

In order to prove the relevance from the statistical point of view of the data used for the PCA analysis, authors compare for two different situations the results of the PC analysis for the experimental data used, and a new dataset, formed by the experimental data and 30 more random results that fulfill the average value and the standard deviation of the experimental data. The calculation has been done for the mechanical strength of samples with substitution of coarse aggregate at 28 days and for the water absorption of the blocks where the fine fraction of the recycled aggregate has been used.

Mechanical strength of paving blocks with recycled coarse aggregate at 28 days, with two data sets. The first one uses the 8 experimental results, and the second one adds 30 random simulated results that fulfill the average value for the mechanical strength.

Comparison among the eigenvalues, variance and cumulative variance obtained with experimental data, 8 samples (blue) and experimental +simulated data 38 samples (green).

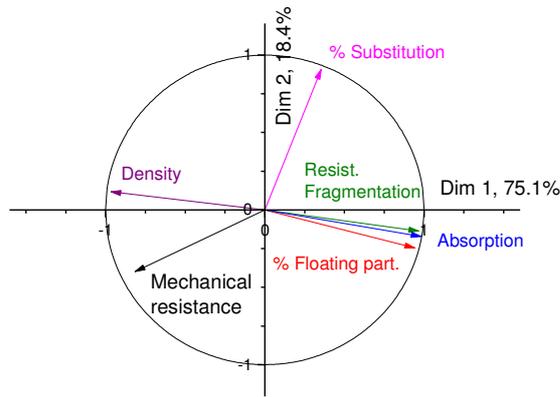
| | Eigenvalue | Variance (%) | Cumulative variance (%) | Eigenvalue | Variance (%) | Cumulative variance (%) |
|--------|---------------------------|--------------|-------------------------|--------------------------------------|--------------|-------------------------|
| | Experimental data 28 days | | | Experimental+simulated data, 28 days | | |
| Dim. 1 | 4.50 | 75.12 | 75.12 | 4.5 | 75.07 | 75.07 |
| Dim. 2 | 1.11 | 18.42 | 93.54 | 1.11 | 18.42 | 93.49 |
| Dim. 3 | 2.75e-01 | 4.59 | 98.13 | 2.78e-1 | 4.64 | 98.13 |
| Dim. 4 | 9.48e-02 | 1.58 | 99.71 | 9.48e-2 | 1.58 | 99.71 |
| Dim. 5 | 1.71e-02 | 0.28 | 99.99 | 1.75e-2 | 0.29 | 99.99 |
| Dim. 6 | 1.86e-05 | 3.11e-04 | 100.00 | 1.87e-5 | 3.01e-04 | 100.00 |

Comparison of the weights for the different aggregate properties in each dimension.

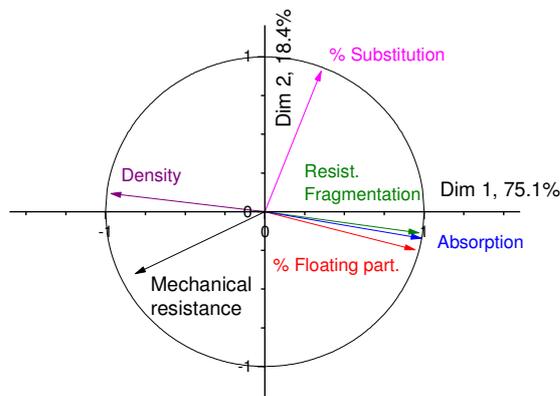
| | Experimental data (8 samples) | | | | | Exp.+simulated data (38 samples) | | | | |
|----------------|-------------------------------|--------|--------|--------|--------|----------------------------------|--------|--------|--------|--------|
| | Dim. 1 | Dim. 2 | Dim. 3 | Dim. 4 | Dim. 5 | Dim. 1 | Dim. 2 | Dim. 3 | Dim. 4 | Dim. 5 |
| Density | -0.966 | 0.117 | -0.207 | 0.043 | 0.090 | -0.966 | 0.116 | -0.206 | 0.043 | 0.092 |
| Fragmentation | 0.966 | -0.137 | -0.025 | -0.205 | 0.070 | 0.966 | -0.137 | -0.024 | -0.205 | 0.071 |
| Floating part. | 0.942 | -0.246 | 0.005 | 0.224 | 0.046 | 0.942 | -0.245 | 0.006 | 0.223 | 0.046 |
| Absorption | 0.981 | -0.172 | 0.083 | 0.014 | -0.004 | 0.981 | -0.172 | 0.083 | 0.014 | -0.004 |
| Substitution | 0.353 | 0.908 | 0.224 | 0.023 | 0.026 | 0.353 | 0.907 | 0.226 | 0.023 | 0.026 |
| Mech. strength | -0.815 | -0.398 | 0.418 | -0.009 | 0.035 | -0.813 | -0.399 | 0.421 | -0.009 | 0.035 |

