

Ensuring safety and integrity

Grain storage structures must be designed, constructed, maintained and inspected properly to ensure structural integrity and safety. Follow these guidelines to avoid disaster:

Suitable design

Grain storage structures are among the most heavily loaded agricultural buildings. The pressure on foundations is typically 4,000 pounds per square feet (psf), but it can run as high as 7,000 psf. That's why it's vital to choose a specialized and reputable engineer and bin manufacturer. The designer must first determine what material will be stored to properly account for its flow properties. Other considerations are flow channel geometry, flow and static pressure, and dynamic effects. Nonuniform loads, thermal loading and the effects of nonstandard fabrication details must also be considered. The grain storage structure may seem simple, but there are many complex conditions to consider 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

Many of these errors can be prevented by hiring only qualified contractors, conducting quality control inspections during construction and enforcing all design specifications.

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 middle and lower thirds of the outer wall
- Look for water ponding on flat concrete roofs; this 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 location(s) of concrete tunnel cracks, which are usually a sign of uneven settling; they 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 having improperly trained or 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
- Suspending temperature probes improperly, which can cause roof failure when grain is allowed to pull on them
- 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:

- Failure 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
- Failure to replace worn deflectors, allowing grain to shoot against sidewalls and lead to the uneven loading of bins
- Overfull bins, which can cause roofs to burst from pressure
- Overfull flat storage buildings (filling grain above the design maximum fill line), which could cause failure
- Improper aeration resulting in wet grain that creates excessive sidewall pressure and buckling
- Failure to reinstall door reinforcing rods, resulting in damage around side door frame
- Improper or defective anchoring of bins and tanks

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