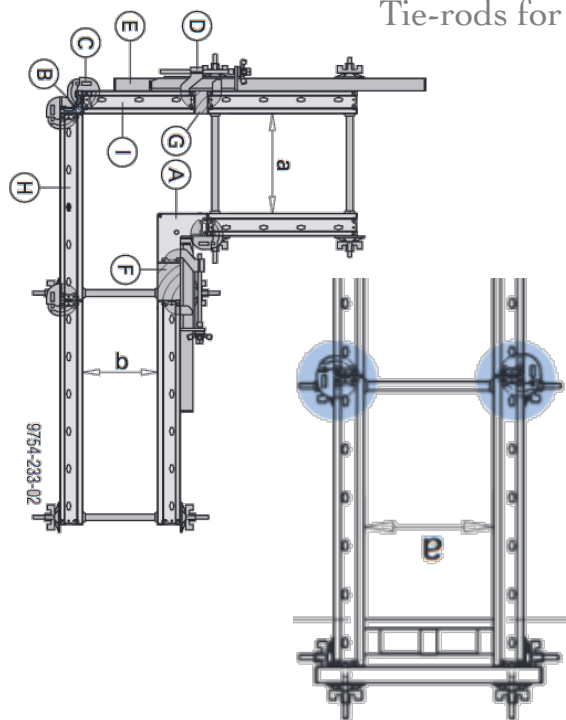
## Off-form concrete: Step 1 - The Formwork

Concrete members can be manufactured at the building site by cast-in-place techniques or precast methods especially for the supply chain. Cast-in-place concrete is a building technology using formworks of different kinds and materials. This practice has ancient roots and has been continuously in use from Roman time to the XX century. Formworks are commonly set in place to pour a concrete mix\*) in and hold this in place until it has hardened. Formworks are mainly made out of timber boards (facing) that the wet concrete sits against and other timber members, which are holding boards in position while opposing thrusts coming from the pouring process.

\*) Concrete is a blend of Portland cement, sand, aggregate (gravel) and water



Formwork for extended surfaces



## Off-form concrete: Step 1 - The Formwork

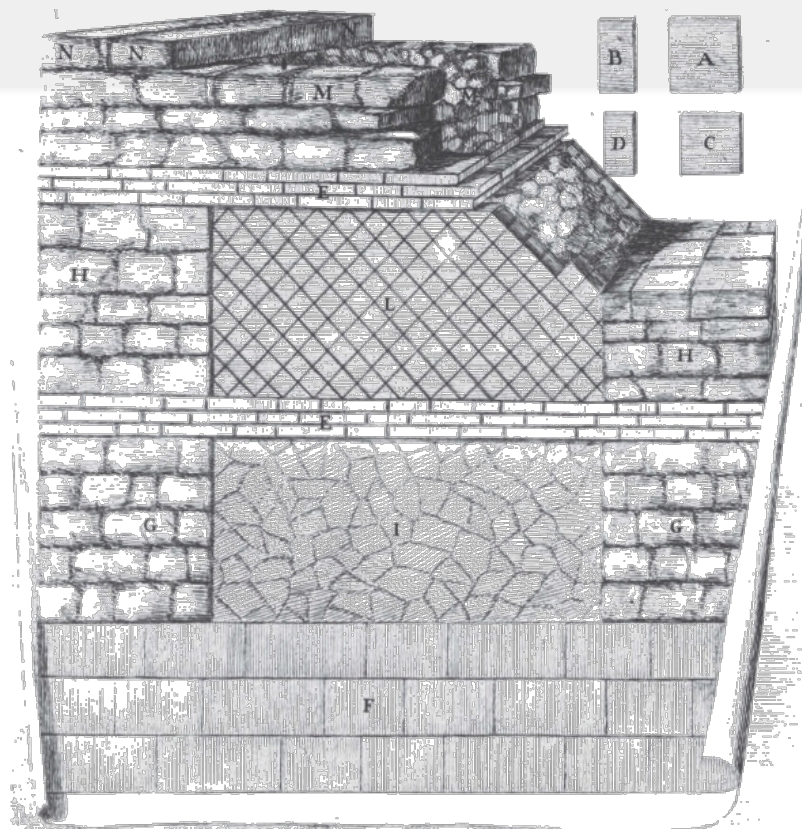
During curing the concrete takes on the wood grain of the forms' facings – therefore, it is crucial to pay attention to the setting and design of forms before pouring the concrete in. Tie-rods are needed for extended surfaces to prevent facings from overturning and/or displacements.

