DEPARTMENT OF BIOLOGICAL
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Planning Cattle Feedlots

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Construction of a new feedlot or expansion of an existing feedlot requires adequate planning. The goals of planning cattle feedlots are to:

- minimize animal and worker stress during handling,
- feed cattle in an adequate and efficient manner,
- provide well drained cattle space,
- maintain efficiency and profitability of feeding operations, and
- protect the surrounding environment.

Initial Site Planning

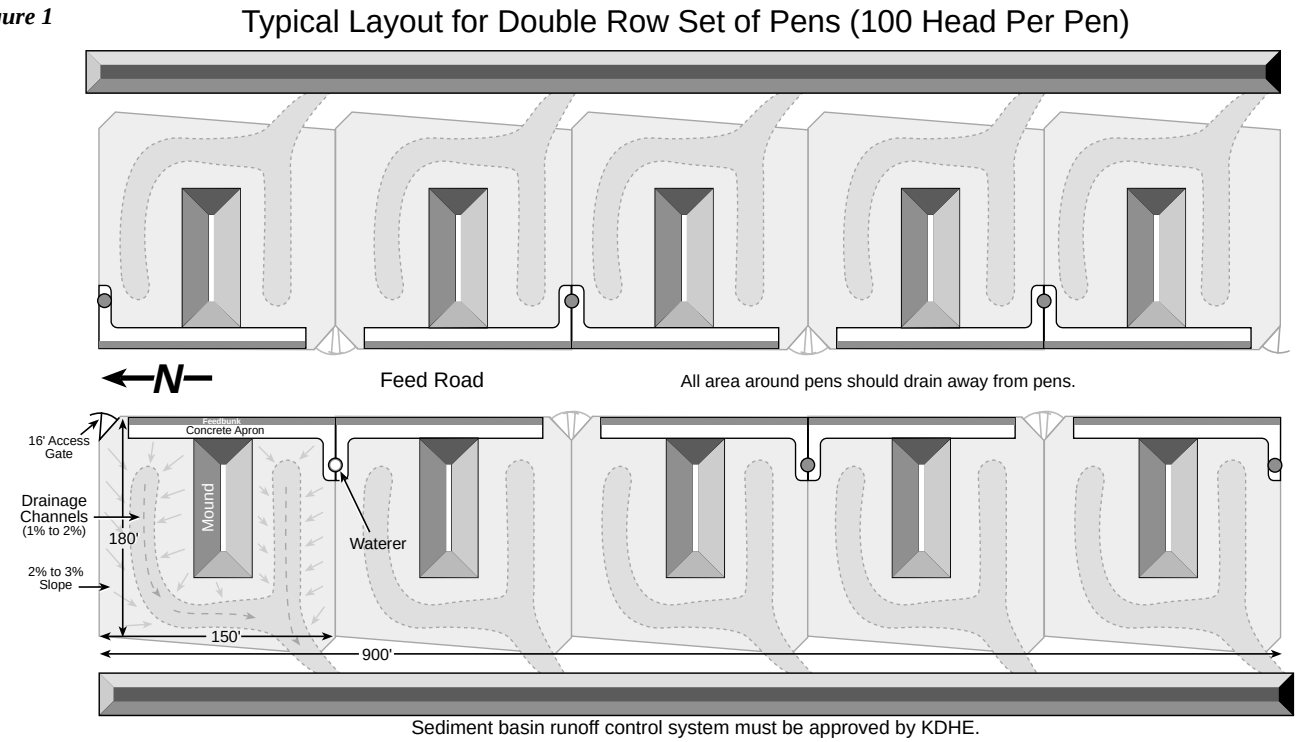
Preliminary site evaluation considers topography, present and future cattle numbers, and accessibility. A 2 to 5 percent land slope is recommended. A soil with 25 percent or more clay is preferred to sand or fractured rock structures. Approximately 1 acre of land is required per 100 head for pen space, alleys, and feed roads. The distance from the bunk to back side of the pen will vary between 175 feet to 250 feet. A minimum of 200 feet from the back side of the pen to nearest water carrying channel is recommended. This allows room for runoff control structures. Water channels can include road ditches, streams, waterways, or pasture draws. Therefore, initial planning requires a minimum distance from the bunks to the water channel of 400 feet. All extraneous runoff needs to be diverted away from the feedlots and roads. For new sites, this is most easily accomplished by siting the feedlots on a ridge or elevating the feed road to construct a diversion channel.

