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Shade Options for Grazing Cattle

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Shade is a must for pasture-based grazing systems. It curtails heat stress, which is detrimental to cattle and causes a decrease in milk production, feed intake, weight gains, and fertility.

Heat stress is made worse in Kentucky and other humid parts of the eastern United States by the endophytic fungi that infect tall fescue, which is one of the most widely grown pasture grasses in the region. It's estimated that up to 95% of tall fescue pastures are infected with endophytes. Cattle grazing endophyte-infected pastures experience increased body temperatures, largely from their inability to effectively transfer heat from their skin by sweating.

Heat Stress in Cattle

For dairy and beef cattle, the ideal ambient temperature is between 41° and 77° F. When temperatures are over 77° F, cattle may begin to experience heat stress depending on a number of environmental factors, including relative humidity, solar radiation, wind speed, access to water, and diet. Other factors, such as the amount of vegetation present, can also impact heat stress. Dry lots with limited to no vegetation will reflect more light and heat than thick grass pastures, as will graveled and concrete areas. Controlling the amount of solar radiation that cattle receive is one of the best methods of reducing heat stress.

Heat stress can vary with cattle characteristics. Cattle with dark coats experience higher body temperatures than those with light ones. For the genotype *Bos Taurus*, the inward flow of heat was 28% greater for cattle with dark red coats as compared to those with white coats. Heavy cattle are more susceptible to heat stress than lighter cattle because of the increased fat deposits. The increased metabolic heat produced by lactating cattle also makes them more susceptible to heat stress. Sick or stressed cattle are also more affected by heat stress than healthy cattle.

Signs of heat stress, such as increased water intake or reduced feed intake, may be subtle and therefore difficult to recognize. Other signs, such as increased respiration rate (greater than 90 breaths per minute), standing versus lying down, and congregating under shade or at water sources are more easily identified. As both temperature and humidity play a significant role in heat stress, looking at the combined impact of these factors can help identify potentially dangerous conditions for cattle. Figure 1 shows the various temperature and humidity combinations that result in low to high heat stress.

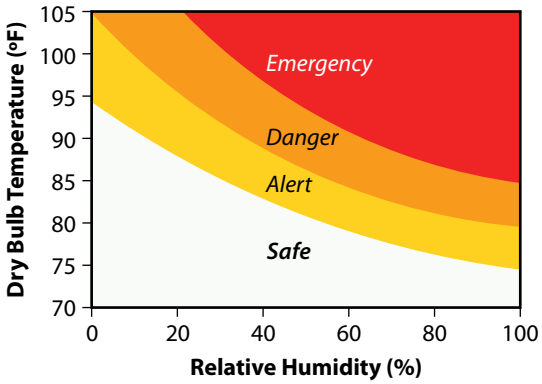


Figure 1. Livestock Heat Stress Guide. Adapted from the Livestock Weather Hazard Guide, Samuel Roberts Noble Foundation, Inc.

Benefits of Shade

Although animals tend to reduce feed intake when they congregate under shade, there are benefits to shade in pasture-based grazing systems, which are explained in this publication.

Although the benefits of providing shade to cattle will vary depending on factors such as breed, coat color, weight, health, and lactation status, producers may be able to increase production and improve pasture use and water quality by providing it.

Weight Gain

Research at the University of Kentucky's Animal Research Center indicated that beef cows and calves showed improved weight gain with the use of portable shade during the heat stress periods of spring and early summer. An increase of 1.25 lb per day for cows, 0.41 lb per day for calves, and 0.89 lb per day for steers was achieved when shade was provided. Research at the University of Missouri found that providing shade had the biggest effect on cattle grazing endophyte-infected pastures. Those cattle gained 0.72 lb per day more than cattle without shade. At the University of Arkansas, researchers found that providing cattle with artificial shade resulted in an average daily gain of more than 20% compared to cattle with no shade, and cattle with tree shade showed nearly a 60% increase compared to those with no shade.

