

Flush Floor Systems Need To Be Fully Costed

By Dr Mike Kelly

Flush floor systems for dairy units are attracting a lot of attention at the moment. It seems to be design flavour of the month. Anyone contemplating such a system should be fully aware of the capital and running costs involved. There is considerable technology associated with the system, including flush tanks, intermediate tanks, pumps, possible settlement tanks, a separator, and a main storage tank. The flush floor system is very effective in cleaning down passes provided fairly clean wash water is used. The system demands a lot of water, since water flows from each flush valve at a rate of over 20 cu m per minute, albeit only for a few seconds, with each flush pass using about 9 cu m of water. It is recommended that any farm considering this system has access to a plentiful free water supply.

For even a modest sized unit the flush system installation could cost £18,000 with a separator at over £30,000. There will also be significant increased slurry storage costs because of the additional flush wash water. Annual running costs could be in excess of £15,000, taking into account mechanical replacement, maintenance and energy costs of the separator and flush system. Anyone contemplating such a system must do a very detailed costing of the whole enterprise, not just the cubicle house and passes.

If you decide to go ahead with this system, then it is important to visit existing units to learn from their experience including capital and running costs. The design must be right and the following recommendations may be helpful:

- Slope the unit 3% on a constant slope, not variable. Hence choose the right sloping site, with a good water supply.
- Brush finish and/or groove the floors to give cows some grip. Do not rough tamp the floors, because this could affect flushing effectiveness.
- Make the cubicle access step 200mm, to avoid any risk of flood wash surcharging onto the cubicles.
- Have wide feed passes and cubicle access passes all on straight runs top to bottom.
- Keep passes flat across the slope for an even flush, full width. If there is any slope across the pass it should be higher in the middle to keep flush levels good at the kerbs, where deposits are most likely.
- Locate water entry valves for maximum flushing power for all passes and aprons, including the collecting area, after each milking.
- Finish off floors with a hard brush finish, not a rough tamped surface, since this may affect flow. A grooved finish down the length of the flush direction will help to create a less slippery surface for cows, but it does not appear to increase cleaning effectiveness. A hard brush finish will not smooth off to the same extent as on a mechanically scraped floor, but if it does become slippery, then concrete grooving is always an option.
- Sand is a bedding option which will flush down, but careful design and management of channels and tanks is required to cope with sand settling out, and it is very abrasive on pumps and motors.
- Contain the flush wash water within a cross channel across the full width of the inside of the building, prior to transfer back for recycling. This is a receiving gutter, and it must be dimensioned to best suit the flush volume and velocity. Keep the receiving gutter open and railed away from cow flow, rather than gridding the top, which could block up.
- Arrange the facilities to flush when cows are held elsewhere in the unit. Flushing when there are a lot of cows standing in the passes does affect the force and effectiveness of the wash.
- Design intermediate cross passes with a step up, and on larger units provide a cross pass with at least every 24m run of cubicles, to allow cows good access across the unit, including to feed.
- Have a contingency plan to tractor scrape, in case of power, or other system failure. A flat profile across the width of each passage aids effective scraping and flushing.



Flush wash valve centred on an internal passage, discharging recycled liquids.



Flush wash valve placed outside a building, centred on a feed passage. Unfortunately the flush wash is hampered by the external gates as shown by the slurry deposits

Careful management of the system is essential with a requirement to flush the passes at least three times a day. The flush water is recycled and can become thickened with slurry through time. Thicker washings are less effective so it is important to regularly renew the water supply, possibly every four weeks as a guide. The flushing will create a lot of surface moisture and so it is important to ventilate the cubicle house well, especially by providing good ridge outlets to enable stale, moist air to escape.

New Developments in Prefabricated Drained Floors

The flush floor system suits a sloping site and avoids slurry pooling on the cubicle passes. An alternative approach suitable for flat sites is being developed in Denmark. This comprises of a drained floor between cubicles, and at feed stances.

The National Centre for Building and Technique based near Aarhus, are working on a series of development projects, in co-operation with farmers and agricultural building contractors. One project is concerned with the fabrication and installation of prefabricated drained floors, incorporating automatic scrapers. A reduction in ammonia emission is the primary aim of the project, but there are obvious additional benefits to cow foot health, including digital dermatitis, from having a drained floor.

For one system, prefabricated, profiled concrete panels form the building alleyways. Slurry is drained via herringbone grooves, to a slotted drainage channel, placed down the middle of the panels. The floor slopes between 1% and 2% towards the drainage channel. A cleaning flap fixed to the automatic scraper blade slots into the drainage channel, and cleans it out as the scraper progresses down the building. The slot width is 35mm to 40mm wide, the same as the gap between conventional slats.

A longitudinal slotted panel system is a variation on this herringbone design. This system integrates a scraper designed with 'fingers', which fit into the slots, as the scraper moves down the length of the building. Installation, on a sand bed, must be very precise. A series of surface grooves in the panel, both longitudinal and transverse, direct slurry liquids to an under panel drainage pipe. This pipe runs the full length of the building to a storage channel at one gable end.

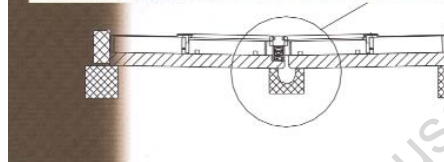
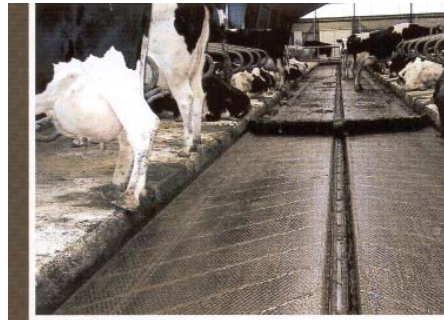
These drained floor systems are being assessed by staff at The National Centre for Building and Technique, and farmer uptake so far looks good. Twenty two installations were completed by March 2004, with more to follow. Similar installations are to be found in the Netherlands, but the tendency there is to run slurry channels under the panels, rather than automatically scrape the panels to one end of the building. An ammonia reduction of approximately 50% found in Denmark, corresponds to that found in Dutch studies.

Danish assessments so far, indicate the following:

- The floor scrapes thoroughly, with slurry running easily to the drain or drainage channel.
- Hard frost can be a problem, pushing up the scraper, or tripping it to return early because of frozen manure resistance.
- Straw as a bedding material can be a problem because it compresses in the scraping channel, sawdust is fine.
- The floor can get slippery in the summer as it dries out between scrapings.

The initiatives shown by staff at the National Centre for Building and Technique and Danish concrete panel suppliers deserve every support. The floors are of a very high quality and slurry ponding is avoided. Although the work was initiated to reduce ammonia emissions from dairy buildings, a bonus must be a cleaner floor to cope with foot health problems, especially digital dermatitis.

The systems described in this article are part of a wider study, funded by the Milk Development Council, carried out by the author and others, including waste management consultant Dave Howat. The report identifies general performance requirements for dairy cow housing design and management, as a basic checklist, before going on to establish more specific design and management standards. Pending publication of the report, any farmers requiring further information can contact Mike Kelly directly (Telephone 01563 830147; e-mail mkelly.builddesign@btinternet.com).



Prefabricated drained floor with automatic scraper, with the drainage grooves sloping towards a centre channel.



Installation of a slotted drained floor on a sand base. This will form an access pass between cubicles.



Completed slotted drained floor with scraper.