11.FARM INFRASTRUCTURE

Well planned, managed and maintained farm infrastructure can make a big difference to the day-to-day running of a farm. See this section for recommended dimensions and management tips for farm infrastructure such as feed and stand-off pads, tracks, water supply, milking sheds, and yards.

11. FARM INFRASTRUCTURE

Buildings and yard sizes

Dairy cow yard	1.3m^2 / cow Jersey 1.5m^2 /cow Friesian
Calf pen	Allow 1.1 -1.4m^2 per calf
Haysheds	Allow 2m^3 per large round bale
Fertiliser Bins	Allow 0.9m^3 per tonne

Feed pads

Dimensions	• 4.5 – 6.0m wide feed lanes • 4.0- 4.5m wide single cow lane • >7.0m wide double cow lane • 0.7m/cow – length of feed face /bin when all cows feed at once • 0.3m/cow length of feed face when cow feeding adlib • Entry and exit points – 8.0-10.0m wide • A feed pad where cows are kept for short periods of time should allow a minimum of 3.5m^2 /cow with 0.7m feed bin length per cow.
Slope	• 2° - 4° • 2° – is a rise of 35mm per 1m along or 3.5m fall over 100m • 4° – is a raise of 75mm per 1m along or 7m fall over 100m
Concrete	• Feed lanes 25-30 mpa • Cow lanes 20 mpa

Stand-off pad

Short term		**Long term**		**Permanently**
+ 12 hrs / day (up to 2 days in a row)		+ 12hrs / day, (3 or more days in a row)		No on-off grazing
Surface type	Area per cow	Surface type	Area per cow	Area per cow
Woodchip	3.5m^2	Woodchip	6-8m^2	9-11m^2 including a comfortable lying area plus 1m^2 feeding area. Length of the feed face: 0.7m/cow feed all at once,0.3m/cow feed ad-lib
Sand	3.5m^2	Sand	6-8m^2	
Concrete	3.5m^2	Concrete	Not recommended	

*These figures are based on a standard cross-bred size cow. Add an extra 1m^2 per cow if you have large Friesians.

Track/race

Width

www.dairynz.co.nz/efficient-tracks

Herd size	Race width
<120	5.0
120-150	5.5
250-350	6.0
350-450	6.5
>450	Varies with split of herd

Camber

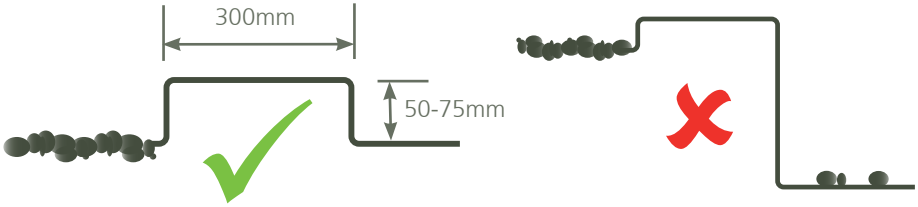
www.dairynz.co.nz/track-building

Measure using a 1m spirit level.

Yard intersection

www.dairynz.co.nz/yard-intersection

- Advantageous for track to widen by 2m as it enters the yard to avoid congestion
- Nib should be square not rounded, without a change in level
- Nib should be 500mm back from the end of the concrete to avoid forming a pot-hole



Dairy design

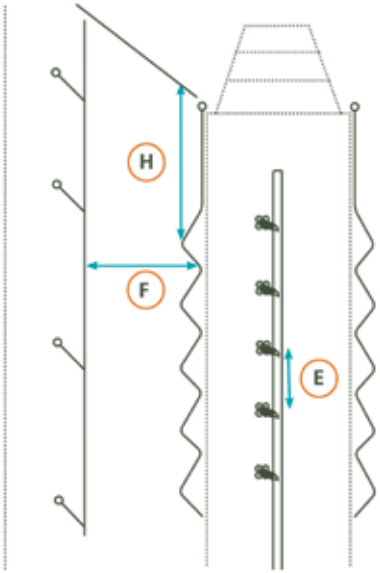
Collecting yard design – **www.dairynz.co.nz/yard-design**

