Design of Layer House

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LAYERS

HOUSE

LAYERS

Structure of houses

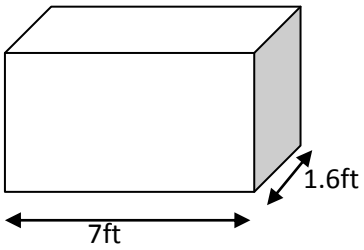
Dimension of house choose:

Length of house = 500ft

Width of house = 40ft

Height of house = 8ft

Size of one cage:



Size of layers needed for one cage is $1ft^2$

So, for cages with the size 1.6t * 7ft, we can put 5 layers in 1 cage.

With length of 500ft, no. of cages that can be place in 1 row is

500ft/1.6ft = 312 cages

312 cages can be placed in 1 row.

For a set of row, they contain 4 cages per set.

So, 312 cages * 4 = 1248 cages per set of row

There's 4 set of cages in 1 house, so in 1 house,

1248 cages * 4 set = 4992 cages per house

For 5 layers per cages, a house can keep

4992 cages * 5 birds/cage = 24960 layers/house

So, for 250000 layers,

250000layers / (24960 layers/house) = 10 houses

So, 250000 layers need to be placed at 10 layer houses.

For 10 single-storey layer house, distance needed between each house is calculated by:

$D = 0.4 * H * L^{0.5}$

Whereas D = distance between house

H = height of blocking house

L = length of blocking house

So, $D = 0.4 * 8 * 500^{0.5}$

= 72 ft

Thus, 72 ft of distance between each house is needed for good air circulation

Ventilation

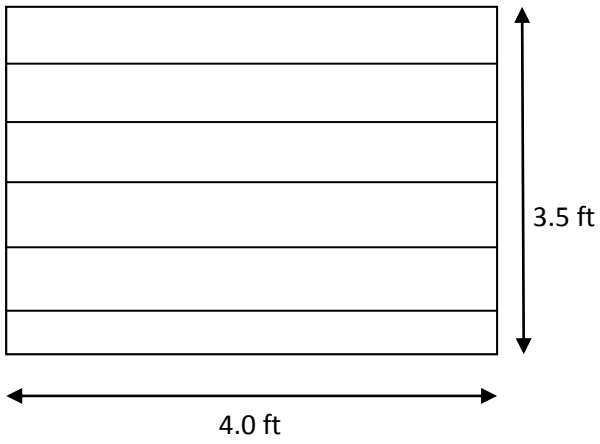
Ventilation requirements for layers:

1. Weight of layers
2. Waste management system
3. Building construction
4. Outside moisture content and temperature

System used: Negative Pressure Ventilation System

How they work: exhaust fans expel air flow from the barn, creating an interior vacuum which draws fresh air into the building. Air distribution and mixing within the barn is controlled by the air inlet or baffle system. A well constructed air inlet baffle that can be adjusted to maintain a desired velocity of 800 to 1000ft/min is required. This is achieved by providing 13 ft^2 to 16ft^2 per 5000cfm. This velocity is very critical, especially in colder temperature, to ensure good air mixing and to prevent drafts.

Air inlet size:



For air inlet size of 4ft * 3.5ft, they can give a desired velocity of air of 800 to 1000 ft/min

Capacity of air in the house = volume of the house

Length*width*height

500*40*8 ft^3

= 160 000 ft^3 of air capacity

By using fan with ability of 20000 cfm. No. of fan use are:

160000/20000 = 8 fans

For cooling system, cooling pad systems are being used.

Cooling pad is installed within the air inlet. Air entering from the inlet must go through the cooling pad that is wetted with water. Hot air from outside converts them to water evaporation.

As air go through the cooling pad, they may reduce the air velocity from 800ft/min to 500ft/min.

For 160000cfm of fan capacity, total pad area required is:

$$\frac{\text{Installed fan capacity (cfm)}}{Recommended\ air\ velocity\ through\ pad\ (fpm)}$$

= 160000 cfm / 500 fpm

= 320ft^2 of cooling pad is required

For 320ft^2 of cooling pad area, we might use the type of 6 inches of thickness, and small flute recirculating.

