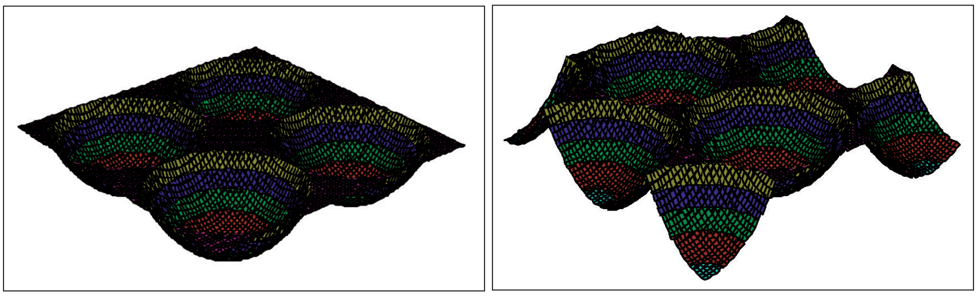
# Choosing the best screen roll for your printing process

**Fourteen years ago *Wilbert Streefland*, director of Technical Coaching in Belgium, attempted to create a simulation of the surface engraved on a screen roll. The computing power by today's standards was very limited so when he recently came across the old floppy disk, he decided to run the data again.**

The project to simulate the surface engraved on a screen roll began in 1995 during a trip to the US. Although suffering from jet lag, I decided to use the time developing the formula. The laptop on which the data was run had good specifications for that time. The 486 processor with co-processor ran Windows 3.11 with a hard disk of 120 MB. The program was Excel 4 with 80x80 cells, 6,400 cells in all. At the time the file size was a challenge for the hard disk, however, the problem was solved by writing Excel macros.

The images created and used in subsequent presentations showed the difference between a square pattern, commonly referred to as a 45-degree angle screen roll, and a hexagonal pattern, commonly referred to as a 60-degree angle screen roll. The main difference being the hexagonal pattern allows about 20% more cells on the surface of the screen roll than a square pattern.



*The original square pattern screen (left) and hexagonal pattern produced with Windows 3.11.*

## Re-running the data

Reworking the spreadsheets today with 100,000 spreadsheet cells I decided the simulation could be a useful tool for helping customers to choose the right screen roll specifications. The image created by re-running the data shows a ratio between cell depth and width. Using the numerical surface values allows calculating the actual values as a function of the screen count. The colours in the image help to see better the surface profile. The depth values of the surface profile are calculated on every crossing of two lines in the image. It is possible to see the surface and the 'wall thickness' between the cells.

There is more to specify on a screen roll such as the total indicated run out or dynamic balance of the roll, however, this focuses on the engraving and the cell configuration. The screen roll is probably the core of the printing process. It determines how much ink is ready for being transferred to the print plate. It prepares the ink film that can be transferred. The actual ink film transferred from the screen roll depends on the ink properties, mainly surface tension; the surface properties of the print plate, surface energy; and the cell shape of the screen roll cell. The simulation gives the cell shape only.

Talking to suppliers gives many suggestions, but the printer will probably have difficulty seeing the wood for the trees. So who are the partners that need to provide you with the information so the printer can select the right screen roll surface profile?

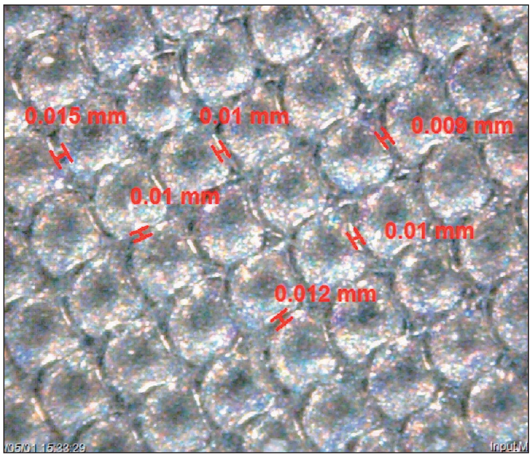
Brand owners are particularly focusing on a perfect printed full tone area so changing screen rolls on the machine is not always easy. It is wise to set the ink film thickness to at least a level that a full tone area is printed on 95% of the substrate volume problem free.

The ink supplier needs to provide a specification for the cell width to depth ratio. It is important that the cell on the surface of the screen roll has a shape able to release the ink. Narrow deep cells will have problems releasing the ink compared with wide shallow cells. The ink properties like surface tension influence how well an ink is released from the cell. The repro house will always claim that a high screen count in the image is better and so claim that the screen roll needs a four times higher screen count. Remember it is the observation distance to the image being viewed that determines what screen count is best. Images looked at from close distance need a high screen count so fine details can be reproduced, magazines for example, but it will result in a low contrast in the image.

## Packaging on the shelf

Images viewed from a longer distance, such as packaging on the shop shelf, need contrast to attract a customer's attention and mostly can do with a lower resolution in the image. The human eye cannot see fine details at a long distance.

The screen roll manufacturer needs to tell what the smallest cell wall width is that can be engraved. Not all is possible as is commonly believed. If a 500 lines per cm screen is engraved on the roll then the space to engrave one cell is 20 microns. If the minimum cell wall that can be reliably reproduced is 10 microns then only 10 microns is left for the cell. This is not much. The image on the next page shows a 120 line per cm screen and the cell wall width is measured in




*A 120 lines per cm screen with the cell width measured at around 10 microns.*

the image at around 0.010 mm, which is equal to 10 microns.