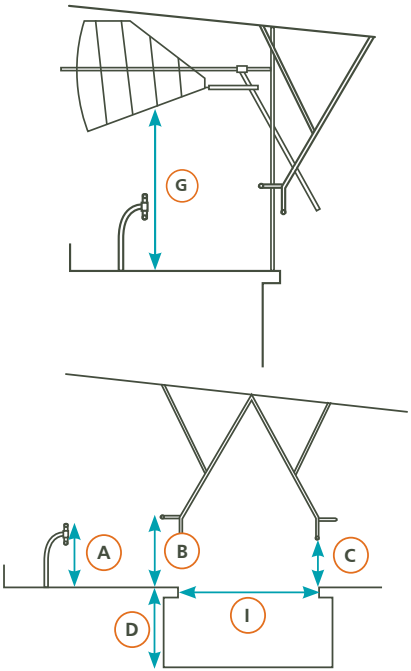
Yard size	1.3m²/Jersey cow 1.5m²/Friesian cow
Backing gate speed	0.5m per 5 sec for rectangular yards 1m per 5 sec for circular yards
Recommended maximum backing gate length	12m for rectangular yards 12m for circular yards with a herringbone 15m for circular yards with a rotary

Herringbone design

www.dairynz.co.nz/herringbone-design

Bail lead-in	900-1000mm
Breast rail height (A)	700mm Jersey 760mm Friesian
Rump rail height (B)	Approx. 900mm
Kick rail height (C)	Approx. 200mm below the rump rail
Depth of pit (D)	850-950mm
Cluster spacing (E)	Wider gives better cow flow, guide 700mm
Bail width (F)	Depends on cluster spacing 1450mm for 600mm cluster spacing 1050mm for 900mm cluster spacing
Head gate clearance (G)	At least 1400mm
Width of first bail in zig-zag (H)	Cluster spacing + 200mm

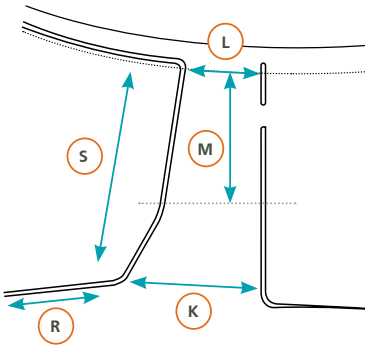


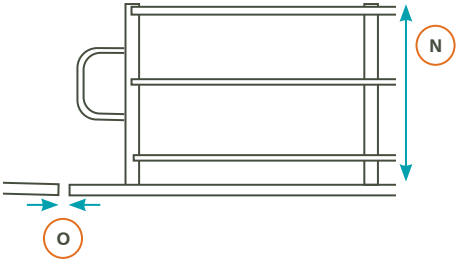


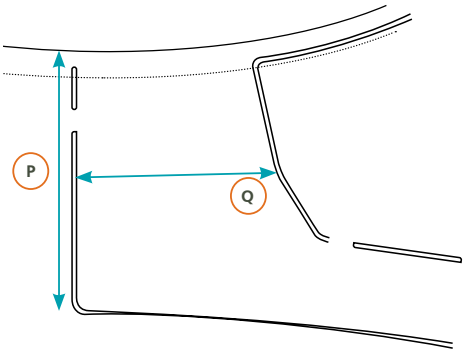
Rotary design

www.dairynz.co.nz/rotary-design

Width of entrance at yard (K)	Approx. 1200mm
Width of entrance at platform (L)	Approx. 900mm
Length of entrance race (M)	Minimum 2500mm
Height of entrance fence (N)	Approx. 1200mm
Gap between bridge and platform (O)	Not more than 40mm
Ability for cup-on person to step back (R)	Must be able to step back 2m unobstructed
Distance from entrance to yard man-gap (S)	At least 2m from bridge entrance
Depth of exit turning area (P)	Not less than 3m
Width of exit turning area (Q)	At least 2.5m when measured 1.5m from the platform edge







Herringbone efficiency

www.dairynz.co.nz/herringbone-principles

The expected number of cows milked per hour for various row time/herringbone size combinations are shown in the table below.