This publication is dedicated to the memory of Larry W. Turner, Ph.D., whose work helped make it possible. Some of the ideas and designs in this publication are based on his work as a specialist.

Milk Production

Research at the University of Florida indicated that dairy cows provided with shade produced 10-19% more milk than cows without shade. Virginia Tech researchers found that high levels of heat stress, experienced when temperatures exceed 90°F, can reduce milk production by 20 to 30% (10-25 lb of milk per day). Cows that were cooled peaked at 9 lb more milk per day as compared to cows that had not been cooled.

Fertility

Research at the University of Florida found that cattle provided with shade had conception rates of 44.4% as compared to conception rates of 25.3% for cattle without shade. At the University of Missouri, researchers found that shade increased the overall pregnancy rate of cows by nearly 40%. Cows with shade had an overall pregnancy rate of 87.5%, while the pregnancy rate was only 50% for cows without shade. Research has shown that bulls with access to shade have increased semen counts.

Improved Pasture Use

Cattle drink water to lower their body temperature, so when they're heat stressed, cattle will congregate closer to water sources, which results in overgrazing near the water source and undergrazing farther away from it. Therefore, incorporating shade throughout pastures can result in more even pasture use—silvopastures (trees, forage, and livestock combined) have been shown to result in more uniform grazing patterns.

Shade also has a notable effect on grazing patterns. Research at the University of Kentucky found that as heat stress increased, cattle spent a larger amount of time under tree shade.

Improved Water Quality

Researchers at Iowa State University found increased heat stress resulted in cattle spending more time in streams and riparian areas. Cattle loafing in and near streams causes pollution from sediment, nutrients, and pathogens. An off-stream shade source, particularly if it's located at an off-stream source of water, may reduce the time that cattle loaf in streamside areas and thus reduce pollution to water resources.

Figure 2. This shade structure is portable, so it can be moved with the animals. It has a shade cloth roof.

Types of Shade

The following alternatives can be used for shade in grazed pastures.

Natural

Cattle generally prefer shade from trees rather than constructed structures. Trees are effective at blocking incoming solar radiation, and moisture evaporating from their leaves helps cool surrounding air. Though natural shade is low-cost, often it is not where you need it, and there are other disadvantages.If there are not enough trees for the number of cattle, they will congregate under the trees, eroding the soil and exposing the roots, which can damage or kill the trees. The typical condition the trees experience is called "heart rot." In many cases, trees are located near riparian areas, and if cattle congregate in those areas, off-site runoff of soil and manure into adjacent streams or water bodies can occur. One option is to rotate cattle through naturally shaded pastures during periods of heat stress and allow these pastures to rest during cooler periods. Exposed roots can be covered with topsoil and grass sown to control erosion and provide cool bedding for the cattle. Using strategic plantings can increase natural pasture shade. Planting shade trees on the west side of pastures will provide protection from the afternoon sun. Feed and water can be located close to the existing or planned natural shade.

Permanent

Permanent shade can be provided by constructing barns or sheds. It is most often provided for dry lots and bull lots. Often in a grazing system, permanent shade is not located where it's needed, and it can be costly.

Portable

Portable, low-cost shade structures can be built from 2.5 in pipe and welded into a frame sturdy enough to withstand cattle (see the attached plan sheet). For rotational grazing, the frames can be moved with the animals or relocated to cleaner, drier parts of the pasture to avoid high manure buildup. Frames should have a skid-type bottom for easier transport. A portable shade structure should be no more than 10 x 20 ft to be practical.

Table 1. Suggested shade requirements for beef and dairy cattle (75% of optimum amount).

Animal Type	Space Requirement (square feet/head)
400 lb calves	15-20
800 lb feeders	20-25
Beef cows	30-40
Dairy cows	40-50

Note: These recommendations are based upon limited UK research results and previous experience; additional research is needed regarding the benefits and optimum size to improve production, welfare, and economics.

