

EXILVA® BY BORREGAARD

EXILVA, A MULTIFUNCTIONAL AND SUSTAINABLE CONCRETE ADDITIVE

Producing a concrete that is both strong and durable but also workable and sustainable is often a challenge. Frequently, manufacturing a concrete with the desired flow properties and compressive/flexural strength depends on the areas where the concrete will be deposited and the surrounding environment.

There are many different methods to increase the compressive strength of a concrete mix-design. These can vary from adjusting the cement type, reducing the water to cement ratio, adding different admixtures or supplementary cementitious materials as well as altering the aggregates used. Improving the flexural strength can be done by adding steel or fiber reinforcement as well as adjusting the water to cement ratio, the aggregates used and the type of cement. These methods are complex and take time and effort to implement. Furthermore, they increase the CO2 foot-print of the concrete. Exilva as an additive manages to increase the compressive strength, without loss of the flexural strength, whilst at the same time maintaining the sustainability of the concrete.

Exilva P 01-L, when incorporated into concrete mix-designs, acts, initially, as a viscosity modifying agent (VMA). VMAs are designed to add structure to a concrete as well as reduce bleeding and segregation effects. This is observed when using a concrete mix-design in Table 1 below.

Exilva P 01-L was dosed at 5.4% (as delivered), based on liquid by weight of cement (lbwc). The superplasticiser, which is PCE based, was dosed at 1% (as delivered) lbwc. The mix-design containing Exilva P 01-L was water-content adjusted*.

| COMPONENT | Reference (kg/m³) | Reference with Exilva P-01 L (kg/m³) |
|-------------------|-------------------|--------------------------------------|
| Aggregate 8/16 | 678 | 678 |
| Sand 0/8 | 1080 | 1080 |
| Std Cement CEM II | 384 | 384 |
| Water | 192 | 192* |
| PCE | 3.8 | 3.8 |
| Exilva P 01-L | - | 20.8 |
| W/C ¹ | 0.5 | 0.5 |

TABLE 1.

Concrete Mix-design.

¹ Water-to-Cement ratio

The visual results of the slump and cone test for these two formulations are shown in Figure 1 below, as well as the height and area of the cone and slump in Table 2. Addition of Exilva P 01-L into the concrete gives a much reduced visual slump as well as reduced bleeding and segregation.



FIGURE 1.

Visual Slump and Cone Results for the Reference (left) and Reference with Exilva P 01-L (right).

| FORMULATION | Cone (mm) | Slump (mm) |
|------------------------------|-----------|------------|
| Reference | 250 | 640 x 680 |
| Reference with Exilva P 01-L | 160 | 250 x 250 |

TABLE 2.
Slump and Cone Results.

Additional added benefits were noticed when Exilva P 01-L was used in concrete. A higher compressive strength will lead to a concrete that is stronger and more durable and will weather the effects of the surrounding environment better. An increase in compressive strength was noticed (~10%) when compared to the reference after 28 days.

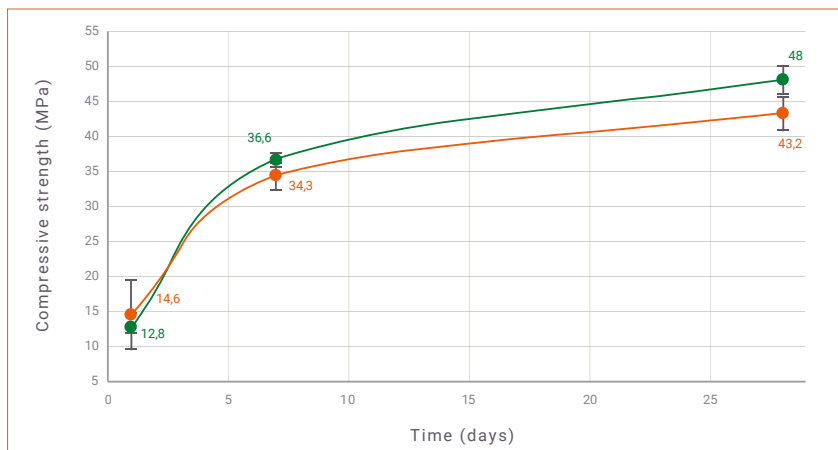


FIGURE 2.
1, 7 and 28 day Compressive Strength (MPa) Results of Reference and Reference with Exilva P 01-L.

The flexural strength of concrete is the ability of the concrete to maintain its resistance to deformation under bending. The flexural strength results, seen in Table 3 below, for the same concrete mix-design show that addition of Exilva P 01-L did not have a detrimental effect over 28 days.

| FORMULATION | Cone (mm) | Slump (mm) |
|------------------------------|-----------|------------|
| Reference | 250 | 640 x 680 |
| Reference with Exilva P 01-L | 160 | 250 x 250 |

TABLE 3.
28 day Flexural Strength Results of Reference with Exilva P 01-L.

In summary, addition of Exilva P 01-L into a concrete mix-design, containing a PCE based superplasticiser, reduces the slump and cone values as well as reducing bleeding and segregation. Exilva P 01-L also improves the compressive strength of the same concrete mix-design and does not negatively influence the flexural strength values over 28 days. Exilva P 01-L works in synergy with the superplasticiser to give a more uniform and stronger overall concrete.

KEY POINTS

- Rheology Control – reduced slump and cone values, more homogenous paste, gives a more uniform concrete with less bleeding and segregation.
- Improves 28 day Compressive Strength – use of Exilva P 01-L with a PCE based superplasticiser, improves the overall compressive strength after 28 day without reducing the flexural strength.
- Synergy Effect – addition of Exilva P 01-L with a PCE based superplasticiser improves the overall strength of the concrete.
- Very efficient at low dosages.
- 100% natural and infinitely sustainable – can reduce the CO2 foot-print in concrete.