



# Agricultural Concrete Requirements



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
- Nutrient Management Act, 2002
- NSTS – 04: Concrete, Steel or Equivalent Storage Facilities



While all of these standards make specific references to concrete construction requirements, the most stringent requirements are included in both CSA A23.1 & NSTS – 04 as follows:

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.	<b>A – 1</b>	<b>0.40</b>	<b>35 MPa</b>	<b>1</b>	CSA A23.1 NSTS – 04
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.	<b>A – 2</b>	<b>0.45</b>	<b>32 MPa</b>	<b>1</b>	CSA A23.1 NSTS – 04
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.	<b>A – 3</b>	<b>0.50</b>	<b>30 MPa</b>	<b>1</b>	CSA A23.1 NSTS – 04
Non-Structurally reinforced concrete exposed to moderate manure and/or silage gases and liquids, without freeze thaw exposure. Examples: interior slabs on grade.	<b>A – 4</b>	<b>0.55</b>	<b>25 MPa</b>	<b>1</b>	CSA A23.1 NSTS – 04
Plain unreinforced concrete not in contact with manure or manure gases. Examples: footings, interior walls, beams, columns and slabs not exposed to agricultural waste.	<b>N</b>	<b>0.55</b>	<b>25 MPa</b>	<b>-</b>	NSTS – 04

## Requirements for the Air Content Categories

CSA A23.1 – Table 4

Air content category	Range in air content* for concretes with indicated nominal maximum sizes of coarse aggregate, %		
	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.

**Note:** Air contents measured after pumping or slip forming may be significantly lower than those measured at the end of the chute.



**NSTS – 04** Concrete, Steel or Equivalent Storage Facilities also includes the following requirements that are critical to concrete agricultural projects in Ontario:

- 6.4.1 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.
- 6.4.4.1 Cracking should be controlled by the proper use and construction of control joints, expansion joints, and isolation joints as specified by the engineer.
- 10.2 Concrete Materials – 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.
- 10.4 Air Entrainment – as per Table 4, CSA A23.1 (Note: NSTS-04 Specifies Air Content Category 1 for all concrete exposure conditions)

- 10.5 Admixtures – 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. Note: The use of water-reducing admixtures is recommended to improve workability and the overall performance of the concrete.



Photo courtesy of CAC

References:

- 1 CSA A23.1-04 – Concrete Materials and Methods of Concrete Construction, Canadian Standards Association International
- 2 Ontario Building Code – 1997, 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 Nutrient Management Act, 2002, Ontario Ministry of Agriculture and Food
- 5 NSTS – 04 , Concrete, Steel or Equivalent Storage Facilities, Ontario Regulation 267/03, Ontario Ministry of Agriculture and Food
- 6 Concrete Manure Storage Structures – Specifications and Standards in Canada, Cement Association of Canada

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