QEST Performance Monitor

Statistics

Document Control

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Introduction

There are a number of statistics calculated by the Performance Monitor as part of an assessment. This document outlines how these values are obtained in some detail.

Each value may have statistics calculated from data sets of differing sizes. This is done such that a longer and shorter term picture of performance can emerge. For instance, using a data set of the last available thirty values will give a longer term indicator than using a data set of only five.

Note that the data set sizes in this document refer to the maximum number of available results that will be used. If fewer results are available then they will all be used in the calculations.

For instance, if a strength assessment is run with a period of ninety days the system will search for data within this time frame. If the specified data set size is thirty but only twenty results are available, the system will use twenty.

Strength Assessment

Slump

Actual Slump

Data set sizes: 5, 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔	✔	✔	✔	
5	✔	✔	✔	✔	✔	

This value is obtained from:

The QESTLab database field DocumentConcreteDestructive.MeasuredSlump. It corresponds to the value entered on the concrete sample screen under "Rec. Slump (mm)".

Slump Failures

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30						✔

This value is obtained from:

A combination of two QESTLab database fields. Namely DocumentConcreteDestructive.SlumpWet and DocumentConcreteDestructive.SlumpDry. If either of these two fields are set in the database then the slump failure value will be taken as 1.

These fields are set automatically by QESTLab when a slump is entered on the sample screen if it falls too far away from the target slump.

This statistic essentially counts how many samples had dry or wet slumps out of the entire data set.

Strength

Predicted Strength

Data set sizes: 5, 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔	✔			
5	✔	✔	✔			

This value is obtained from:

Either an internal model based on historical results or an existing QESTLab field. Both of these situations are described below.

1. Existing field

The QESTLab database field DocumentConcreteDestructive.COMP100PrdStrength_28 which is automatically populated by QESTLab when a 7 day strength result is entered. This is dependant upon prediction factors for the product or mix in question being present in the database. Prediction factors are calculated from QESTMix using the "Update Targets and Predictions" tool.

If no prediction factors are available at the time seven day strength results are entered there will be no predicted strength values available.

2. Internal Prediction

It is possible to have the system predict values for these data sets internally. This is achieved by checking the appropriate box on the "Predictions" tab and setting the maximum age of the model.

When an assessment runs the system will create a simple regression model from historical data if necessary. If a model already exists and is still valid it will be used instead.

The system will then search for samples with the required mix and plant codes which also contain a value for seven day strength. The strength at seven days will then be applied to the model to generate a predicted strength at twenty eight days.

Actual Strength

Data set sizes: 5, 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

5	✔	✔	✔			

This value is obtained from:

The QESTLab database field DocumentConcreteDestructive.COMP100AvgStrength_28. This field is calculated automatically by QESTLab from all specimens in the sample which have twenty eight day strength results.

Density

Actual Density

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The weight and dimension values for sample specimens stored in the QESTLab database. This value is recalculated on the fly whenever a suitable sample is found. Each point is taken as the average density of all specimens contained within. A suitable sample in this case consists of a sample with at least one specimen which has had the correct weight and dimension values entered in QESTLab.

Design Density

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The DocumentConcreteDockets.ActualSpecificGravity field. This field is populated by calculations performed whilst importing docket data with reference to data stored within QESTMix.

A docket contains data regarding materials batched. The SG of each material is retrieved from QESTMix, where available, and used to find what the expected density value of the batch should be.

Finally a correction factor is applied to this value whenever it is used within the QEST Performance Monitor. This correction value is used to compensate for density measurements taken after a specimen has been in a curing tank.

Actual Cement

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The DocumentConcreteDockets.ActualCementM3 field. This field is populated by calculations performed whilst importing docket data. A docket contains data regarding materials batched. This value is the sum of the actual batched weights for all materials classified as GP cement divided by the volume of concrete batched.

Actual Cementitious

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The DocumentConcreteDockets.ActualCementitiousM3 field. This field is populated by calculations performed whilst importing docket data. A docket contains data regarding materials batched. This value is the sum of the actual batched weights for all materials classified as GP cement or supplementary cementitious materials divided by the total volume of concrete batched.

Actual Effective Cementitious

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The DocumentConcreteDockets.ActualEffectiveCementitiousM3 field. This field is populated by calculations performed whilst importing docket data. A docket contains data regarding materials batched. This value is the sum of the actual batched weights for all materials classified as GP cement or supplementary cementitious materials with a correction applied for all supplementary cementitious materials. This value is then divided by the total volume of concrete batched in the load.

Within QESTMix, each supplementary cementitious material can be assigned a value called "effectiveness". This defines how well it performs compared to GP cement. In calculating this field, the docket import routine multiplies the actual weight of the material batched, per meter cubed, by this effectiveness. This "normalizes" the weight of the supplementary material batched back to an equivalent weight of GP cement.

Total Water

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The DocumentConcreteDockets.ActualTotalWaterM3 field. This field is populated by calculations performed whilst importing docket data. A docket contains data regarding materials batched. This value is the sum of the actual batched weights for all materials classified as water summed with the assumed moisture contents of all materials present.

The assumed moisture content of a material is calculated by taking from QESTMix and summing this value with a calculated moisture content. It is assumed that, when a material is batched, the difference between design weight and target weight is due entirely to water present in the material.

The calculated moisture content, which is added to the moisture content as defined in QESTMix, is then (target weight – design weight)/design weight x 100.

Water-Cement Ratio

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The total water value divided by the actual cement per meter cubed value as described above.

Water-Cementitious Ratio

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The total water value divided by the actual cementitious per meter cubed value as described above.

Water-Effective Cementitious Ratio

Data set sizes: 30

Statistics calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The total water value divided by the actual effective cementitious per meter cubed value as described above.

Yield Assessment

Actual Yield

Data Set Sizes: 30

Statistics Calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

A combination of the design and actual densities as described above. In effect this value is Design Density/Actual Density.

Design Yield

Data Set Sizes: 30

Statistics Calculated:

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The QESTLab database field DocumentConcreteDockets.DesignYield. This field is populated when docket data is imported.

The value inserted into this field is the volume of all design weights of materials to be batched, worked out by SG values retrieved from QESTMix, divided by the load size batched.

Grading Assessment

Grading assessments are carried out on individual sieve sizes. Due to the fact mixes in a family could potentially have differing target gradings statistics are carried out on the difference between the actual grading and target grading.

Data Set Sizes: 30

Statistics Calculated (per sieve size):

Data Set Size	Arithmetic Mean	Standard Deviation	Slope	Median	Geometric Mean	Sum
30	✔	✔				

This value is obtained from:

The difference between that target grading of a particular mix, as stored in QESTMix, and the grading present on docket data. Grading data is populated within dockets when they are imported into the QESTLab system. This is done from the actual combined gradings as stored in QESTMix.

Sampling Assessment

The sampling assessment is somewhat different to those discussed above. These assessments consider the family as a whole and, rather than checking any specific value, will determine the amount batched for the family in the given time period. The total number of samples present in the database for this family within the period is also checked.

The total batched quantity and number of samples are saved in the database. These values are then used to determine sampling frequency when reporting the results to the user via the QESTLab reporting engine.