Terrain and drainage determines bunk orientation, but it is preferred to orient the bunks in the north-south direction in a east-west sloping lot. Bunks oriented east-west can have ice accumulate on the north side of the bunks during the winter months. North sloping lots will not dry as quickly during wet weather. Cattle also may be exposed to more severe winds.

Generally, most producers find 300 square feet per head to be adequate pen space. Space may be reduced if the facilities are being located in the western third of the state. In the drier climates, space is often reduced to 200 to 250 square feet per head. Feedlots and runoff control structures need to be a minimum of 100 feet from property lines, 50 feet from rural water lines and 100 feet from the nearest well (preferably downhill from the well). The lowest point of the facilities (normally the bottom of the sediment basin or lagoon) must be at least 10 feet above groundwater.

Site evaluation also includes development and location of the working facilities. Most operations are better suited to move cattle out the lower side of the pens rather than onto the feed road. Using the feed road may save fence construction, but can interfere with truck traffic and create animal and worker stress during handling. Normally 1/8 to 1/2 acre of land is needed for siting the working facilities. Additional space may be needed for sick or receiving pens. Trucks and stock trailers must have easy access to the working facilities. A circular turning area is preferred to the backing of trucks and trailers. Allowing a semi-truck to enter and circle back out the entrance road requires a turning area of 130 to 150 feet in diameter. Similar space is required for many fifth-wheel stock trailers pulled by farm trucks.

Figure 1



Pen Arrangement

Pens are arranged using a single or double row arrangement. A double row arrangement requires locating the pens along a ridge with lot construction on both sides of the feed road (see Figure 1). A single row arrangement typically has feed bunks located on one side of the road and a diversion channel on the other side to carry away extraneous drainage. Often, a single row arrangement is used for operations with less than 800 head and may follow a terrace around a hillside. An advantage of the single row arrangement is only one runoff control structure is required. With a double row arrangement, the runoff must be contained from both sides of the ridge using either two structures or channels to bring the runoff back to a common lagoon. An advantage to the double row arrangement is the cost of the feed road is distributed between two pens rather than one. In larger operations, a wider feed road may be required and thus the cost savings are not as prevalent.

