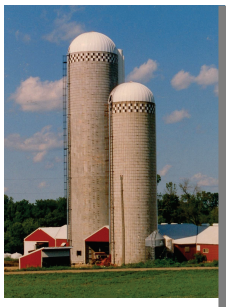

TECHNICAL SPECIFICATIONS

Agricultural Concrete Requirements

RMCAO

The minimum concrete requirements for agricultural concrete projects are based primarily upon the following standards and codes:

- Ontario Building Code
- National Farm Building Code of Canada
- CSA A23.1 – Concrete Materials and Methods of Concrete Construction

While all of these standards make specific references to concrete construction requirements, the most stringent requirements are listed in the table below:

CONCRETE APPLICATION	CLASS OF CONCRETE	MAXIMUM W/CM	MINIMUM 28 Day STRENGTH	AIR ENTRAINMENT CATEGORY	REFERENCES
Structurally reinforced concrete exposed to severe manure and/or silage gases, with or without freeze-thaw exposure. Examples: reinforced beams, slabs and columns over manure pits and silos, canals, pig slats, access holes, enclosed chambers, and pipes partially filled with effluents.	A – 1	0.40	35 MPa	1 or 2	CSA A23.1
Structurally reinforced concrete exposed to moderate to severe manure and/or silage gases and liquids, with or without freeze-thaw exposure. Examples: reinforced walls in exterior manure tanks, silos and feed bunkers, and exterior slabs.	A – 2	0.45	32 MPa	1	CSA A23.1
Structurally reinforced concrete exposed to moderate to severe manure and/or silage gases and liquids, with or without freeze-thaw exposure in a continuously submerged condition. Examples: interior gutter walls, beams, slabs and columns, and sewage pipes that are continuously full.	A – 3	0.50	30 MPa	2	CSA A23.1
Non-Structurally reinforced concrete exposed to moderate manure and/or silage gases and liquids, without freeze thaw exposure. Examples: interior slabs on grade.	A – 4	0.55	25 MPa	2	CSA A23.1
Plain unreinforced concrete not in contact with manure or manure gases. Examples: footings, interior walls, beams, columns and slabs not exposed to agricultural waste.	N	0.55	25 MPa	–	CFBA Guidelines

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Requirements for the Air Content Categories

CSA A23.1 – Table 4

	Range in air content* for concretes with indicated nominal maximum sizes of coarse aggregate, %		
Air content category	10 mm	14-20 mm	28-40 mm
1	6-9	5-8	4-7
2	5-8	4-7	3-6

**At the point of discharge from the delivery equipment, unless otherwise specified.*

The following items should also be considered by the designer:

- The minimum thickness of all concrete floor slabs on grade in permanent liquid nutrient storage facilities should be **125 mm** or as required satisfying the concrete cover requirements.
- Cracking should be controlled by the proper use and construction of control joints, expansion joints, and isolation joints as specified by the engineer.
- All materials used to make concrete and methods of concrete production and construction should conform to CSA A23.1 and the concrete producer should have a valid **"Certificate of Ready Mixed Concrete Production Facilities"** as issued by the Ready Mixed Concrete Association of Ontario.
- Products for concrete mix enhancement such as high-performance concrete, fly-ash and chemical admixtures may be used to improve the structural design and performance. Chemical admixtures should meet the requirements of CSA A23.1.
- The use of water-reducing admixtures is recommended to improve workability and the overall performance of the concrete.

2006 Ontario Building Code requirements for Manure Storage Tanks

The most recent edition of the OBC adds the following concrete requirements in section 4.4.5.1

- Type 50 Cement

- Minimum 28-day strength of 32 MPa
- Maximum W/CM ratio of 0.45

While Type 50 (Type HS) cement is typically not available in Ontario, the equivalent performance can be achieved via the use of supplementary cementing materials such as slag and fly ash (Type HS_b cement) as identified in CSA A23.1 Table 3. Speak to your local RMCAO member about how this requirement will be met on your project.

References:
1 CSA A23.1-09 – Concrete Materials and Methods of Concrete Construction, Canadian Standards Association International
2 Ontario Building Code - 2006, Ontario Ministry of Municipal Affairs and Housing – Housing Development and Buildings Branch
3 National Farm Building Code of Canada 1995, Canadian Commission on Building and Fire Codes, National Research Council of Canada
4 Concrete Manure Storage Structures – Specifications and Standards in Canada, Cement Association of Canada
5 Canadian Farm Builders Association – Guidelines for Concrete Specifications

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