Feeders and Waterers

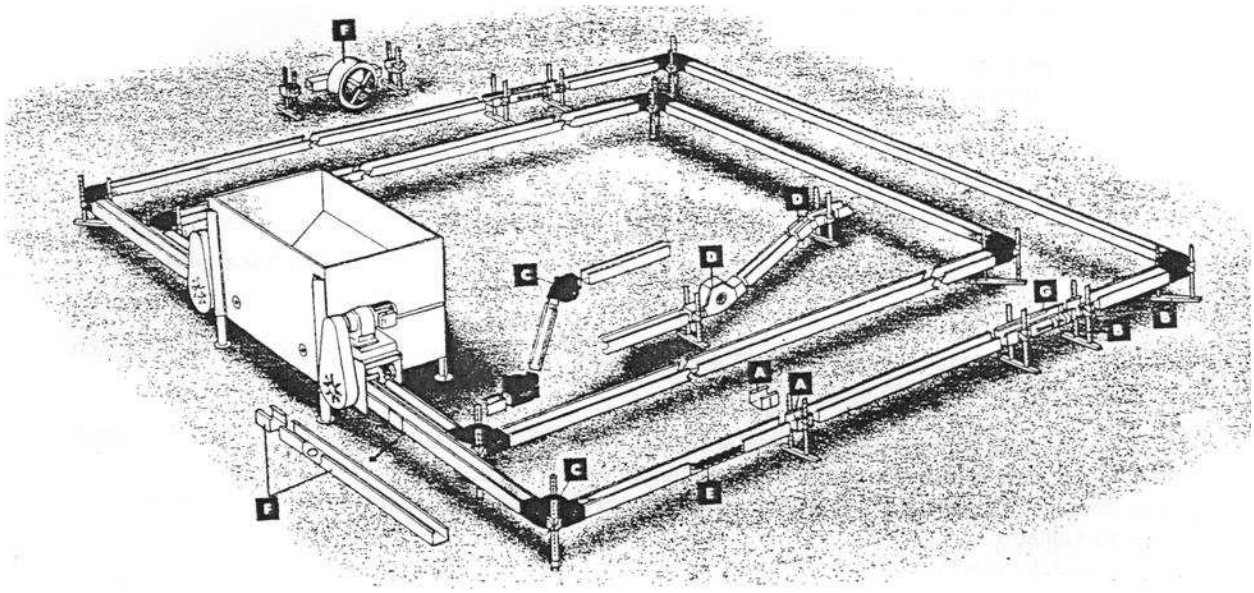
The feeding system used are automatic chain feed troughs.

There are one or more storage hoppers and the feed is delivered by a flat chain running in the feed trough. The speed of the chain is approximately 4-6 metres/minute. Sometimes the speed is adjustable.

If a restricted feeding programme is in operation (B.P.S.) it is recommended to increase the speed up to 12 metres/minute since the feed should be distributed quickly over the whole house, in order to keep the flock uniform.

The main parts of the feed-chain system are:

- hopper
- drive unit
- troughs (different designs)
- leg assembly; the whole system can be adjusted as the birds grow
- chain; connection/disconnection possible everywhere
- corners
- rise or fall elbows; e.g. one feed line is used in the litter part and the other in the slatted part of the house
- feed cleaner which removes dirt an debris from the troughs as the chain returns to the hopper
- electric time switch: how often per day and for how long should the system function
- a device to maintain the right tension in the chain



Automatic chain feeding system

Water system being used is the nipple drinkers. In temperate climates almost 100% of the batteries are fitted with nipple drinkers. For hot climates the advantages of nipple drinkers are less distinct.
All nipples have three main parts, namely nipple body, nipple pin and nipple top dolly.
The *body* can be made entirely from stainless steel or the inner body only.
The *nipple pin* is the important part because it must be lifted by the birds, to open the water supply. The weight of the pin plays an important role: too heavy, it is difficult for the birds to lift the pin; too light, the nipple may leak.
The *nipple top dolly* makes the nipple return to its closed position. Nowadays nipple drinkers have a fixed top dolly, to prevent the dolly from falling off the nipple.
The best place for the nipple drinkers is in a side wall back in the cage. This position has certain