The amount of time available for milkers to perform their work routine (e.g. attaching/removing clusters, teat spraying, loading row etc) is also shown. This number should be multiplied by the planned number of milkers in the pit to calculate the amount of time each milker will have available to achieve that row time.

Go to **www.dairynz.co.nz/herringbone-calculator to test a specific scenario.**

Number of clusters

Row time in minutes	12	14	16	18	20	22	24	26	28
6	120 30	140 26	160 23	180 20	200 18	220 16	240 15	260 14	280 13
7	100 35	120 30	140 26	150 23	170 21	190 19	210 18	220 16	240 15
8	90 40	110 34	120 30	140 27	150 24	170 22	180 20	200 18	210 17
9	80 45	90 39	110 34	120 30	130 27	150 25	160 23	170 21	190 19
10	70 50	80 43	100 38	110 33	120 30	130 27	140 25	160 23	170 21
11	70 55	80 47	90 41	100 37	110 33	120 30	130 28	140 25	150 24
12	60 60	70 51	80 45	80 45	100 36	110 33	120 30	130 28	140 26
13	60 65	60 56	70 49	80 43	90 39	100 35	110 33	120 30	130 28
14	50 70	60 60	70 53	80 47	90 42	90 38	100 35	110 32	120 30

30	32	34	36	38	40	44	
300	320	340	360	380	400	440	cows/hour
12	11	11	10	9	9	8	seconds/cow
260	270	290	310	330	340	380	cows/hour
14	13	12	12	11	11	10	seconds/cow
230	240	260	270	290	300	330	cows/hour
16	15	14	13	13	12	11	seconds/cow
200	210	230	240	250	270	290	cows/hour
18	17	16	15	14	14	12	seconds/cow
180	190	200	220	230	240	260	cows/hour
20	19	18	17	16	15	14	seconds/cow
160	170	190	200	210	220	240	cows/hour
22	21	19	18	17	17	15	seconds/cow
150	160	170	180	190	200	220	cows/hour
24	23	21	20	19	18	16	seconds/cow
140	150	160	170	180	180	200	cows/hour
26	24	23	22	21	20	18	seconds/cow
130	140	150	150	160	170	190	cows/hour
28	26	25	23	22	21	19	seconds/cow

Rotary efficiency

www.dairynz.co.nz/rotation-time

The expected number of cows milked per hour for various rotation time/rotary size combinations are shown in the table below. Note these figures assume no empty bails but make allowances for cows going-around on a second rotation. The number of go-around cows was estimated for this table using a milk yield of 12 L/cow (i.e. equivalent to the morning milking for a herd averaging 20 L/cow/day).

Go to **www.dairynz.co.nz/rotary-calculator** to estimate a different milk volume.

Rotation time in minutes

	30 Bail	34 Bail	40 Bail	44 Bail	50 Bail	54 Bail	60 Bail
6.0	170 12 21	200 11 18	240 9 15	260 8 14	300 7 12	330 7 11	370 6 10
7.0	170 14 21	190 12 19	240 11 15	260 10 14	300 8 12	330 8 11	370 7 10
8.0	170 16 21	200 14 18	240 12 15	260 11 14	300 10 12	330 9 11	370 8 10
9.0	170 18 21	190 16 19	230 14 16	260 12 14	300 11 12	320 10 11	360 9 10
10.0	160 20 23	190 18 19	220 15 16	250 14 14	280 12 13	310 11 12	340 10 11
11.0	160 22 23	180 19 20	210 17 17	230 15 16	270 13 13	290 12 12	320 11 11
12.0	150 24 24	170 21 21	200 18 18	220 16 16	250 14 14	270 13 13	300 12 12
13.0	140 26 26	160 23 23	180 20 20	200 18 18	230 16 16	250 14 14	280 13 13
14.0	130 28 28	150 25 24	170 21 21	190 19 19	210 17 17	230 16 16	260 14 14

