Farm Structures
FACTSHEET

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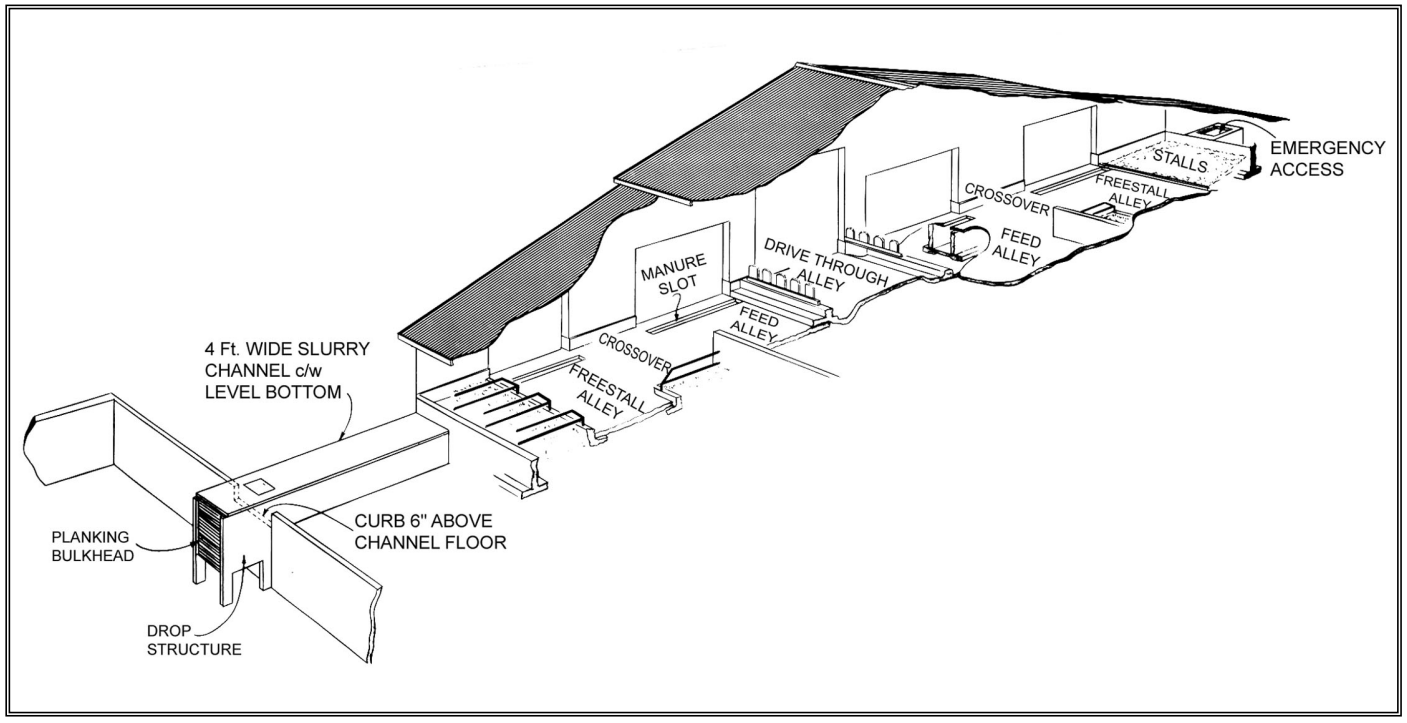
GRAVITY FLOW SLURRY CHANNELS FOR DAIRY MANURE



Gravity flow slurry channels are becoming increasingly popular as a method of dairy manure transfer in liquid manure handling systems. Proper management of slurry channels is essential to their satisfactory operation, but provided that the channel is carefully designed and the correct management scheme is followed, trouble-free operation is easy to achieve.

Dairy manure from free stall barns has a moisture content of 88 to 95%. Even though the material is not perfectly liquid, gravity will cause the manure to flow. The manure surface in a channel forms a slope which usually ranges between ½% to 2%. Dry manure (moisture content of less than 88%) will assume a slope of more than 2% and does not flow well

ADVANTAGES OF A SLURRY CHANNEL

- Reduces or eliminates mechanical manure handling systems required for transfer of manure from the barn to the storage structure.
- Simple design and operation.
- High reliability.
- No agitation of manure is required inside the barn.