According to the type of timber used and its production processes, indentations on off-form concrete will vary. In the past, natural timber was used to design formworks – thus, producing marked indentations amplified by compaction processes.





Opus Reticulatum a cubila of the facing used as a formwork, Villa Arianna, Stabiae, Italy



Galiani 1790, vol. 2, Tav. III

Opus Caementicium and its different formworks

## Off-form concrete: Step 1 - The Formwork

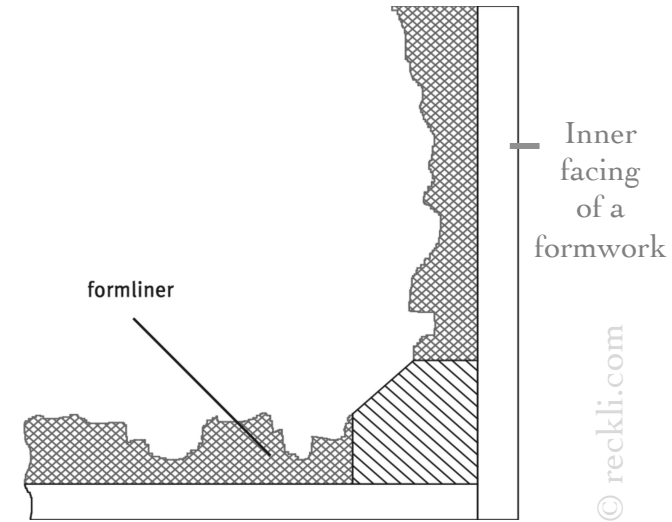
Nowadays, sheets of plywood are commonly replacing massive timber to lowering production costs\*).

\*)In Roman time, stone wythes were replacing timber formworks to built walls that are made out of concrete up. Afterwards, stone wythes were left in place to speed up the building process while lowering construction costs. Concrete in Roman Era was based on lime and consists of a different sized aggregate mixed with hydraulic mortar having pozzolanic ash and water.





Off-form concrete, different wood grains



form liner

## Off-form concrete: Step 1 - The Formwork

This change from massive timber to sheets of plywood is causing disparities in patterns, which obviously are reflected into the aesthetic of surfaces at finish: indentations on wood grain and grout lines will vary according to the solution applied.

Further, tightening joints between timber boards/sheets will prevent grout lines.

To re-use form face sheets is not advisable when an off-form concrete finish is required.

Note: To obtain special and imaginary textures formliner can be applied on the inside faces of the formwork.



Components for the concrete mix



Effects due to a change in the aggregate

## Off-form concrete: Step 2 – The Concrete mix

The ratio between sand and cement, and the type of aggregate\*) chosen (e.g. particle size and type of material), will provide the cast-in-place concrete with different chromatic effects and textures. Particularly, textures of cast-in-place concrete members can be more or less smooth or coursed according to the granulometry of sand and size of aggregates regardless from its pattern.

Joints will be lined at surfaces according to the design of sequences of cast-in-place members. This is mainly due to the engineering standards applied both for the design of formworks and concrete members\*\*).

\*) This is supposed to be a granular material such as rock, crushed stone, gravel, or other particles mixed with cement to improve its performance, along with sand.

\*\* ) Extended surfaces of concrete show a number of joints, which might be crucial to reduce post-curing cracking due to shrinkage of concrete.





## Off-form concrete: Step 3 – Stripping formworks

Formworks having special indentations will have to be left in place for a much extended time period than formworks having flat and smooth surfaces. Particular care must be exercised when removing formworks to reduce the possibility of damage to the off-form concrete surface. The use of appropriate form-release agents is recommended to facilitate stripping. Concrete form oil are commonly applied owing to the possibility of concrete sticking to forms.