The amount of time available for a cow to walk on to the rotating platform is also shown. The milker can have more time available to attach clusters as not every cow in a rotation needs their clusters attached (because cows can be going-around on a second rotation).

64 Bail	70 Bail	80 Bail	
400 6 9	440 5 8	500 5 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
400 7 9	440 6 8	510 5 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
400 8 9	440 7 8	500 6 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
390 8 9	430 8 8	490 7 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
370 9 10	400 9 9	460 8 8	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
340 10 11	370 9 10	430 8 8	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
320 11 11	350 10 10	400 9 9	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
290 12 12	320 11 11	370 10 10	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
270 13 13	300 12 12	340 11 11	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster

Water supply

Peak drinking water daily requirements

Category	Non-irrigated pasture		Irrigated pasture	
	At trough	At pump[1]	At trough	At pump[1]
Lactating cow average annual	35 litres/head	60 litres/head	25 litres/head	28 litres/head
Lactating cow peak	72 litres/head	105 litres/head	61 litres/head	68 litres/head
Lactating cow average milking period (Sep – Feb)	44 litres/head	70 litres/head	35 litres/head	39 litres/head
Dry cow	45 litres/head		45 litres/head	
Calves	25 litres/head		25 litres/head	

[1]Leakage has been found to be highly variable between farms, and was 29-47% of the water use at the pump on non-irrigation farms, and 13% of the water use at the pump on irrigated farms.

Peak drinking water flows required at trough

Lactating cow – non-irrigated pasture	15 litres/head/hr
Lactating cow – irrigated pasture	12 litres/head/hr
Dry cow	8-10 litres/head/hr

Water supply

Herd size	Trough flow (1 per sec)	Trough size (litres)
100	0.33	600
200	0.67	1200
300	1.00	1800
400	1.33	2 @ 1200
500	1.67	2 @ 1500

Flow rate = 12 litres/cow/hr at trough

1 litre = 0.26 gallons

Dairy shed water requirements

Category	Non-irrigated	Irrigated
Dairy shed water annual average	49 litres /head	64 litres /head
Dairy shed water peak	82 litres /head	118 litres /head
Dairy shed water average milking period (Sep – Feb)	63 litres /head	90 litres /head

Irrigation

Five tips for good irrigation management

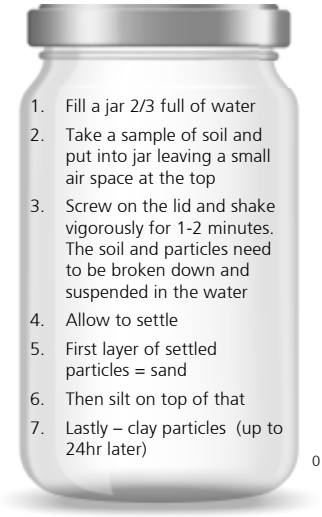
1) How much productive water can our soil hold?

a. Identify your soil type by:

