

Grain Aeration System Design

ADM, Beech Grove, IN

Brent Cox, Lee Franklin, Kent Schroeder

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Problem:

This grain facility currently has grain bins with aeration systems that do not meet safety regulations, therefore not allowing this grain to be aerated.

- Fans must be relocated to outside of cement structure.
- Aeration "skins" inside of bin are damaged, allowing grain to enter the duct work.
- Transition duct work is collapsing from weight of grain collecting inside. This has made an unsafe work environment.

Objective:

To provide a design of an adequate grain aeration system that meets the needs of ADM.

- Provide at least two solutions to the problem.
- Supply a cost analysis for each solution.
- Give layout drawings of new equipment.



Information about the project.

- Facility has 6 identical 100,000 bushel hopper bottom concrete silos.
- This facility currently cannot aerate any of this 600,00 bushels of storage because it does not meet safety regulations and equipment is not adequate or efficient enough to meet current needs.
- This aeration system is a negative pressure system (pulls air down through the grain from roof inlets) which will affect design requirements.



Current situation with fans located inside structure.



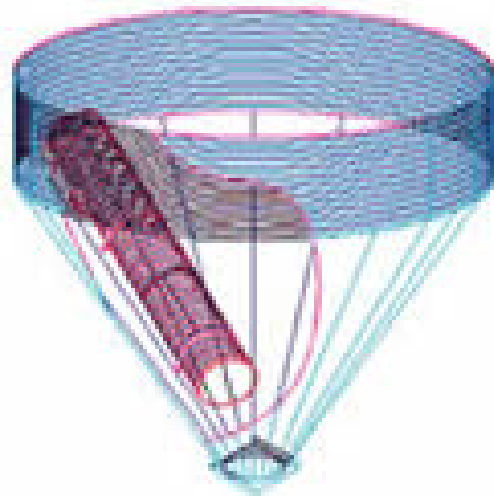
Requirements for new system design.

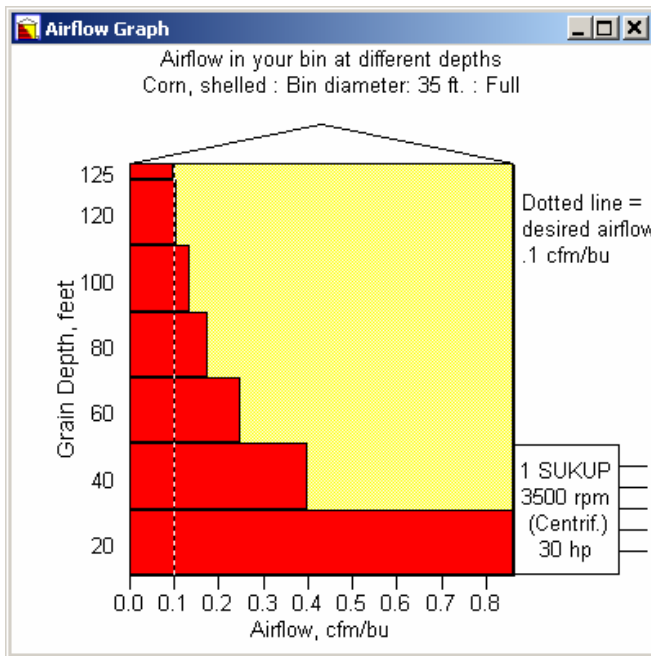
System must adequately aerate grain in efficient and safe manner while meeting industry standards.

- Fans must be relocated outside of structure.
- All duct work must be adequately supported overhead.
- ADM requires that this system be able to provide 0.1 cfm/bushel of air to the bin.

Aeration for hopper bottom bins.

- Each bin has three identical semi-circular aeration ducts on the hopper bottom that will provide the aeration. (As depicted in red)
- Currently many of these ducts are damaged, which will not allow proper aeration.





Airflow vs. Grain Depth

This illustration shows how airflow will change as depth increases.

- In order to reach the desired airflow for the entire bin, the airflow will be greater at the initial depths.
- Obtaining the desired airflow requires a larger hp fan, because of the large volume of grain the air must travel through.
- The increased depth also increases the static pressure which requires a larger fan.

Equipment Requirements

- Large horsepower fan.
- Transition duct work.
- Aeration "skins" inside bin.

Overall Cost Analysis for Differently Designed Aeration Systems

Plan	Fan Prices	Duct Prices
A	\$1745 - \$3858	\$945 - \$1312.50
B	\$2070 - \$5011	\$1161 - \$1612.50
C	\$2070 - \$5011	\$1791 - \$2487.50
D	\$1450 - \$3604	\$315 - \$437.50

*Prices are shown in a range because we priced equipment and supplies at various distributors (listed in report) to give ADM a comparison for making their final purchasing decision. Plans A-D represent different duct layouts for different bin configurations.

This drawing shows a cut-away view of the hopper bottom bin with aeration skins and the new transition duct work that will provide aeration to the bin.