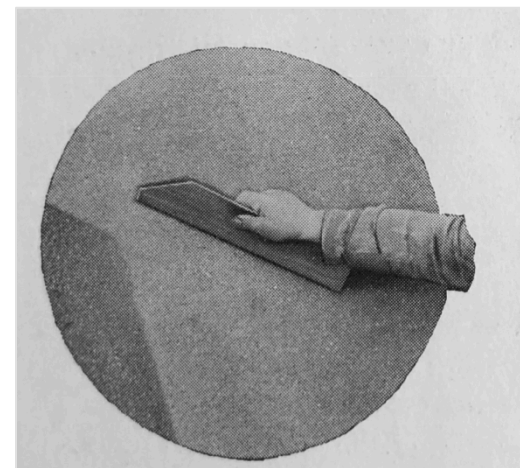
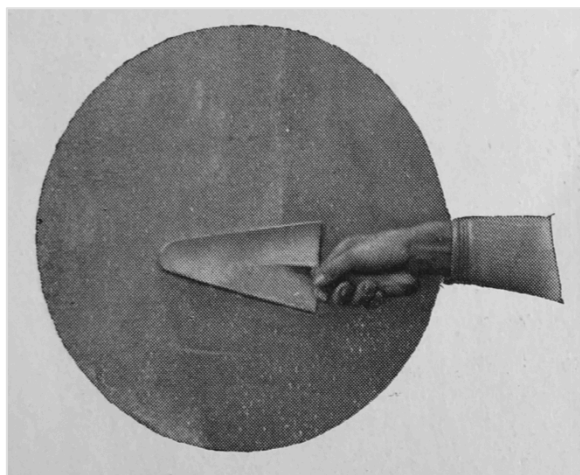
Further, timber can be sanded in advance to achieve a better end effect: timber grain will be much more pronounced over surfaces.

Further, timber grain can be impressed on surfaces by means of additional layers of timber which are used with similitude with form liners and applied at the inner face of formworks.





Freshly placed concrete

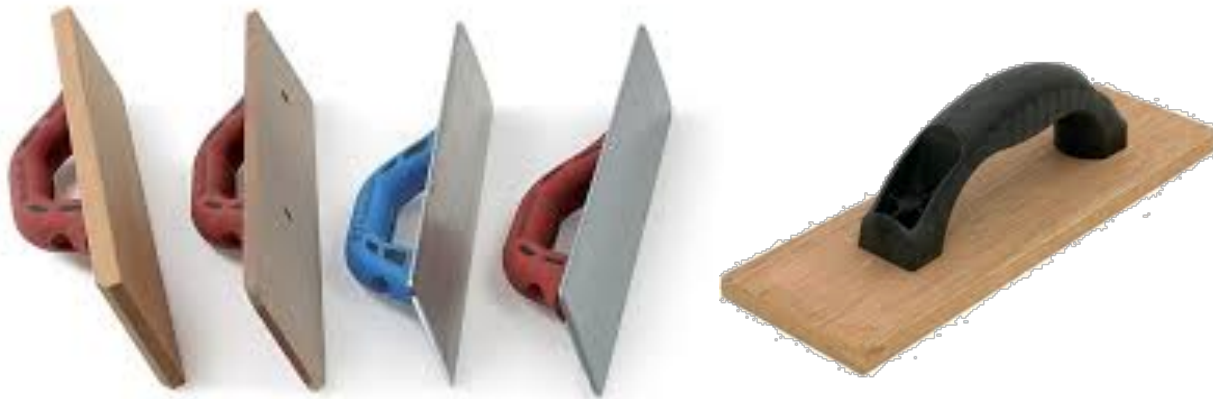


straightedge

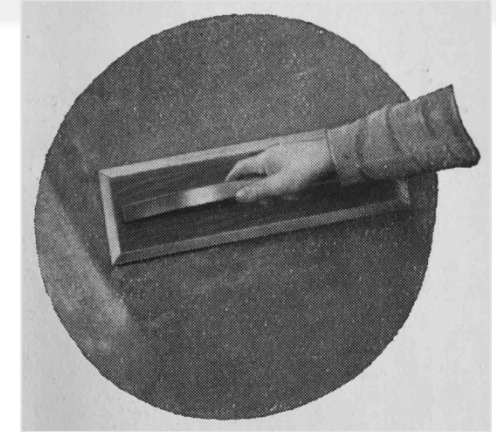
## Rendered surfaces simulating off-form concrete finish: Step 1 - Screeding freshly placed concrete

A thick layer of freshly placed concrete is applied over a damp base. A damp base is a wet surface on which a first layer of coating is spread. Immediately after the spreading of the concrete, straightedges are commonly used to screed the freshly placed concrete. This is aiming at removing excess concrete while bringing the top surface to a proper grade and producing a true plane face as level as possible. This process must be completed before excess bleed water\*) appears on the surface. There is a wide variety of screeding tools-both hand tools. Particularly, wood straightedges need to be straight and warp-free. Otherwise, they can leave undesirable indentations on the concrete surface. Metallic tools have the advantage that concrete will not stick on them.

