

PRODUCT DATA SHEET

LF-Fill

Lightweight Flowable Fill

Ironstone Civil's lightweight Flowable Fill, **LF-Fill** is a low density polymer modified grout. LF-Fill is produced from a GP cement and water slurry, mixed with a prepared foam surfactant.

Features

LF-Fill features include:

- Low Density
- High Fluidity
- High Pumpability
- Nil Shrinkage (< 1%)
- Nil Bleed/Separation (< 1%)
- Self Levelling & Compacting

LF-Fill is available in a wide range of densities and compressive strengths.

Applications

LF-Fill can be used in a wide range of applications including:

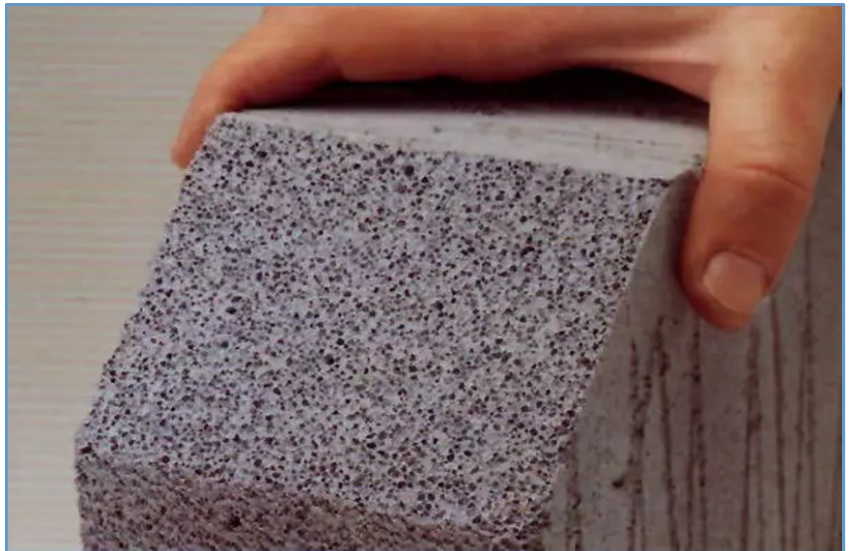
- Pipe Abandonment
- General Void Fill
- Annulus Fills
- Net Zero Loading
- Soil Replacement
- Controlled Backfill
- Bridge Approaches
- Roofing
- Insulation

Availability

LF-Fill can be produced in small or large quantities anywhere in Australia.

A surfactant concentrate is introduced into foam generator and mixed with water to produce a foam with a high proportion of stable air voids or "small bubbles". A pump is used to used to mix the foam with the slurry. The resultant **LF-Fill** is a highly flowable lightweight material that has proven to be extremely useful and versatile in many civil engineering applications.

Once produced **LF-Fill** behaves like other cement based products and has a measurable initial set time, final set time, and compressive strength which gains over time.



LF-Fill Mix Design

LF-Fill is produced to a specific mix design. There is a wide range of mixes available that produce **LF-Fill** with dry densities of between 400-1200kg/m³, resulting in 28-day compressive strengths of between 0.5 and 6.0MPa. There is an almost linear relationship between **LF-Fill** density and compressive strength, i.e., the lower the density of the **LF-Fill** the lower the compressive strength.

The dry density of **LF-Fill** is approximately 15% less than the wet density.

Production of LF-Fill

LF-Fill is mixed on site using a specially formulated base slurry of GP cement, potable water and foam surfactant. The batching process requires special grout pumps and a surfactant foam generator and slurry/foam mixer.

The base slurry can be supplied from a pre-mixed concrete batch plant, or be produced on site using volumetric mixers or, for small quantities, mixed from 20kg GP cement bags in a small mixer / pump.

The production process requires LF-Fill to be produced "on demand" meaning that the LF-Fill must be installed directly after it is produced.

Specification

In some applications the designer will want to achieve a target dry density, and in other applications a target compressive strength may be required.

Ironstone Civil's Standard Mix Designs will cater for most applications and can be specified by specifying either a target dry density (kg/m³) or a target Compressive Strength (MPa).

For special non-standard mix designs contact Ironstone Civil.

Compressive Strength

LF-Fill follows a strength gain curve similar to its base material, GP Cement. At seven days typically 70% of strength is achieved. Design strength is achieved by 28 days.

Porosity

Ironstone Civil's standard mix designs generally have low porosity.

Porous **LF-Fill** mix designs are available. All enquiries for high porosity mixes should be directed to Ironstone Civil.

Product Disclaimer

Recommendations regarding the use of this product are to be taken as a guide only. If in doubt contact Ironstone Civil Pty Ltd or seek professional advice. To the extent permitted by law, Ironstone Civil excludes all implied warranties, conditions and guarantees imposed by legislation. Ironstone Civil excludes all liability for loss, damage or injury arising from use of the product (i) otherwise than in accordance with the recommendations or (ii) for purposes other than those for which it is ordinarily acquired. For all other loss, damage or injury arising from the use of this product, to the extent permitted by law Ironstone Civil's liability is limited, at its discretion, to refunding the cost of the product or resupplying the product or equivalent product.

Standard Mix Designs

Ironstone Civil has several standard "off the shelf" **LF-Fill** mix designs available. Their properties are detailed in the table below. Note that these are typical values and there may be regional variances due to the different GP cements available.

Compressive Strength (MPa)	Wet Density (kg/m ³)	Dry Density (kg/m ³)	% air voids
0.5	375	320	80
1.0	490	420	73
2.0	620	430	65
4.0	780	660	57
6.0	920	780	50

Quality Control

The recommended quality control specification for **LF-Fill** comprises in-process wet density measurements, in addition to NATA laboratory compressive strength testing and dry density measurement.

There is a very strong relationship between wet density, the expected dry density and the resultant compressive strength of the **LF-Fill**. Tight in-process control of wet density is therefore a very good guide to consistency of the **LF-Fill** being produced and its eventual dry density and compressive strength.

200mm high x 100mm diameter concrete test cylinders are used to cast samples of the **LF-Fill** for compressive strength testing. The sampling, curing and crushing procedures are based on standard concrete testing procedures. Dry density is measured by weighing the samples prior to crushing.

The following testing standards are typically used for determining properties of **LF-Fill**, ASTM C513 and ASTM C495.

Curing

A minimum curing period of seven days is recommended. **LF-Fill** should be maintained in a continually moist condition wherever practicable. Water sprays, wet sand or moisture retaining techniques, such as clear polyethylene sheets or curing compounds are recommended. Curing should begin as soon as the **LF-Fill** has achieved final set. The practice of curing can deliver compressive strength results up to 100% greater than **LF-Fill** not subjected to curing.