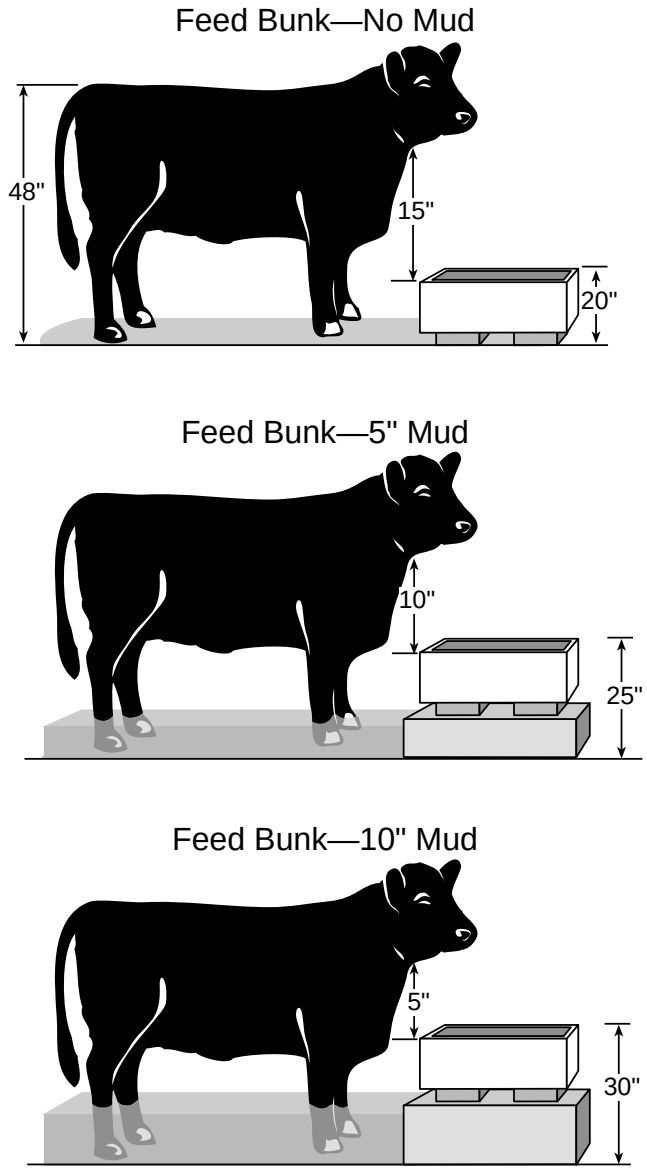
Feed Roads

Most feed roads are 12 to 16 feet wide for single row arrangements. The feed road is sloped away from the feed bunks and pens into a diversion channel. Feed road width with double row arrangements can vary from 16 to 30 feet. The wider road is required if snow or runoff from the road is drained or stored in a center channel of the feed road. The center channel normally drains away from the pens and to one end of the feed road. If the feed road water drains towards the pens, then the feed road should to be crowned in the center. To build an all weather road, adequate road bed preparation (elevation, slope, and drainage) is required prior to placement of 8 to 12 inches of gravel.

Pen Size

Number of cattle in a pen varies from 60 to 150 head. Smaller pens are suggested if cattle are being custom fed or if cattle are being purchased and grouped together. Otherwise, most pens are sized to handle the number of head per either one or two semitrailers. If cattle are 300 to 400 pounds upon arrival, then a typical pen may be 120 head. Incoming cattle in the 500- to 600-pound range can be placed in pens from 80 to 100 head or in pens of 140 to 160 head by combining two semitrailer loads. Receiving pens should be sized to handle no more than one truckload since it is easier to identify stressed animals in smaller group sizes.

Figure 2.



Bunk Space per Animal

Recommended bunk space for backgrounding feedlots (500 to 700 pounds) is 18 inches per head. Younger cattle prefer to eat together and thus require more bunk space than finishing cattle. Finishing cattle operations typically have a bunk space of 9 to 12 inches per head. Frequency of feeding also can influence the bunk space. Once-a-day feeding requires more bunk space for containing the feed than operations feeding two or more times per day. It may be necessary in the receiving pen to allow 24 inches per head to avoid crowding and ensure feed intake upon arrival.

Fence line bunks are preferred to in-pen bunks. Feeding equipment in pens during wet weather can damage the pen surface resulting in reduction of feed efficiency and in some cases damage to the equipment when using in-pen bunks. If in-pen bunks are used, then a gravel packed base should be constructed with the bunks located in the center. A minimum width for the gravel pack is 24 feet, which allows room for cattle to stand on both sides of the bunk and feed equipment to feed on one side of the bunk. The gravel pack should be extended to allow room at the end of the bunks for turning around equipment to exit the pen. Studies show 4 inches of mud reduces feed efficiencies 10 percent per day (see Figure 2). The mud makes it harder for cattle to move around and reduces the their ability to reach the bottom of the bunk. Therefore, firm standing areas near the bunks and waterers are necessary.

Concrete Apron

The concrete apron adjacent to the fence line bunk provides the cattle a firm place to stand while eating. A 12-foot-wide apron is recommended on the cattle side of the bunk. The apron must be wide enough to allow tractors to scrape along the bunk. Rutting of the pen will occur if the tractor travels along the side, rather than on top of the apron. If the feed bunks are resting on the apron, then the total apron width needs to be at least 15 feet. Along the back side of the apron, it is recommended to place a 10- to 20-foot wide section, 8 to 12 inches thick, of gravel screening. This provides some additional solid ground for the cattle to stand during wet weather. A cubic yard of concrete will construct approximately 6 to 8 linear feet of apron if the

Figure 3.