\*) After screeding and floating, water rises to the surface of freshly placed concrete and some will turn into moisture vapour while allowing for a proper floating of surfaces. Bleed water is basically needed to wet out the hardener sufficiently.



Different kind of floats



Darby

## Rendered surfaces simulating off-form concrete finish: Step 2 - Darbying and Floating

After screeding, a darby or float is used to ensure that surfaces are ready for a decorative finish. Basically, here, ridges and voids, which were left following screeding, will be carefully levelled and filled (Darbying). Further, coarse aggregates will be embedded down onto the concrete mix allowing for the paste to move up on the surface while creating a rough surface texture (Float finish) - thus, simplify subsequent finishing operations while consolidate aggregates.

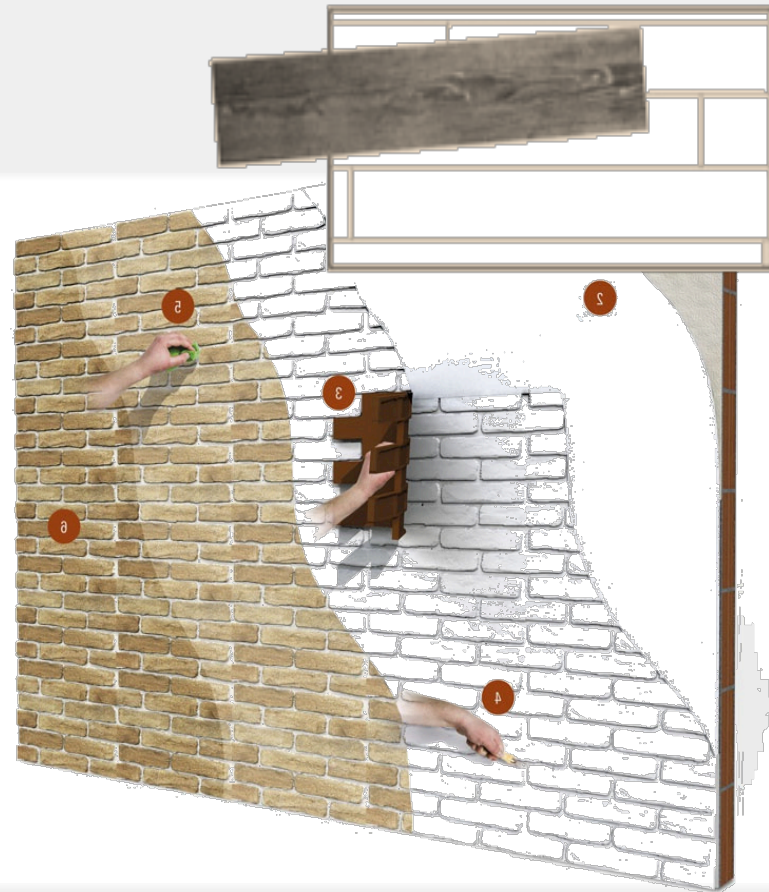
This process must take place before excess moisture (bleed water) appears on the surface. In this light, it is crucial to choose the right tool. Particularly, according to the type of concrete mix, surface sealing is limited or favoured. Especially, magnesium darbyes and floats will smooth the surface while prematurely sealing this up. On the contrary, wood darbyes and floats will make this open allowing for any bleeding water to evaporate and does not seal the concrete too soon. To seal the surface of the concrete before bleeding may cause blistering or scaling.



