

Classification of visual appearance of materials

Objective

Visual appearance of materials like flooring, wallpaper and natural materials as wood, marble and granite etc. are difficult to classify. In a production of floor tiles, variations of the appearance might degrade the quality, but with a sorting of the tiles, two or more first class qualities might be obtained and the amount of waste products reduced.

Generally two main problems exist namely how to measure colours in small areas of visually non-uniform materials and how to quantify and/or sort randomized patterns or even filamentous colour shade variations.

With ICAM the classification can be done with the same perception as the human vision system.

In a laboratory conductive flooring was laid out, but the customer did complain as the 'average' brightness seemed to vary from lane to lane. See figure 1.

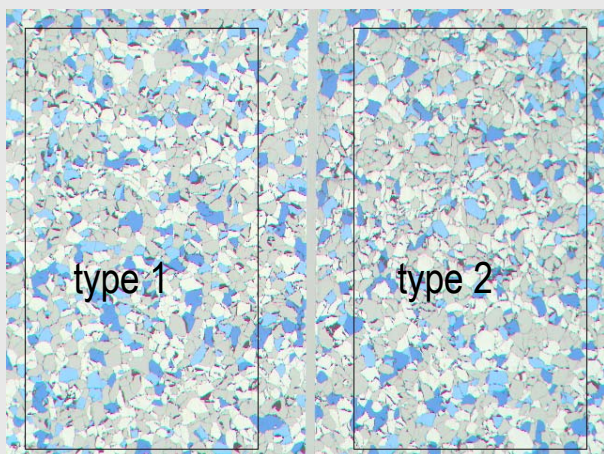


Figure 1. Flooring samples.

Work done

With ICAM, images were recorded of two lanes (see figure 1), type 1 and type 2, with apparently different brightness. The basic colours of white, grey, light- and dark blue was identified. See figure 2.

Colour analyses of the images showed no variation in reflectance and colour of the four basic colours, between type 1 and 2. Further the average colour of the two lanes was almost

identical. The chromaticities were equal but the reflectance showed a slight difference from 27.8% to 26.2%.

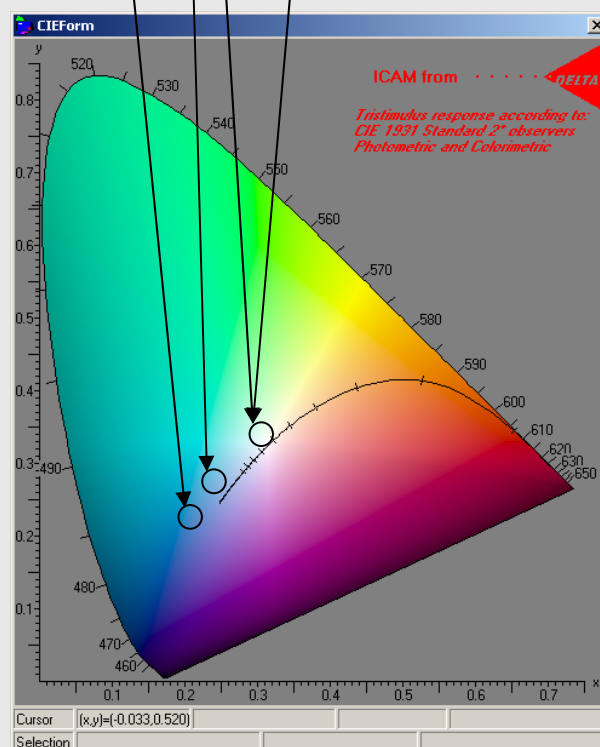
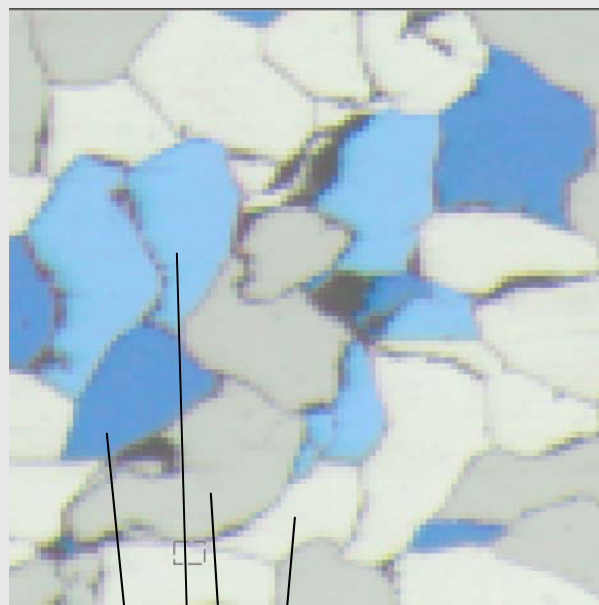
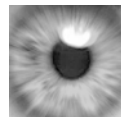


Figure 2. Identification of colours.



Hence most of the apparent difference had to be caused by variations of area, size and number of 'spots' of the different colours.