Typical Cross-Section of Feedbunk and Apron

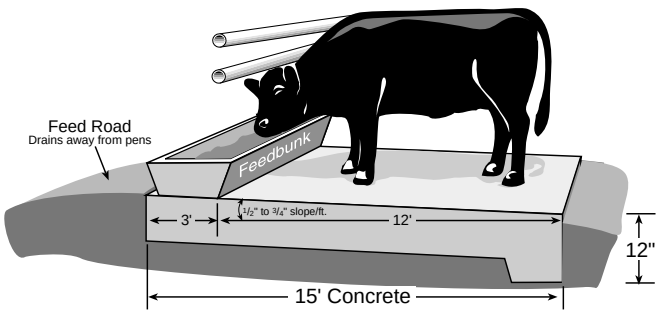
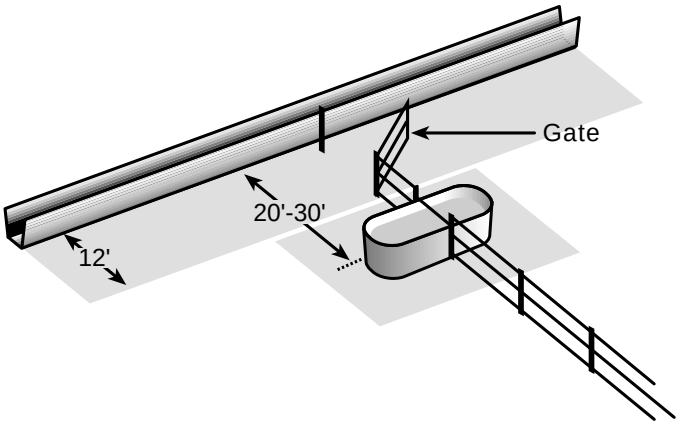


Figure 4. *Water location in a fence line.*



apron is 12 feet wide, 6 inches thick, and has a 12-inch-deep back-edge footing (see Figure 3).

Concrete bunks are more economical than constructing wooden bunks. Concrete bunks either have a round or flat bottom. Normally, the selection of bunk is based on economics. It is easier to clean snow or old feed out of a flat bottom bunk as compared to the round bottom bunks. Movable steel bunks are similar in cost to concrete bunks on a per-foot-basis, but normally are used with in-pen feeding and constructed so cattle can feed from both sides. Bunk life is increased by removal of old feed and maintaining open drain ports in steel bunks. A cable or neck rail extends along the inside of the bunks. Flexibility is added to the pens by using an adjustable neck rail rather than a fixed rail, which is normally positioned for one size of cattle. Provisions for mounting the neck rail must be considered when using posts anchored into the concrete apron, bolted on to the feed bunks, or positioned in the feed bunk base.

Waterer

Most operators use frost-free waterers in the pen. Manufacturer's recommendations for number of head per opening must be followed. Frost-free waterers need to be installed according to manufacturer's recommendation to avoid frozen waterers during the winter months. Waterers can be located in fence lines or the middle of the pen. It is advisable to have a 10-foot concrete apron around the waterer and a 10- to 20-foot wide concrete apron from the feeding apron to the waterer. This is not feasible if the waterer is located at the back of the pen. Having an open water trough for newly arrived cattle can aid initial water consumption until the cattle learn to drink from small automatic waterers. Open tanks or trough waterers require additional consideration for handling of the overflow water to avoid mud holes and ice around the waterer. All water pipes should be insulated to reduce heat loss to the concrete slab where water pipes pass through the concrete slab.

Water consumption varies from 8 to 20 gallons per 1,000 pound animal unit, depending on the weather. Table 1 shows daily water consumption rate based on size and temperature. Daily water usage should be determined based on hot weather needs.

Figure 5.