DISADVANTAGES OF A SLURRY CHANNEL

- Use of sand bedding is not possible in a gravity system.
- Manure which is frozen, dry, or contains an excess of long hay, straw, or sawdust bedding will not flow in a gravity system.
- The site must allow the manure storage or reception pit to be lower than the barn.

CHANNEL DESIGN

The consistency of manure is a variable depending on the nature of the feed ration, class of animal, bedding type and the degree to which the manure is frozen or dried. It is essential that the channel be designed to handle the wide range of possible manure consistencies. This ensures that the channel will continue to operate satisfactorily regardless of changes in the manure consistency with time of year or feed ration.

Figure 1 shows a manure channel design that follows the recommendations contained in this leaflet. Every barn layout is different, but if the design criteria listed below are followed carefully, the channel will work well.

1. **Channel width** should be 1,200 mm (4 ft.). This is a practical dimension that is easy to build and is certain to function well. Narrower channels should not be used because sidewall friction and crust buildup tends to slow down manure flow and plug the channel. Since wider channels are more expensive to build and provide no further improvement in performance, widths greater than 1,200 mm (4 ft.) are not justified.

2. **Channel depth** should be a minimum of 1,200 mm (4 ft.). Channels shallower than these are more prone to plugging and should not be used. The longer the channel, the deeper it should be. **Use Table 1 to find the minimum required channel depth.** Channels may be built to a depth equal to or greater than the minimum. Many operators prefer to spend the extra money and build their channels 2,400 mm (8 ft.) deep for improved reliability.

3. **Channel length** should be kept as short as practical and, generally, should not exceed 50 m (164 ft.). The maximum allowable length of channel is related to width and depth.

4. A **channel lip** is required at the discharge end of the channel. This lip is very important to the satisfactory operation of the channel. Practical experience shows that **a lip height of between 150 mm and 300 mm (6 - 12 inches) works well.** The reason for the lip is related to the flow characteristics of the manure. Coarse solids and fibrous material tend to stratify (float) above a suspension of fine particles and water. The lip is like a small dam that holds back a layer of liquid along the bottom of the channel. This layer of liquid then acts like a lubricant and allows the manure to flow down the channel.

5. The **channel bottom** should be **dead level.**

6. A **channel cover** made of wood or concrete helps to prevent freezing and drying of the manure in the channel. The channel should not be open to the air at any point along its length.

7. A **drop structure** at the outfall to the pit, such as the one illustrated (see Figures 1 and 2), is a very simple and valuable part of any good channel design. It prevents winter winds from freezing the manure in the channel.

8. It is necessary for the manure storage or reception pit to be lower than the barn floor. This is required because the manure surface slopes downward as it flows. If the pit is the same level as the barn, it will not be possible to fill the pit all the way to the top. **Use Table 1 to determine how much lower the pit should be in relation to the barn floor.**

9. If parlour wash-water is to be added to the manure pit, it is an excellent idea to add this water to the channel. Parlour wash-water added to the upstream end of the channel assists the manure flow. Use a minimum 150 mm (6-inch)

pipe from the parlour to the channel. The pipe should include a one-way flap valve. An important planning note here is that the parlour must be higher than the barn floor level. Otherwise, when the channel is running full, parlour and dairy wastewater will not drain to the channel unless it is pumped.

10. If possible, provide access for a vacuum tanker to add water to the upstream end of the channel. Should the channel plug for any reason, the tanker can flush the channel out with a blast of water. This access can also be designed to accommodate the PTO-powered manure agitator.

11. The location of the channel in relation to the barn layout is important. The channel is best located so that the **drop slots** are located midway along the cattle alleys. This facilitates the scraping operation since the tractor operator does not have to turn any corners or "jockey" the tractor around to push the manure into the drop slots. The scraping operation is then a simple straight pass with the tractor.

