

ENSURING SAFETY AND INTEGRITY

Grain storage structures must be designed, constructed, maintained and inspected properly to ensure structural integrity and safety. The following guidelines can help you avoid accidents by constructing safer storage structures.

Suitable Design

Grain storage structures are among the most heavily loaded of agricultural buildings. The pressure on foundations is typically 4,000 pounds per square foot (psf), but can run as high as 7,000 psf. That makes choosing a specialized and reputable engineer and bin manufacturer critical. The designer must first determine what material will be stored as well as its flow properties. Other considerations are flow channel geometry, flow and static pressure, and dynamic effects. Non-uniform loads, thermal loading, and the effects of non-standard fabrication details must also be considered. The grain storage structure may seem simple but there are many complex conditions to account for during the design.

Proper Construction

Proper design is effective only when construction remains consistent with the design plan. Trying to save on construction costs is no bargain if structural integrity is compromised. Some common construction errors include:

- Improperly mixing concrete
- Improperly constructing or installing bar roof joists
- Using steel-structured roofs as support for other grain handling equipment
- Using metal bin sidewalls for leg or tower support
- Installing side draws, resulting in off-center unloading
- Insufficient quantity of rebar (applies to both bin walls and all foundations)
- Improper placement of rebar

Hire only qualified contractors, conduct quality control inspections during construction and enforce all design specifications to avoid potential errors.

Appropriate Use and Adequate Maintenance

Grain storage structures are subject to the most significant pressure when they're being loaded and unloaded. Always follow contractor and manufacturer procedures and instructions regarding use and maintenance. Also, train your employees to use the proper loading and unloading techniques.

- Check for cracks in concrete tank sidewalls; look for vertical cracks, focusing on the mid- and lower-third of the outer wall
- Look for water ponding on flat concrete roofs, which can indicate a sagging support structure
- Look for missing bolts in steel tanks and metal bins, signaling the need for a complete inspection
- Check seams in welded steel tanks for rust and deterioration
- Pinpoint the presence of concrete tunnel cracks, which are usually a sign of uneven settling and will stabilize as structures mature.
- Get a professional inspection if new cracks appear
- Perform routine inspections around side draws to spot potential signs of structural weakness
- Check the security of roof connections on metal bins and verify that overhangs are even all around
- Check the security of anchors and cables on flat grain storage structures
- Check for bulging or out-of-round bins, indicating defects or improper use
- Check bin foundations for cracking, which can indicate excessive uneven settlement
- Check cribbing in wood structures for wear from grain movements; years of use can wear cribbing away and make it thin and weak



Grain structure failures are often the result of improperly trained and inattentive operators. Failures may also result from normal wear and tear and/or:

- Installing side-draw discharges improperly – flumes should be installed above the discharge opening
- Unloading bins too quickly or from an off-center location
- Allowing roof vents to plug or freeze over while unloading
- Roof failure caused by the pull of grain on improperly suspended temperature probes
- Aerating grain when vents are plugged
- Failing to perform adequate maintenance and repair

Regular Inspection

An ounce of inspection may prevent a ton of reconstruction. Accidents can result from:

- Failing to perform adequate maintenance and repair
- Improper maintenance and repair of cribbing, beams and corner bracing
- Insects, dry rot or water damage that weakens or destroys wood structures
- Improper design of discharges and openings
- Foundation failures
- Failing to replace worn deflectors, allowing grain to shoot against sidewalls and lead to the uneven loading of bins
- Overfilling bins, causing roofs to burst from pressure
- Overfilling flat storage buildings, filling grain above the design maximum fill line
- Improper aeration resulting in wet grain that creates excessive sidewall pressure and buckling
- Failing to reinstall door reinforcing rods, resulting in damage around side door frame
- Improper or defective anchoring of bins and tanks



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