Comparison of the correlation circles

Experimental data.



Experimental+simulated data



Water absorption fine recycled aggregates at 90 days with two data sets. The first one uses the 8 experimental results, and the second one adds 30 random simulated results that fulfill the average value for the water absorption.

| | Eigenvalue | Variance (%) | Cumulative variance (%) | Eigenvalue | Variance (%) | Cumulative variance (%) |
|--------|-------------------|--------------|-------------------------|-----------------------------|--------------|-------------------------|
| | Experimental data | | | Experimental+simulated data | | |
| Dim. 1 | 4.09 | 68.15 | 68.15 | 4.09 | 68.15 | 68.15 |
| Dim. 2 | 1.37 | 22.91 | 91.06 | 1.37 | 22.91 | 91.06 |
| Dim. 3 | 0.53 | 8.78 | 99.84 | 0.53 | 8.77 | 99.83 |
| Dim. 4 | 9.6e-3 | 0.16 | 100.00 | 9.7e-3 | 0.16 | 100 |
| Dim. 5 | 5.2e-29 | 8.6e-28 | 100.00 | 4.3e-28 | 7.1e-27 | 100 |
| Dim. 6 | 3.1e-31 | 5.2e-30 | 100.00 | 2.4e-29 | 4.0e-28 | 100 |

Comparison of the weights for the different aggregate properties in each dimension.

| | Experimental data (8 samples) | | | | | Exp.+simulated data (38 samples) | | | | |
|------------------|-------------------------------|--------|--------|--------|--------|----------------------------------|--------|--------|--------|--------|
| | Dim. 1 | Dim. 2 | Dim. 3 | Dim. 4 | Dim. 5 | Dim. 1 | Dim. 2 | Dim. 3 | Dim. 4 | Dim. 5 |
| Density | -0.961 | 0.268 | 0.069 | 0.007 | 0.000 | -0.961 | 0.268 | 0.069 | 0.007 | 0.000 |
| Fragmentation | 0.860 | -0.103 | -0.499 | -0.024 | 0.000 | 0.860 | -0.103 | -0.499 | -0.024 | 0.000 |
| Floating part. | 0.800 | -0.385 | 0.460 | 0.015 | 0.000 | 0.800 | -0.385 | 0.460 | 0.015 | 0.000 |
| Absorption | 0.951 | -0.304 | 0.057 | -0.002 | 0.000 | 0.951 | -0.304 | 0.057 | -0.002 | 0.000 |
| Substitution | 0.740 | 0.664 | -0.078 | 0.072 | 0.000 | 0.740 | 0.664 | -0.078 | 0.072 | 0.000 |
| Block Absorption | 0.579 | 0.781 | 0.226 | -0.060 | 0.000 | 0.579 | 0.781 | 0.226 | -0.061 | 0.000 |

The correlation circles have not been included in this comparison, because seeing the weights of each propertie on dimension 1 and 2 readers can notice that the circles will be imposible to distinguish.

Conclusion

As it can be seen with this comparison the number of samples included in the paper, following the standard, are representative for the principal component analysis and including a bigger number of samples will not change the statistical results.