Question to EURCAW-Pigs: Stocking density calculation
25 March 2024

Question
Received: 9 November 2023

EURCAW-Pigs received the following question from a veterinary inspector in one of the Member States:

"We recently did a stocking density inspection visit to a pig farm. We collected all the data including the pen dimensions, the feeding trough dimensions, the number of pigs per pen and the average weigh of the pigs in the pen. In some pens the weights of the pigs are in different legal weight bands, and without weighing all pigs, it is not clear what the space allowance should be. Can you help us with an estimation of the required pen space? On the basis of such an estimation we can decide to take further action or not."

Several EURCAW-Pigs experts contributed to the response below. The EURCAW-Pigs secretariat did the final editing, and may be contacted for queries: info.pigs@eurcaw.eu.

Answer
In short, the answer is:

EURCAW-Pigs developed an Excel tool which may be of help to estimate the space required for a group of pigs, according to the legislation. The estimation is based on the assumption that the weights of the pigs in a pen are subject to a 'normal distribution'. By estimating the weights of the lightest pig and the heaviest pig, the Excel tool estimates how many pigs are in each of the legal weight bands and thus what the average space allowance for the whole group should be.

The tool can be found with this link in the document repository of EURCAW-Pigs. It requires the following steps:

1. Measure the length and width of the pen
2. Measure the length and width of feeder and other construction in the pen
3. Extract the measurement of 2 from 1 to obtain the unobstructed floor area
4. Weigh the smallest and biggest pig in the group
5. Insert the measurements in the Excel table etc.

Please note: the tool provides an estimation, and should be used as an indicator for taking further action (or not). Legally relevant conclusions can only be drawn after all pigs have been weighed and the exact average space requirement is calculated.

Background
Article 3 of Council Directive 2008/120/EC laying down minimum standards for the protection of pigs stipulates that:

The unobstructed floor area available to each weaner or rearing pig kept in a group, excluding gilts after service and sows, must be at least:

Live weight (kg)	**M²**
Not more than 10	0.15
More than 10 but not more than 20	0.20
More than 20 but not more than 30	0.30
More than 30 but not more than 50	0.40
More than 50 but not more than 85	0.55
More than 85 but not more than 110	0.65
More than 110	1.00

Because it says 'each pig', it can be that some pigs in a group require more space than others, if they fall in different weight bands. By adding up the space needed for each individual pig, the total space requirement can be calculated, for the whole group.

The best way to do this is to weigh all the pigs, allocate them to their respective weight bands, and then add up all the individual required space to come to the total space needed for the whole group.

For example, in a group are six pigs of 17, 18, 21, 22, 22 and 25 kg. Legally they need 0.2 + 0.2 + 0.3 + 0.3 + 0.3 + 0.3 m^2 = 1.6 m^2 available floor space.

However, groups are usually much bigger. To weigh all of them would take a lot of time. Also, it is often only needed to estimate whether the available space is sufficient. If this estimation suggests that the pen is overstocked, the inspector can proceed to weigh all the pigs and calculate the exact amount of space needed.

As most groups have a so called 'normal' weight distribution of the pigs, the weights of the individual members can be estimated by estimating the heaviest and the lightest animal. These individual weights than add up to the total space requirement.

Example:
Imagine a slightly larger group of 20 pigs, with the following weights: 16, 18, 18, 19, 19, 20, 20, 20, 21, 21, 21, 21, 21, 22, 22, 22, 23, 23, 24 and 25 kg. Eight of these pigs are in the weight band up to and including 20 kg (requiring 0.20 m^2), and 12 in the next band (0.30 m^2). Therefore in total they require a minimum of (8 x 0.2 m^2) + (12 x 0.3 m^2) = 5.2 m^2 unobstructed floor space. Figure 1 shows how the weights vary within this example group.

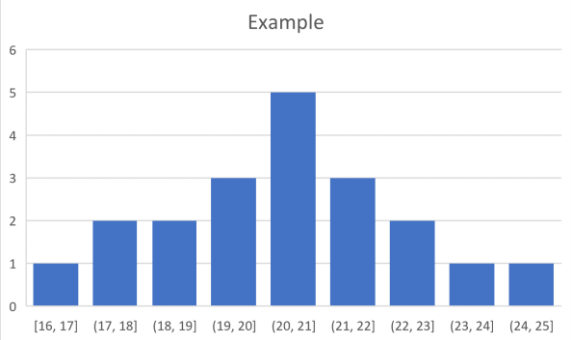


Figure 1. Bar diagram of the number of pigs in each 1 kg weight band, reflecting a normal weight distribution of 20 pigs between 16 and 25 kg.