- the eggs do not become wet by leaking water
- the feed in the trough stays dry; hens do like wet feed but it is not good for the feeder bottoms
- in each cage the hens have access to two nipples; if one nipple does not work there is always a second to use, on the other side of the cage

Lighting

For cages operation, 25watt lamps, 10ft on center down the walk aisles is being used. Light should be controlled by dimmer and time clock. A light intensity of 5 lux is equivalent to 15 watts per 60ft^2.

So, for 20000 ft^2 of house size, watts of light needed is:

(20000 ft^2 * 15 watts)/60 ft^2

So, amount of light needed is 5000watts.

If we used a bulb of 60 watts each, so we need about 83 bulbs.

Total light controls are needed to ensure maximum egg production. Building construction has to be tight and light traps over the exhaust fans and air inlets. For house with light control:

1. Increase lighting at regular intervals by 15 to 20 minutes until 17 hours is reached.
2. At 28 to 33 weeks use about 11 lux that is equivalent to about 40 watts.

Waste Management

Estimating layers litter and compost production and storage:

1. Weight of birds produce on the farm each year:

   Weight of birds per year = **Number of houses** * **Flock size** * **Number of batches** * **Pounds weight per bird**

   W = 10 * 25000 * 6 * 4.4 = **6.60 tons of birds produced each year**

2. Litter produced:

   Weight of manure per year = **Weight of birds per year** * **0.5**

   W_M = 6.60 tons * 0.5 = **3.3 tons of litter produced each year**

Floor operations system used are solid manure system. This system is conducted by using litter of wood shavings. The waste from the chicken is being mix with the litter, cause them to be solid and produce less odour. The litter is cleaned after every flock.

The advantage of using wood shavings:

1. They are a very good water absorber, so that can produce less odour within the house.
2. Can mix well with the chicken manure

The thickness of the litter being put on the floor is about 2 to 3.5 inch.

Before the litter being place on the floor, plastics that can withstand air and water being attached to the floor. This is to make sure the manure doesn't touch the floor thus make the floor dirty.

The litter with the manure then can be sold for reclamation or horticultural purposes.

Egg Handling and Cooling Room

- Egg collection

Egg is collected from the cages via conveyor belt. The conveyor carries the egg smoothly in a single file, to prevent the egg from collide with each others. The egg elevator from higher tiers of cages is maintained to lower the eggs without increasing the speed. The eggs are transferred from the longitudinal egg belt via the dosing wheels onto the elevator chain, which transports the eggs down the elevator. Reaching the lower cage, the conveying direction of the elevator chain is changed and the eggs are transferred to the cross collector at the desired height. Depending on the type of installation, egg transfer can take place at any height, preferably at 2.10 m. Hence, a passage height of 1.95 m is guaranteed. When a hand-gathering table is used, egg transfer occurs at a height of 80 cm.
Cross conveyors are used in this collecting system, and being designed to make sure that the egg does not collide with each other. Egg collection from the end of the conveyors is collected straight to the packaging.

- Egg cooling Room

The egg rooms are built closed to the laying flock. The eggs are gathered at least twice a day. The eggs then being gather in baskets or containers that allow them for rapid cooling. They have to be cool to less than 13^0C and above 7^0C immediately after gathering. Air humidity also has to be maintained as close to 70% as possible so that the egg moisture loss can be slow down. After chilling process, pack the eggs with the small end down into fillers or flats placed in shipping cartons.

This is the size preferred for the egg cooling rooms.

Flock	: 6000-9600 layers
Inside size	: 8ft * 9ft
Cases	: 64
Baskets	: 21
Refrigeration	: 3.0 kW