An example of how the simulation works assumes the following feedback from a printer's suppliers. The repro house claims a 120 line per cm is required; substrate supplier and ink supplier agree the need to use a screen roll ink film thickness of 11 micron; the ink supplier advises a cell width to depth ratio of 1:2.5 to be sure the ink is released from the cells and the cells can be cleaned; and the screen roll manufacturer claims the minimum cell wall thicknesses that can be engraved is 10 micron.

## Change in ratios

During the simulation process the algorithm optimises the relation between cell depth, width, the wall thickness between the cells and the screen count. The change in the ratios can be seen in the changing image. The image will show a calculated screen roll surface and not a close-up photo of a screen roll surface. The algorithm uses the same numerical values used to make the image to calculate the potential ink film thickness available on the surface of the screen roll, the cell width depth ratio and the cell wall thickness.

This image shows the last graph of the simulation when the algorithm has found the optimum cell ratios for a screen count, giving the requested potential ink film thickness. The simulation had to reduce the screen count from 120 lines per cm to 110 lines per cm in order to meet the other specifications. This simulation can be viewed as a video at www.tcbvba.be

The result shows that it might not be possible to meet all target specifications, with a screen count of 120 lines per cm. The screen count has been reduced to 110 lines per cm to meet the other target specifications.

It might be necessary to rethink the target specifications. What can be done if the screen count has to be 120 lines per cm? Reduce the ink film thickness? This might result in not having a good full tone print or the need for upgrading substrate specification. The printer may have the option to change the screen roll in the machine for every job so you need to have rolls in the machine fit for the majority of substrates you print on.

Reducing the cell wall thickness? It might not be possible to be engraved by the screen roll supplier. The image shows a cell wall thickness of 10 micron is a realistic value. Reduce the cell width to depth ratio? This might result in ink release problems and can cause clogging of the cells in the screen roll so that no ink is transferred from the screen roll to the print plate.

It might be better to reduce the screen roll screen count in order to have a reliable process, printing a consistent colour, instead of being able to print very high screen count halftone images.

Set a target related to how you want to earn money with your machine. Quality is after all what your customer wants. The brand owners want a constant colour.

Remember that anything specified has to be able to be made. However exciting a 500 lines per cm screen count on a screen roll sounds, it is likely it may transfer very little ink. The question is whether a substrate exists that can be printed on with the ink film thickness transferred from a 500 lines per cm engraved screen on a screen roll.

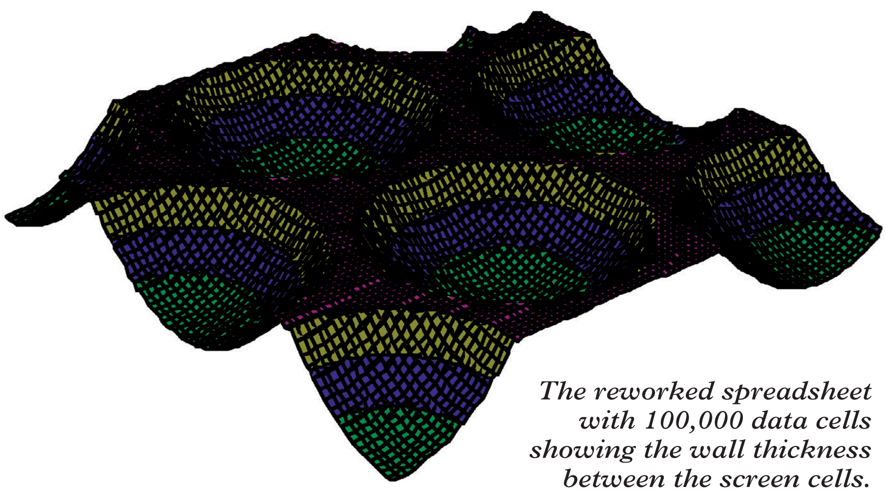
Once the specifications have been decided, all parties involved need to commit to what they have agreed. Next the screen roll supplier will engrave the rolls and then the printer check if the result is what was specified. This will include the cell wall width using the USB Print Microscope with 500 times magnification and the screen count using the same USB Print Microscope.

Measuring the cell depth is more complicated requiring a microscope that allows the user to focus on the surface of the cell walls and in the bottom of the cells. The difference between the two focal distance values is a value for the cell depth. Most screen roll suppliers have this type of microscope. You can thus check the cell depth onsite at the screen roll supplier before the roll is shipped.

## Avoid disappointment

The recommendations are to simulate the roll specification before ordering. It might avoid disappointment in the performance of your rolls. Because it does take time to change rolls on the machine, it is best to choose a specification that satisfies 95% of the substrates you have to print on.

Cleaning a clogged screen roll with heavy detergents due to wrong specifications is not really the best for the environment and it does cost money and time. So choose a cell shape that releases the ink. Regular cleaning of your screen rolls is essential in order to keep the screen roll ink film thickness constant. This is necessary to print a consistent colour over time. ■



*The reworked spreadsheet with 100,000 data cells showing the wall thickness between the screen cells.*