Assuming a normal distribution of weights, the weights of the lightest pig (16 kg) and the heaviest pig (25 kg) can lead to a similar outcome as when all pigs are weighed. EURCAW-Pigs developed an MS Excel tool (click here) to estimate the space required based on a (presumed) normal distribution of 20 pigs between 16 and 25 kg, and estimate it to be 5.26 m^2 for the whole group.

A screenshot of the tool (sheet: "Space estimation tool") with the above calculation in line 3, is presented in Figure 2. The number of pigs (group size) is entered in Cell I3, the weight of the lightest pig in Cell M3, and that of the heaviest pig in Cell N3. The tool calculates the outcome in the green cells, and the Estimated space required for the whole group is presented in Cell U3: 5.26 m^2.

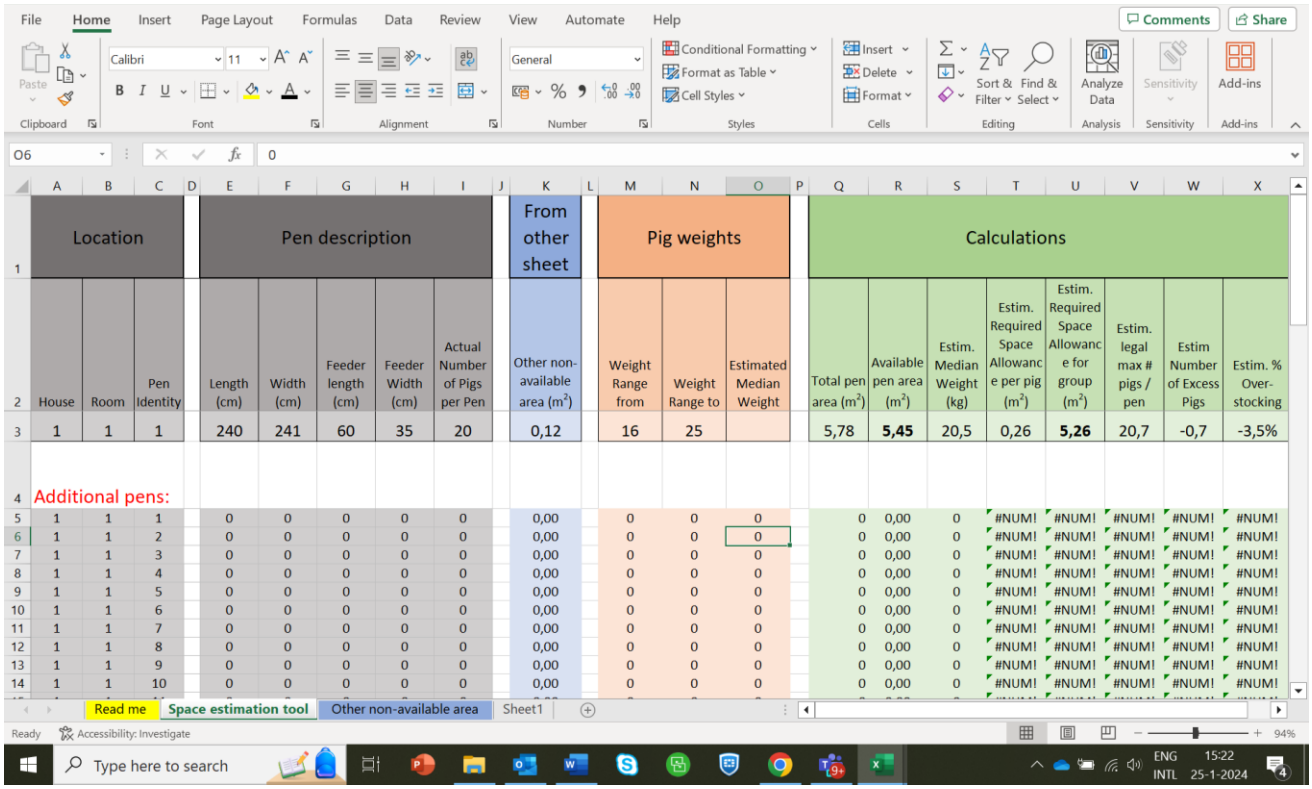
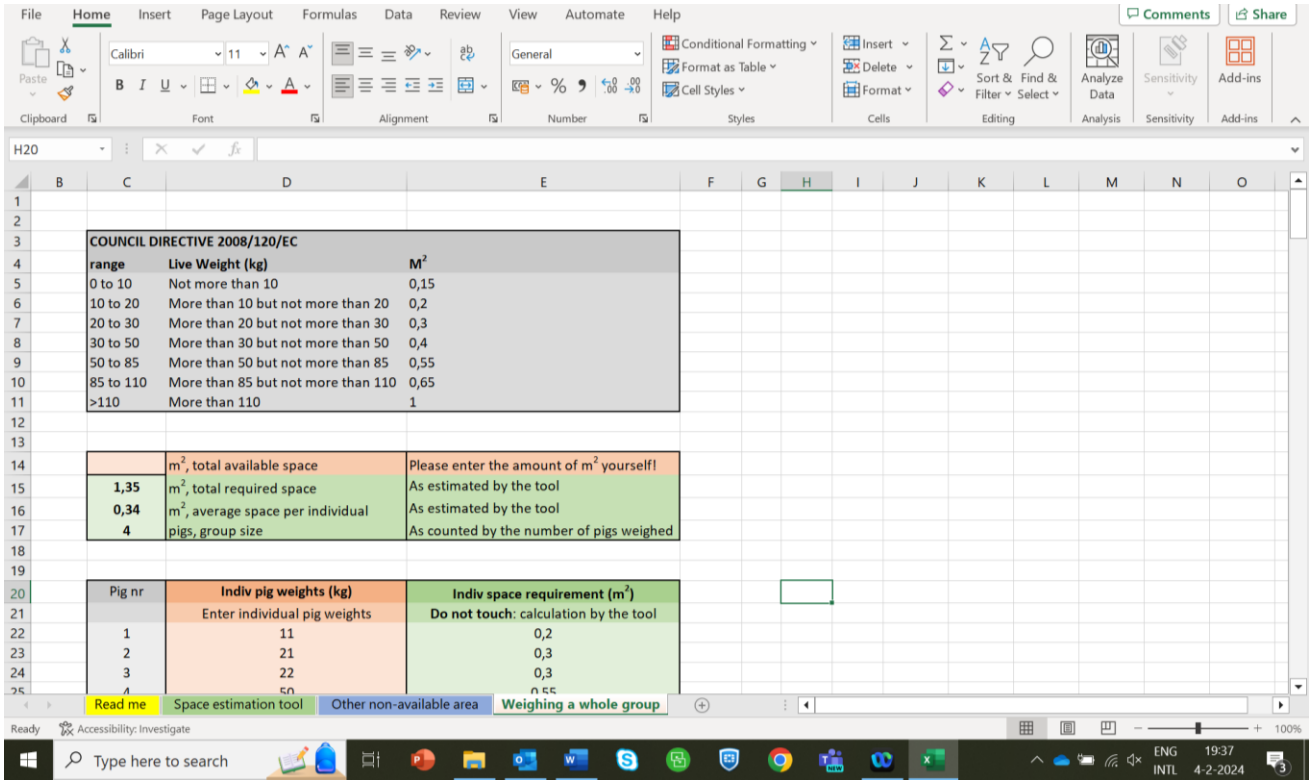