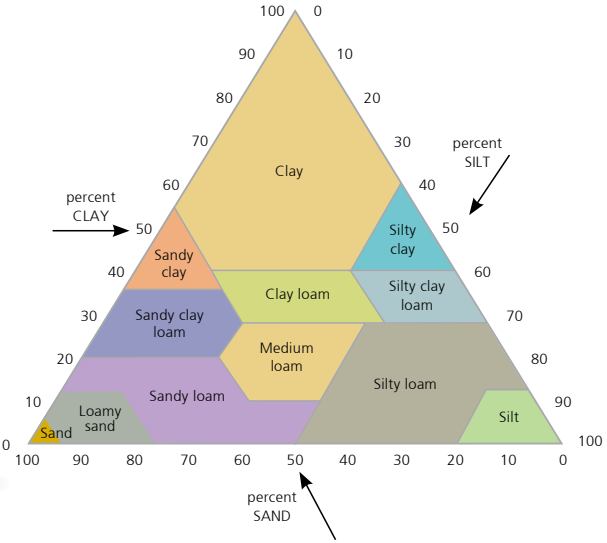
i. Referring to SMAPs **https://smap.landcareresearch.co.nz**

ii. Or carry out a "jar test" (see next page)

Jar test



1. Fill a jar 2/3 full of water
2. Take a sample of soil and put into jar leaving a small air space at the top
3. Screw on the lid and shake vigorously for 1-2 minutes. The soil and particles need to be broken down and suspended in the water
4. Allow to settle
5. First layer of settled particles = sand
6. Then silt on top of that
7. Lastly – clay particles (up to 24hr later)



To interpret the jar test use the 'soil triangle' above:

2) Measure the total volume of sample*

e.g. 4cm *that is the distance from the top of the clay layer to the bottom of the jar

3) Measure each sample layer individually

Sample divided by total x 100 = %

Therefore:

i. Clay – 0.4cm/4cm x100 = 10%

ii. Silt – 0.6cm/4cm x 100 = 15%

iii. Sand – 3cm/4cm x 100 = 75%

Using the triangle, we identify our soil as "sandy loam"

a. Compare soil type with potential "soil water holding capacity chart" to determine your soils' capacity to hold water

Example of test jar

Soil class	WHC (mm/100mm)
Clay loam	17.5-19.0
Silt loam no stones or gravel	15.5-16.5
Silt loam, approx 30% gravel	11.0-12.0
Sandy loam	0.5-11.0
Sand	4.5-5.5

b. Dig a hole to identify the depth of the plant's active root zone
i.e pasture is no greater than 400mm

c. Calculate:

Water holding capacity x rooting depth = plant available water divided by 2 = readily available water (total amount of production water, rest is survival water)

e.g. 8mm x 4 = 32/2 = 16mm readily available water (RAW) the size of your bucket

Applying any more than the plant available water e.g 32mm will cause drainage and runoff which is a major contributor to nitrogen leaching

2) How fast is my pasture going to use this moisture?

a. Identify your daily evapotranspiration (ET) which are often published in the local newspaper.

b. Identify your crop factor using the table provided: (pasture = 1.0)

Pasture	1.0
Clover	1.0
Lucerne	1.2
Maize	1.1
Fodder beet	1.0
Kale	1.1

c. Calculate:

Potential ET x crop factor of pasture

e.g. 4.5 x 1.0 = 4.5

Therefore our pasture uses 4.5mm/day

3) What amount of irrigation does my system need to supply?

a. Information from 1)

b. Information from 2)

= System requirements

That is:16mm (RAW) divided by 4.5mm (crop use per day) = 4 days return interval

Therefore, our system must be capable of applying 16mm of irrigation every 4 days – if not the system needs to be modified.

4) How do I justify my irrigation events?

a. Calculate a water budget at **www.dairynz.co.nz/environment/water-use/irrigation/**

b. Interpret your soil moisture trace. Visit **dairynz.co.nz** for more information.

For further information on soil moisture monitoring refer to **http://irrigationnz.co.nz**

5) How do I measure the amount of irrigation that my system applies?

a. Perform a bucket test to measure application depth and distribution uniformity – a bucket test is a very simple way of understanding if you have a problem or not and showing you are being efficient with your water

www.dairynz.co.nz/environment/water-use/irrigation/ or search the app store for the "check it" bucket test app

b. Carry out pressure and flow verification