Shade cloth is typically used as the roof covering to allow air movement. Use a cloth that reduces light by 80%. Shade cloth is commonly available in black, though lighter colors reflect more heat. If secured tightly to the frame, shade cloth can last about five years before it needs to be replaced. You can also use solid roofing, such as corrugated metal, which is a cost-effective, low-maintenance option.

Requirements

Research indicates that a well-designed portable shade structure can reduce total heat load by 30 to 50%. The amount of shade needed depends on the type and age of the cattle. The optimum recommendation is approximately 40-70 square feet/head of shade for mature cows on pasture, but that's difficult to achieve. A practical compromise is to provide 75% of this requirement (Table 1). For example, a 30-cow beef herd would require 900 to 1,200 square feet of shade, or five to six portable shades (each 10 x 20 ft).

Location and Orientation

Natural ventilation under the portable structure is necessary for cooling. Place the structures at least 50 ft away from large obstructions such as buildings to allow for sufficient airflow. Fencing is not considered an obstruction unless it prevents cattle from accessing the shade. Shade structures should be placed in a north-south orientation to help keep dry the area underneath. Also consider the water source. If cattle have to travel more than 800 ft for water, grazing distribution will be less even. To protect water quality and maximize use of upland pastures, shade structures should be managed and located to lure cattle away from riparian areas and reduce the potential for pollution.

Maintenance

Portable shade structures should be moved periodically. If moving the structures is not feasible, place a heavy traffic pad underneath them to reduce the creation of mud under and around the shaded area.

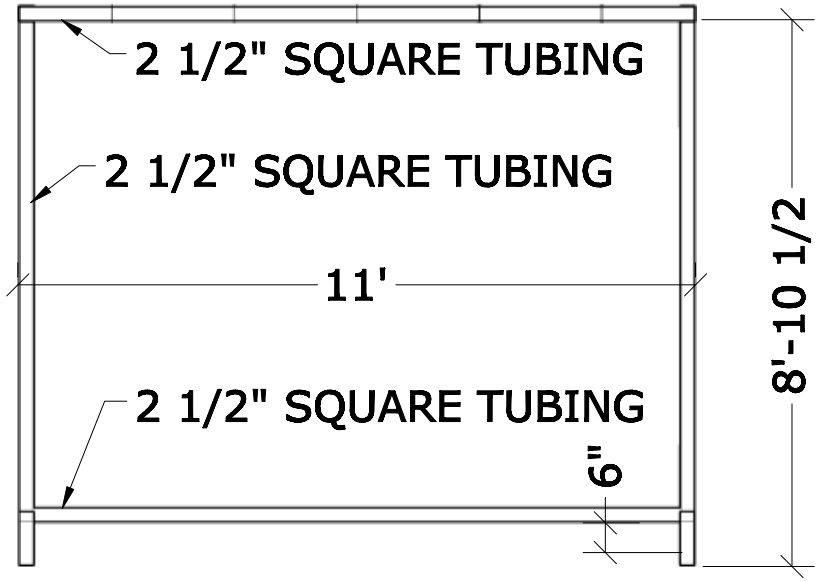
Summary

Heat stress is a major problem for dairy and beef producers in Kentucky, and providing shade can greatly increase production, improve pasture use, and improve water quality.

- For high-producing animals, shade should be provided for at least 75% of the herd in controlled grazing systems, particularly for cattle grazing endophyte-infected fescue. Natural shade, permanent structures, or portable structures can be used.
- Shade cloth that reduces light by 80% should be used for as a roof covering for portable structures. It should be securely attached to the frame and removed in the winter and stored.
- Shade placement will affect the animal grazing patterns and forage use, so you should observe animal traffic patterns and adjust shade locations accordingly for best pasture use.

