

# Farm Structures FACTSHEET



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## CHEMICALLY RESISTANT CONCRETE FOR FARM APPLICATIONS

There are at least two applications for a chemically resistant concrete for dairy farms:

1. Milk house floors that are attacked by lactic acid and C.I.P. chemicals from equipment washing, and
2. silo floors and walls that are attacked by acidic silage effluent.

In both cases concrete surfaces fail due to acid corrosion in a matter of months. The effect of acid corrosion of concrete can be reduced by traditional methods such as using a properly specified concrete mix, good curing procedure and surface treatments such as epoxy coatings. Epoxy coatings have not been successful in these two farm applications because of mechanical damage to the surface coating and damage caused by pressure washing with hot water. Epoxy coatings are stiff and have limited capacity to span cracks in concrete floors and walls.

The commercial, heavy construction industry has made successful use of the pozzolan additive, **silica fume** which strengthens the concrete and increases chemical resistance. Silica fume is a byproduct of the metalurgical industry and is very fine particles of silicon dioxide. The material reacts with the cementitious material in the concrete mix and the resulting cured concrete has low permeability and increased resistance to chemical attack.

For the new, poured-in-place concrete silo at Dykshoorn Brothers Farms on Wells Line Road in Abbotsford, floor slabs of the silo were cast using **Silica Fume Admixture** (SFA) supplied by Target Products Ltd. Mix designs and testing was carried out by Hardy BBT Ltd., Consulting Engineers, Burnaby.

SFA was supplied in 20 kg bags to the site for addition to the back of the ready mix truck. Bagged SFA contains chemical admixtures to minimize slump or air content loss when added to ready mix concrete. In the trial, 3 different concentrations of SFA were used: 20 kg/m<sup>3</sup> of concrete (1 bag per m<sup>3</sup>), 40 kg/m<sup>3</sup> and 60 kg/m<sup>3</sup>.

**Mix designation** for regular concrete for test floor slabs:

Cement (type 10): 307 kg/m<sup>3</sup>

Fly ash (type F): 0 (Important! No other pozzolan additive in mix)

Water (est'd.): 145 kg/m<sup>3</sup>

Water reducing admixture (MB 344N): 500 ml/100 kg

Air entraining admixture as required for 4 ± 1% air

Slump: 80 mm ± 20 mm

Water/cement ratio: 0.47

Specified 28-day strength: 30 MPa

CYLINDER TEST RESULTS	SLUMP	COMPRESSIVE STRENGTH	
		7 DAYS	28 DAYS
Control 1	65 mm	32.1 MPa	37.4 MPa
20 kg/m <sup>3</sup> SFA	65	36.1	51.6
Control 2	80	30.7	36.7
40 kg/m <sup>3</sup> SFA	90	43.1	56.1
Control 3	50	28.9	35.2
60 kg/m <sup>3</sup> SFA	40	33.6*	43.2*

\***Note:** Water, at a rate of 18 l/m<sup>3</sup> had to be added to concrete after SFA addition to maintain adequate slump for placement.

## CONCLUSION

Powdered SFA can be successfully added to ready mix concrete at the job site. These results show that the addition of just 20 kg/m<sup>3</sup> yields significant strengthening of the concrete. Since the test floor slabs are covered with corn silage at the time of writing, it is not possible to examine the test slabs to assess chemical resistance.

The cost of a 20 kg bag of SFA is approximately \$20 so the cost of concrete is increased by approximately 25% depending on the price of ready mix delivered to the site. For small jobs, such as milk house floors, the increase in cost is warranted. On larger floor slabs, the contractor should give consideration to pouring floors in 2 lifts; the top layer treated with SFA.

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### FOR FURTHER INFORMATION CONTACT

John Luymes, Farm Structures Engineer  
Phone: (604) 556-3114  
Email: [John.Luymes@gems7.gov.bc.ca](mailto:John.Luymes@gems7.gov.bc.ca)

### RESOURCE MANAGEMENT BRANCH

Ministry of Agriculture and Food  
1767 Angus Campbell Road  
Abbotsford, BC CANADA V3G 2M3