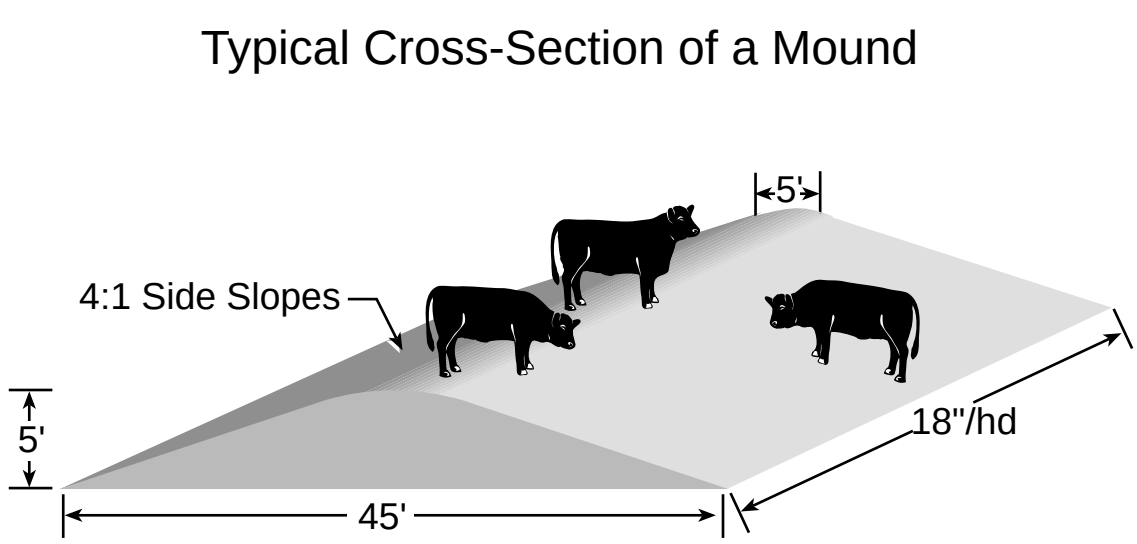


Table 1. *Water System Requirements*

	Daily need, gallons per head	
	50°F	90°F
400 lb calves	5 gallons	10 gallons
800 lb feeders	7	15
1,000 lb feeders	8	17
Cows and Bulls	8	20

Mounds

Mounds are places for cattle to rest and get away from the mud. They are not places to stack manure. Proper mound construction requires 20 to 40 square feet of mound space per head on each side of the mound. The entire pen of cattle should be able to rest on one side of the mound without laying on each other. Cattle should be able to step off of a mound and onto the feeding apron without having to move through mud. The height of a mound ranges from 4 to 6 feet. The top of the mound is less than 5 feet wide and the side slopes are at a 5:1 or 4:1 ratio (see Figure 5). Mounds oriented east-west allow the cattle to use the mound as wind-break by laying on the south side. Mounds should be constructed to allow cattle to lay on the sides rather than the top. Resting on the top often causes areas where rain water or urine can accumulate rather than drain off the sides. Mounds should not impede natural pen drainage and should be constructed so that pen shaping and leveling equipment can travel over and maintain the shape of the mound.

Fencing and Gates

Kinds of fencing available include sucker rod, pipe, cattle panels, steel cable, continuous fence panels, high tensile steel, electric, and wood. Tables 2 and 3 provide recommendations on typical feedlot perimeter and interior fences. No single fence type appears better than others and this decision is left to the producer and availability of local materials. Access into the pens may require 1 or 2 gates. Consideration should be given to moving cattle, cleaning of pens, removal of manure, and accessibility to downed cattle. Normally it is better to use “saw-tooth” gate arrangements or hinge gates at 45 degrees in a corner. This allows easier access to the pens for equipment and movement of cattle. Minimum gate width is 12 feet with 16-foot gates recommended. Along the back or lower side of the pens, an additional gate for cleaning of the lots may be needed where the runoff drains through the pens. Many are using the high-tensile electric fences. Ice accumulation or an electrical short circuit can cause the fence to fail. Therefore perimeter fence of more permanent construction is used to prevent cattle from escaping.

Table 2*. Typical Feedlot Perimeter Fences*

Fencing Material	No. of Members	Member Spacing	Remarks
2 x 8	3	16"	Pressure treated
Poles, wood	4	12"	Minimum diameter 2 1/2"
Pipe	4	12"	Minimum diameter 1 1/2"
Sucker rod	4	12"	Weld or thread joints
Cable	5	10"	1/2" minimum diameter spring tension
Cattle panel or woven wire and 1 barb wire	1	—	Barb 3" above panel

Posts—12' on center, 3' minimum depth in ground, 4" minimum top diameter, pressure treated wood or equivalent.