Touch-Up Roller



Timber pattern for stamped concrete



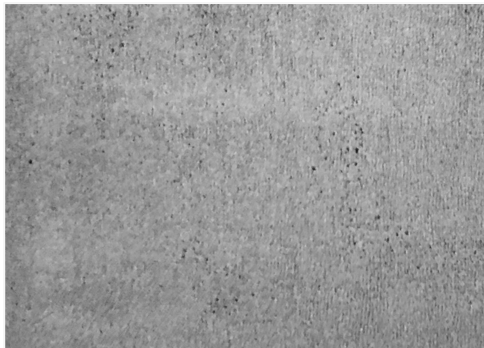
## Rendered surfaces simulating off-form concrete finish: Step 3 - Finishing

In the case of special textures, stamps (made out of plastic\*) are used to make concrete to take the pattern on. Stamps can be used with similitude to form liners and pressing those against the wall by providing hand pressure\*\*). Applying release agent on stamps and boards is crucial to avoid possible damages due to stripping.

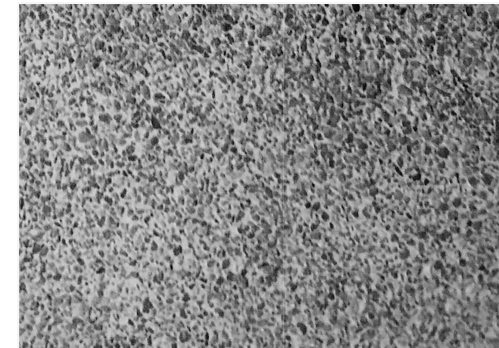
Decorative concrete Touch-Up Roller are used to retouching patterns, which are impressed on the concrete surface.

\*) Propilene \*\*) <https://www.youtube.com/watch?v=zOSKSIFpngU>





Exposing aggregate



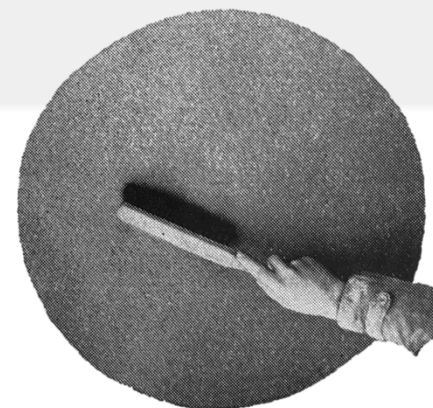
## Rendered surfaces simulating off-form concrete finish: Step 4 - Surface retarder

Then, plasticisers are applied over the concrete surface. These products are also known as surface retarders/deactivators and can be applied to expose aggregates onto the surface regardless from indentations. It is possible to apply surface deactivators at formworks' facings (e.g. Contex and Beton Contex by Bau Chemie G.m.b.H.) or directly on walls by spraying the solution. This delays (one day or so later) the set and provides the flexibility to remove thin layers of cement paste up to specific ranges of exposure' depths – thus, performing a great choice of decorative exposed-aggregate finishes. Particularly, it is recommended brushing and washing away the concrete paste at external surfaces to a depth no more than one-third the diameter of the aggregate particle.

\*) Die Betonkörnung läßt sich auch sehr wirkungsvoll ohne große Nacharbeit nach dem allerdings nicht billigen, sogenannten Contex verfahren sichtbar machen. Contex\*\*) ist eine colloidale Flüssigkeit oder Pate, die entweder auf die Schalung oder Betonform vor dem Betonieren aufgetragen wird (Schalungscontex) oder unmittelbar auf die Frisch betonierten Flächen aufgetragen wird (Betoncontex). Contex verhindert bzw. Verzögert das Abbinden des Zementes auf eine bestimmbare Tiefe. Nachdem der übrige Betonkörper erhärtet ist, kann die noch nicht erhärtete Zementmörtelschicht an der Oberfläche als lose Masse abgebürstet und dadurch die Betonkörnung, Steinschlag, Kies und Sand, freigelegt werden. \*\*) Hersteller von Contex: Bau-Chemie G.m.b.H., Frankfurt (Main).



Sponge floats



Horsehair Brush

## Rendered surfaces simulating off-form concrete finish: Step 4 - Surface retarder

A sponge float can be used to finish surfaces. This will allow for a light or heavy float finish. Particularly, the latter differs from the light float finish on account of a use of additional water to best form patterns while removing the concrete paste to a depth which does not expose coarse aggregates while consolidating further the surface.

Further, plasticizers need to be washed over by using water which is sprayed at low pressure. Once the water dries, a primary colour can be applied by spraying this all over the surface. A secondary colour can be applied by using a horsehair brush. A sponge slightly soaked in water needs to be used in advance to moisture surfaces locally.

## Reference Literature and web links

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