Considerations Before Purchasing Arch Frame Buildings

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Pre-engineered buildings such as fabric covered arch-framed buildings or hoop barns, are common in Ontario's Agricultural Community. These structures are used for hay, machinery and manure storages as well to house sheep. Properly engineered, constructed and maintained they can offer years of useful economic service.

These buildings are not considered to be temporary buildings. A Building Permit is required and if used for livestock housing for more than 5 Nutrient Units (40 meat ewes or 100 Feeder Lambs) or as manure storages they will require a NMS (Nutrient Management Strategy) approved by OMAFRA and if greater than 300 Nutrient Units an approved NMP (Nutrient Management Plan) as well. The NMS and NMP must be prepared by a certified person. In unorganized municipalities where there may be no building permit requirements, a NMS must still be prepared and kept on the farm. Livestock housing and manure storages will also be required to be set back from conflicting land uses as per the Minimum Distance Separation formula, even for capacities less than 5 Nutrient Units. It is also required to file an engineering design with the municipal building official as well if deemed necessary by the official.

Arch Frame structures are subjected to the same snow and wind loads as other types of buildings and should be designed as such. In order for a Farm Building to qualify as a Greenhouse and allowed designed uniform snow load of 0.7 kPa (14.6 lbs/ft^2) it **MUST** have a heating and drainage system installed specifically to prevent the accumulation of snow. Having the building occupied by animals or having a clear plastic covering does **NOT** qualify as a heating system.

These types of structures due to their profile can be subjected to unbalanced loading (accumulation on one side of the structure from drifting and sliding snow and ice) as well. This pile of snow and ice in extreme cases if not designed for, can create significant pressures pushing in on the wall of the structure. These buildings should be located away from other structures such as barns and silos where snow and ice could slide off and onto the roof of the hoop barn.

Arch Frame buildings are commonly constructed on two types of foundation systems, On Grade and On Posts. Both systems have their advantages and disadvantages.

On Grade systems have the steel frames anchored directly to the concrete floor. This provides the best support for the structure as the horizontal forces generated by the roof loads are carried

by the concrete floor. The disadvantage of these systems is that the roof covering must be protected from livestock damage.

On Post systems are favored as they provide a more usable height along the wall. Since the steel frames impose a significant outward thrust on these posts, there must be some features designed so as to counter act these forces. The higher the wall, the more significant these forces become. Often designers use tie rods connecting the two sides of the building encased in a concrete filled trench under the floor to counteract these forces.

Wind causes both uplift and lateral loading on buildings. As the wind moves up and over the top of a structure it generates significant uplift forces. Typically, the net uplift in a 1 year in 10 design wind can be in the range of 4.2 to 8.4 lbs/ft^2. For example a building 27' by 50' could potentially have an uplift force of 11, 250 lbs, and this can double for short periods due to gusting. If this force has not been accommodated in the design and construction of the building, there is a significant risk of total failure.

Lateral wind loads that try to push the structure over must also be designed for as well. The use of diagonal cables and structural members is commonly used to perform this function. Further more the tarp covering must be tightened regularly to insure that it is not damaged by flapping in the wind.

In summary, fabric covered arch framed structures for farm buildings are subject to same building codes and engineering design principles as all other farm buildings. More importantly, for a safe environment for yourself and your animals and a useful structure for the future ensure that the building is properly designed, constructed and maintained for the purpose that it is intended for.

This article was adapted from a factsheet on **Plastic and Fabric Covered Arch Frame Buildings** written by Harold House, Harry Huffman and John Johnson