Figure 2: Sheet "Space estimation tool" that allows an estimate of the space needed given the highest and lowest pig weight in a group, and a normal distribution.

The grey cells also allow the available space in a pen to be estimated, by entering length and width of the pen in Cells E3 and F3. Feeder space that reduces the available space can be entered, as can other obstacles in the pen which can be entered in a separate sheet called "Other non-available area". The sum of these unavailable areas will automatically be transferred to the blue Cell K3 on this sheet.

The tool can also be helpful if it is suspected that the stocking density in a pen is insufficient. As this can only be verified by weighing all pigs, the tool offers a sheet called "Weighing a whole group" (Figure 3).



COUNCIL DIRECTIVE 2008/120/EC		
range	Live Weight (kg)	M^2
0 to 10	Not more than 10	0,15
10 to 20	More than 10 but not more than 20	0,2
20 to 30	More than 20 but not more than 30	0,3
30 to 50	More than 30 but not more than 50	0,4
50 to 85	More than 50 but not more than 85	0,55
85 to 110	More than 85 but not more than 110	0,65
>110	More than 110	1

	m^2, total available space	Please enter the amount of m^2 yourself!
1,35	m^2, total required space	As estimated by the tool
0,34	m^2, average space per individual	As estimated by the tool
4	pigs, group size	As counted by the number of pigs weighed

Pig nr	Indiv pig weights (kg)	Indiv space requirement (m^2)
	Enter individual pig weights	**Do not touch**: calculation by the tool
1	11	0,2
2	21	0,3
3	22	0,3

Figure 3: The sheet "Weighing a whole group", on which the individual pig weights can be entered, to automatically calculate the space needed for the group.

In this part of the tool, all individual weights can be entered in the orange cells of column D, from Cell D22 downwards. The calculated total space requirement for the whole group can be found in Cell C15. The green cells should not be changed.

References:

Council Directive 2008/120/EC laying down minimum standards for the protection of pigs

EURCAW-Pigs was designated by the European Union on 5 March 2018 through Regulation (EU) 2018/329, in accordance with Articles 95 and 96 of Regulation (EU) 2017/625.