NOTES:

1. ALL FRAME MEMEBERS ARE SQUARE 2 1/2"X 2 1/2"X3/16" WALL STEEL TUBING
2. ATTACH A 10'X23' 80% SHADE CLOTH TO FRAME.



FRONT VIEW

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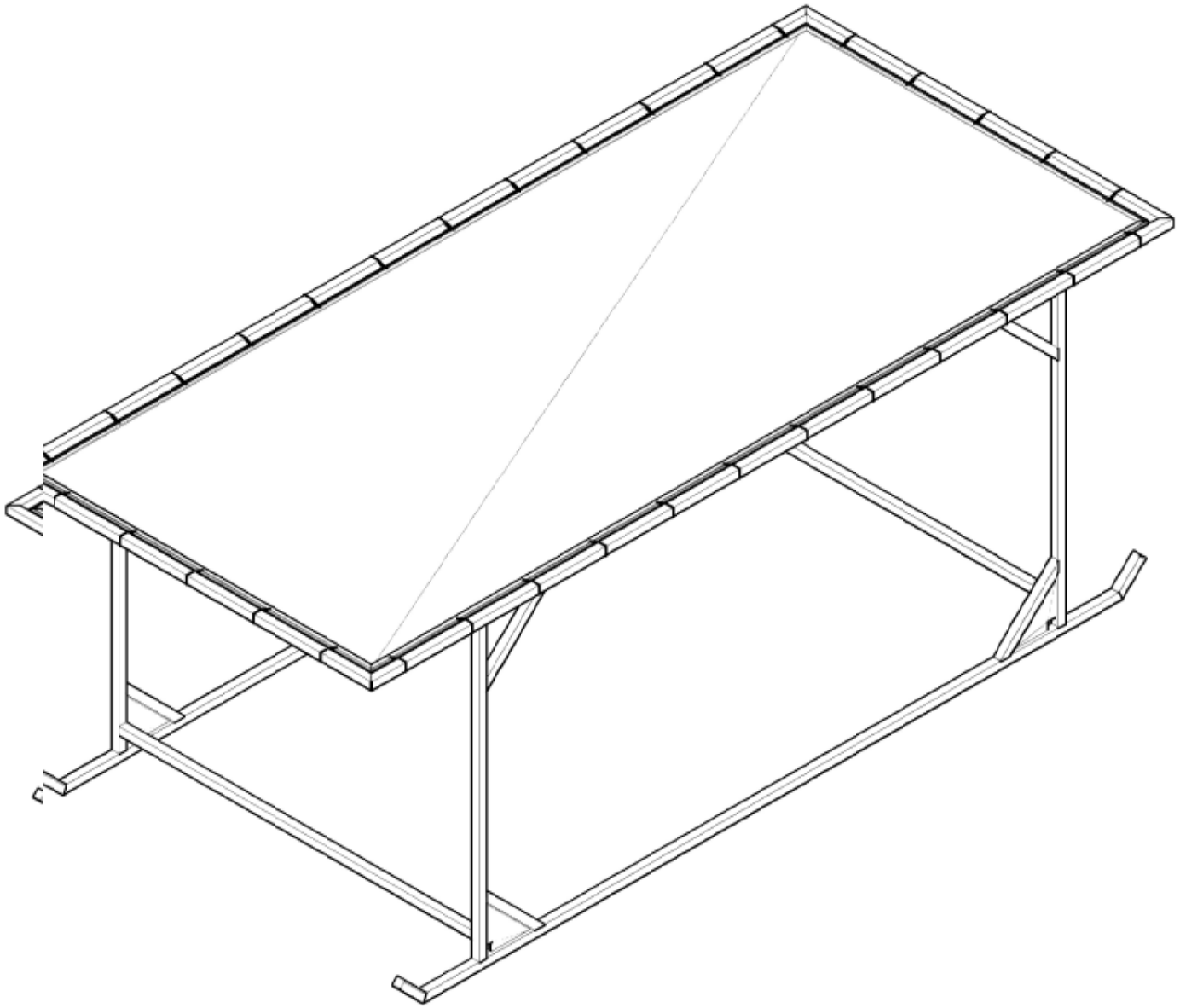
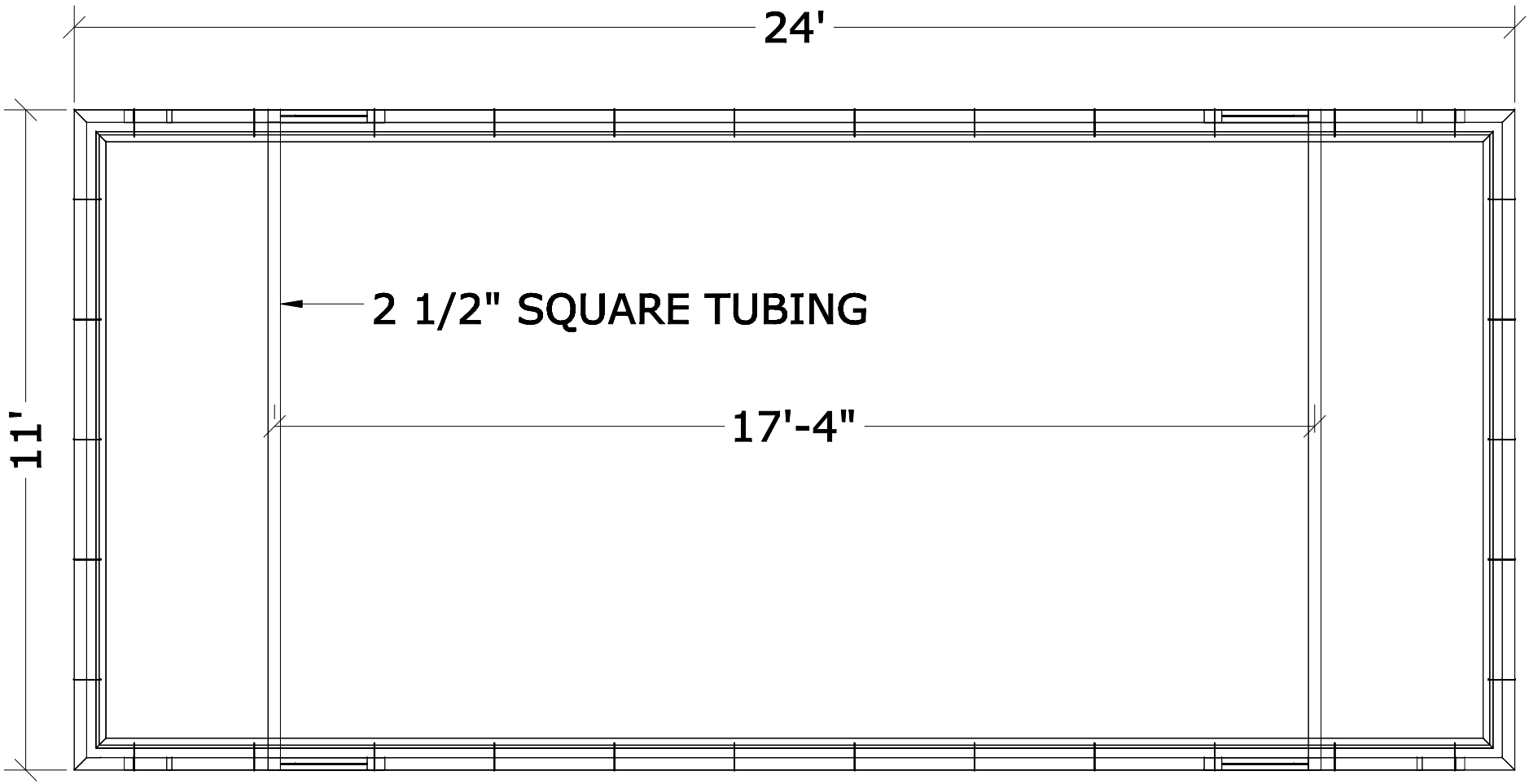


