



CONCRETE THINKING IN AGRICULTURAL SOLUTIONS



CONCRETE STORAGE STRUCTURES BETTER STORAGE SOLUTIONS FOR LIQUID MANURE

The need to find efficient, safe, and cost-effective manure management solutions is paramount. Odour and disease control, as well as water quality protection, have become priority issues to Canadian farmers and their surrounding communities.

WHY USE CONCRETE FOR MANURE CONTAINMENT?



DURABLE, SAFE STORAGE

Concrete manure storage tanks are a key component of safe, modern manure management systems. These systems are designed to turn manure into cost-effective, organic fertilizer. They offer a dependable storage solution with an enduring service life.

ENVIRONMENTALLY SOUND

Concrete tanks are an excellent choice where odour, sensitive soil and groundwater conditions are a concern. Over the years, literally thousands of above and below grade manure pits and tanks have been constructed of concrete and continue to provide durable, economical and safe containment. The displacement of energy intensive inorganic fertilizer with organic fertilizer is another desirable and environmentally sound agronomic practice that can be achieved with this concrete-based storage system.

FLEXIBLE DESIGNS

Flexibility in design is an inherent characteristic of concrete tanks making them adaptable to any type of loading or agitation system. In particular where land constraints are a concern, concrete tanks are an ideal storage solution. They can be designed to have a lower exposed surface area to volume ratio than other solutions resulting in less nitrogen/nutrient loss to the atmosphere from evaporation.

KEY DESIGN CONSIDERATIONS

The primary objective in the design of a concrete manure storage facility is the construction of an economical, structurally sound and leak-free structure. In the design of concrete facility, there are three key areas of consideration:

- concrete material specifications
- structural design, including loads, strength and soil conditions
- construction considerations such as water stops, curing, etc.

Proper reinforcement, water tightness, concrete mix design as well as internal and external load factors must be seriously considered. Product design specifications as outlined in Canadian Standards Association (CSA) and American Concrete Institute (ACI) standards must be strictly adhered to.



ENGINEERING REQUIREMENTS

It is worth noting that, the engineer whose professional seal appears on the design drawings is responsible for both the completeness of data acquired and the design of the concrete manure storage foundation, floors, walls, partitions and covers. Where applicable, the engineer is also responsible for the design of the transfer piping from the source of the liquid manure to the storage, access ramps or pads for portable pumps and agitators, the soil drainage system, safety fencing and monitoring wells.

A professional engineer must be retained to design cast-in-place or precast concrete manure storage tanks. In addition, construction should be supervised by the design engineer to ensure that tank construction conforms to design intent and to specified industry standards. In many areas of the country, building permits are required from municipal or provincial governments who have established standards for design and site placement.



FLEXIBLE SOLUTIONS

TYPES OF CONCRETE TANKS

CUSTOM DESIGNED SOLUTIONS

Liquid manure concrete storage tanks can be constructed in any size to suit a producer's individual requirements. In addition, they can be fabricated using either cast-in-place or precast constructed techniques. The standard types of concrete manure storage tanks currently available in Canada are as follows:

RECTANGULAR UNDERGROUND TANKS

Small short-term storage has traditionally consisted of rectangular underground tanks that are 2.4 metres in depth with a concrete floor, walls and roof. Rectangular tanks usually require a roof to provide lateral support at the top of the walls. Covered tanks are gaining in popularity with the trend towards reduced odour emissions.

CIRCULAR TANKS

Circular, uncovered tanks offer the most cost-effective alternative for long term storage. The circular configuration makes it possible to design an open topped structure in which the walls are self-supporting. However, with increasing environmental concerns and the desire to reduce odour emissions, covered tanks are now more in demand. The tank height and diameter are designed to optimize overall economy while providing the required storage volume.

Often tanks are built partially below grade to ensure the footings are below the frost line. This depth will vary from 0.6 m in warmer areas to 2 m in the coldest zones. Care must be taken to ensure that the base of the tank is located above the water table.

Circular concrete tanks are available in both precast and cast-in-place designs.

A. Circular Cast-in-place Tanks

Cast-in-place tanks are formed in two ways – conventional plywood or steel forming systems and plastic forms that remain in place after the pour. The following features are typical of cast-in-place concrete manure tanks:

- they are the least expensive of any type of manure storage tank
- they can be constructed by local trades and Ready-Mix suppliers
- they may be completely above grade or partially below grade
- typical concrete specifications include a minimum 28 day compressive strength of 30 MPa and a maximum water cementing materials ratio (w/cm) of 0.45
- reinforcement varies with tank height, diameter and structural system, and
- a wide variety of agitation and pump-out equipment can be utilized without fear of compromising the containment.

B. Circular Precast Tanks:

Precast concrete manure storage tanks normally consist of prestressed wall sections that are post tensioned with cables. A grout or sealant is used to water proof the panel joints. The following features are typical of precast concrete manure tanks:

- larger tank sizes are possible with precast vs. cast-in-place construction
- most suitable for above grade construction
- due to the high level of quality control in a precast factory, precast tanks can be constructed to an extremely high standard of quality
- prefabricated in the factory, the component arrives ready to install.



Liquid manure concrete storage tanks can be constructed in any size to suit a producer's individual requirements.





BENEFITS OF CONCRETE FOR MANURE CONTAINMENT

- Low maintenance
- Dependable product quality
- Design flexibility to meet any project requirements
- Safe to build in areas with high water tables
- Widely available materials and workmanship
- Resistant to vandalism and tampering
- Reliable product for safe, long-life containment
- Reduced odour and ammonia emissions
- Controlled manure discharge to protect surrounding environment
- Uses less space where project sites are limited or restricted
- Adaptable to any type of charging system.



CONCRETETHINKING
in agricultural solutions



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For more information
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Manitoba	(204) 667-8539
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Canadian Precast/Prestressed Concrete Institute (CPCI):

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