12. The **drop slots** should always be centered over the channel and should extend curb-to-curb across the cattle alley. The best drop slot cover is made of 5 mm (3/16 inch) checker plate, galvanized steel. This type of cover lasts longest and cannot be kicked out by the cows. The slot width should be 225 mm (9 inches) with a 25 mm (1-inch) support lip all round. A larger slot opening is undesirable for passage by most tractors. Some of the smaller tractor models available today have very small front wheel diameters. Check with the tractor dealer to find out if the tractor can safely pass over the slot.

13. Another planning option is to use raised cross-alleys instead of the conventional level type. This makes the cattle alleys continuous with curbs on both sides of the alley. Such a design makes the scraping operation easier since the manure is contained between the curbs the entire length of the alley. The disadvantage to raised cross-alleys is that they require hand cleaning.

MANAGEMENT POINTS

Managing the gravity flow channel is very simple and can be reduced to a single rule: **Make sure that the manure put into the channel is wet enough to flow.** The following points expand on this simple rule and are based on a survey of a large number of Fraser Valley farmers.

1. **Never use sand bedding with a gravity flow manure channel.** The sand will accumulate in the bottom of the channel and plug it. Sawdust or chopped hay or straw bedding should be used.

2. When starting the operation of a new channel, **it is essential to fill the bottom of the channel with water.** If the channel is dry, the manure will stick to the bottom of the channel and it will plug up. By starting with a layer of water, the channel will start operating perfectly the first day.

3. To reduce plugging problems, locate heifers and dry cows on the side of the barn that is nearest to the manure pit. This is because heifer manure has lower moisture content than cow manure and does not flow as well. By locating the heifers on the downstream end of the channel, the thicker heifer manure will be more easily pushed out of the channel.

4. When new bedding is put into the stalls, the cows kick a good portion of it out during the next two days. This can cause the manure to be drier and may result in plugging problems. **Water may need to be mixed in with the manure.** Suggestions for adding water are listed below.

a) The best way to add water is to add it to the manure on the floor before scraping. During the scraping operation, the water is mixed in with the manure and produces a uniform, liquid slurry.

b) An overhead sprinkler line is a very convenient way to add water to the manure. A 15 mm (3/4 inch) polyethylene pipe can be attached to the rafters above the free-stall alleys. It is drilled with a 2.5 mm (3/32 inch) bit every 3,600 mm (12 ft.). The drilled holes should be at the midspan between the pipe supports. This is the low point in the pipe line and allows the pipe to drain completely to prevent freezing in cold weather. A hand valve or a solenoid valve and timer may be used to control the addition of water. When needed, the sprinkler line should be run for 10 – 20 minutes before scraping.

c) It may not be necessary to add water to the manure on the floor in all alleys. After a new slurry channel is installed, it is a good idea to experiment with it for a month or two before

deciding to add an overhead water sprinkler line. Extra water may only be required in the dry cow and heifer alleys.

d) Some operators find that they only have to add water to the floor for a few weeks during the summer when the dry, hot air is causing the manure to dry out. A common method of adding water in these cases is to jam the drinking troughs open for a few minutes before scraping. Other methods include turning on a garden hose or simply not using the gravity flow channel during these weeks and scraping the manure out of the barn.

a) Another suggestion for dealing with the dry manure caused by bedding kicked out of the stalls, is to leave the dry manure next to the curb and slowly mix it in with the wetter manure over a period of 3 or 4 days.

TABLE 1: MINIMUM CHANNEL, DEPTH AND REQUIRED ELEVATION DROP

LENGTH		REQUIRED MINIMUM CHANNEL DEPTH		ELEVATION DROP: FLOOR TO TOP OF PIT	
m	**(ft)**	**mm**	**(inches)**	**mm**	**(inches)**
10	(33)	1200	(48)	200	(8)
15	(49)	1200	(48)	300	(12)
20	(66)	1200	(48)	400	(16)
25	(82)	1200	(48)	500	(20)
30	(98)	1350	(54)	600	(24)
35	(115)	1525	(61)	700	(28)
40	(131)	1700	(68)	800	(32)
45	(148)	1875	(75)	900	(36)
50	(164)	2050	(82)	1000	(40)

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