Using the ICAM images, with their reproducible and traceable colour and reflectance information, as input data to conventional vision routines, it was a simple task to determine statistical information of 'spot' size and frequency and the total area of each colour. See table 1 and figure 3 and figure 4.

| Table 1 | Type 1 | | | Type 2 | | |
|---------|------------|-----------------|-----------|------------|-----------------|-----------|
| | Total area | Number of spots | Mean size | Total area | Number of spots | Mean size |
| Grey | 0.405 | 3892 | 34.9 | 0.427 | 3056 | 39.6 |
| Blue | 0.163 | 3805 | 15.3 | 0.215 | 3222 | 21.6 |
| L.blue | 0.091 | 901 | 36.2 | 0.074 | 184 | 142.2 |
| White | 0.341 | 490 | 241.1 | 0.284 | 806 | 126.8 |

Results and conclusions

The total amount, the number and mean size of spots for each colour varies substantially from type 1 to type 2. The average colour is the same, but type 2 is darker. The numbers indicates a small difference, but to the human eye, and to ICAM, the type 2 will always look dirty when surrounded by type 1.

The producer benefits from ICAM, in qualifying the production. Afterwards it is simple to ensure that flooring material, to one room, have equal classification and hence the same look, and thereby eliminating complains and costly re-flooring

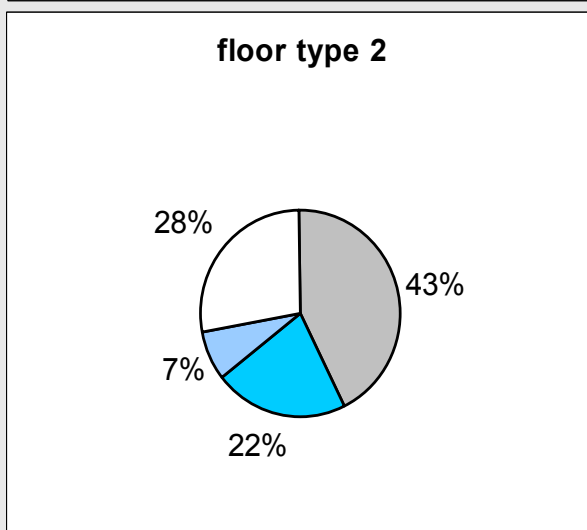
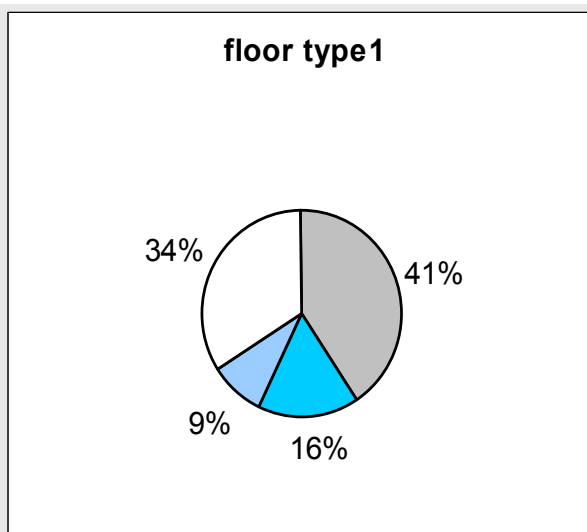


Figure 3. Area distribution.

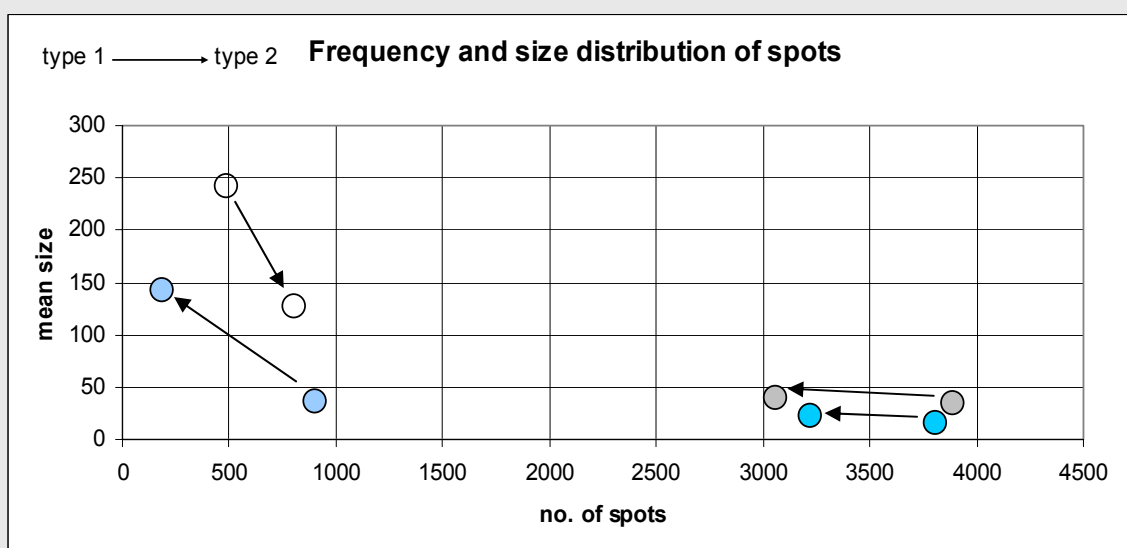


Figure 4. Frequency and mean size distribution of spots.