Table 3*. Typical Feedlot Interior Fences*

Fencing Material	No. of Members	Member Spacing	Remarks
Poles, wood	3	16"	Minimum diameter 2 1/2"
Pipes	3	16"	Minimum diameter 1 1/2"
Cable	4	12"	1/2" minimum diameter spring tension
Wire, Barb	4	12"	

Posts—Same as perimeter fences

Wind Protection

Windbreaks protect an area approximately 10 times the height of the wind break. Windbreaks should be located along the north and west sides of the pens. It may be necessary to provide additional protection if a pen is more than 200 feet from a windbreak. Options available include leaving a gap between pens and planting a second windbreak or placing a nonliving windbreaks in the fence line. Nonliving windbreaks include wooden, metal, or plastic materials. It is important to remember windbreaks need 20 percent open area to function properly. Solid windbreaks create undesirable air currents near the structure and cattle tend to use the windbreak only on calm days. If 24-inch wide metal roofing material is used, a 4-inch gap between sheets is recommended. Maximum gap width is 6 inches. Also available is a plastic wind break fence. It can be attached directly to the fence and removed after cold weather. Windbreaks will drop snow in an area four times the windbreak height. It is important to plant trees such that when fully grown, snow will not be deposited on the feed road or in the feed bunks.

Lighting

Benefits of feedlot lighting include:

- less trouble with predators and cattle theft,
- increased animal safety from the quieting effect of night lighting,
- cattle eat during cool summer nights,
- reduced stress on newly arrived cattle agitated by darkness,
- better feed availability for timid cattle, and
- reduced feed bunk space per head, because of 24-hour feeding period (if feed is available).

Lighting should provide 1 footcandle in a 30 foot by 50 foot strip along the feed bunks. Additional light will be required in the receiving and working areas. The lights can be over the center of a feed alley between two rows of bunks. Automatic controls permit the lights to come on at dusk and go off at dawn with a photo cell or timer.

In open lots, high pressure sodium light sources are economical. With high pressure sodium lamps, 35-foot tall poles can be spaced 225 feet apart, and 20 to 30 feet from the feed road. Mercury vapor and metal halide light sources also are adequate for area lighting. The light poles should be located in a fence line away from the feed bunk and waterer to avoid bird droppings in feed and water.

Runoff Control

Facilities need to be constructed so environmental compliance can be obtained. The feedlot size and location will determine if runoff has to be controlled and type of system that can be utilized. Feedlots with 300 animal units (300 head at 1,000 pounds or 600 head weighing less than 700 pounds) are required to be registered with the state through the Kansas Department of Health and Environment (KDHE). Feedlots with a 600 head or more capacity will probably be required to construct a lagoon or holding pond. Smaller operations may be able to utilize a grass filter. As a minimum, a sediment basin along the back side of the pens is recommended to collect the solids and for containment of smaller storms. The basin should be able to hold a 2- to 3-inch rainfall. Often the earthen material removed from the sediment basin can be used for constructing the mounds. Normally, the sediment basin is 3- to 4-feet deep and 40- to 48-feet wide. The basin length is equal to the pen length.

In eastern Kansas, the total holding pond capacity will be about 2 acre-feet per acre of drainage area. This includes the volume for liquid storage and the volume utilized by the 2 foot of free board required. In western Kansas, the total holding pond storage required is approximately 1 acre-foot per acre of drainage area. The holding pond capacity is based on drainage area; type of surface (i.e. concrete or earthen); normal rainfall; 25-year, 24-hour rainfall event; sedimentation; and additional water (i.e. overflow waterers). Consideration is given to losses expected through evaporation. Holding ponds are required to be constructed such that seepage from the sides and bottom is less than 1/4 inch per day and with a 12-inch minimum clay liner. Some soils may require additional materials such as bentonite to be mixed with the soil to meet the seepage requirements.

Grass filters will require an area of 1 to 3 times the feedlot area depending on stock density, average cattle weight, and normal rainfall events. The water will have to be distributed uniformly across the grass filter. This requires the land to be leveled across the width of the filter and then uniformly sloped the length of the filter. Other types of systems such as wetlands are developed on a case-by-case basis in cooperation with KDHE.

Larger operations need to consider the potential air quality problems. They may have to install sprinkler systems to control dust. Dust and odor problems are most easily minimized by proper site selection. Prevail-

ing winds and habitable structures must be considered to avoid air pollution problems.

Producers need to contact KDHE to determine what steps need to be taken in meeting state regulations. Assistance is available from Natural Resource Conservation Service or private engineering consultants.

Summary

Proper planning will allow producers to meet the goals noted earlier in this publication. Producers must develop the facilities to address human, cattle, and environmental issues to provide safe, efficient, and productive feedlots.

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