PERSPECTIVE VIEW



PLAN VIEW

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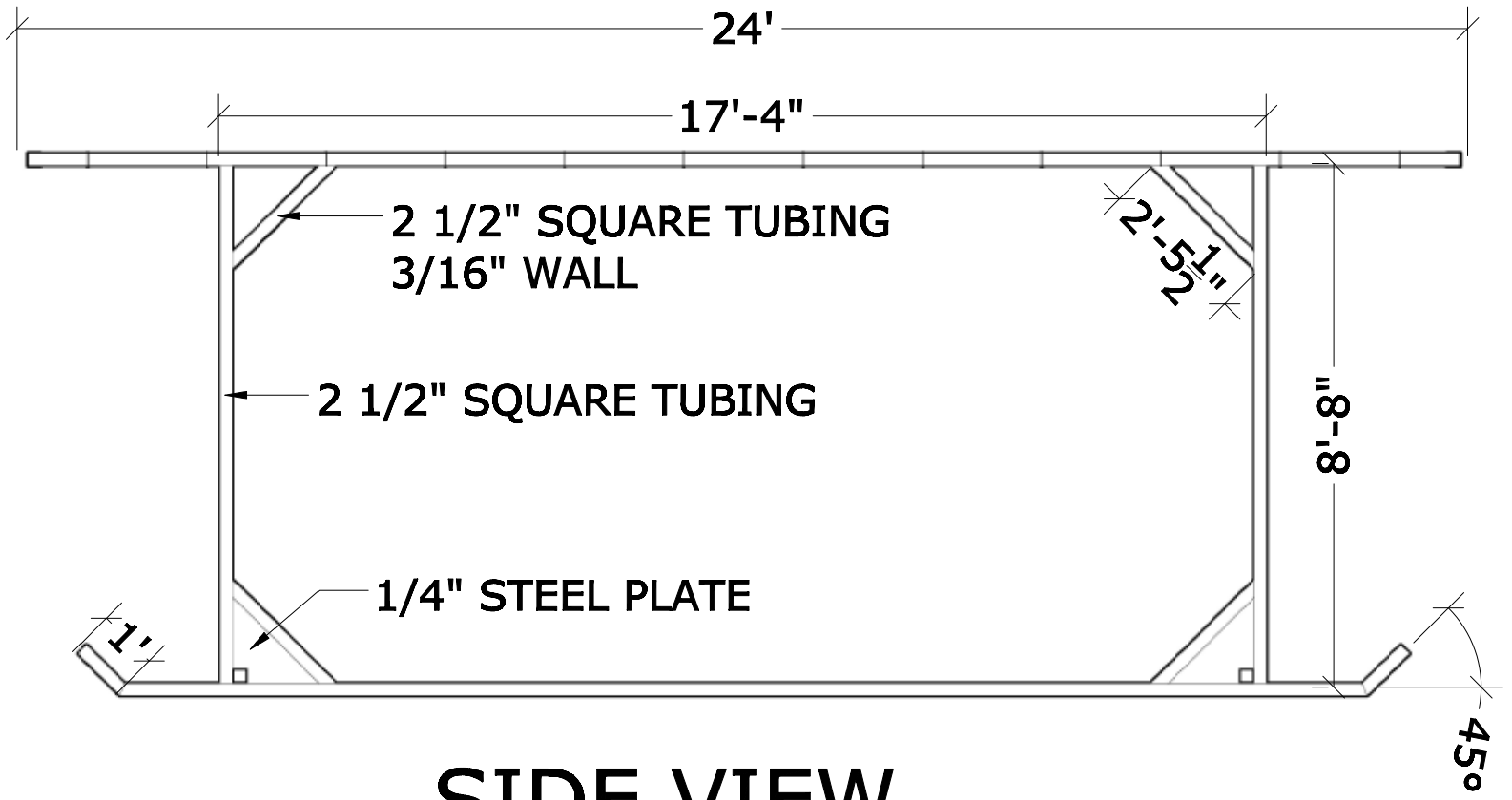

SIDE VIEW

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