

Developments in the use of SMC Test[®] results

JKTech Pty Ltd and SMC Testing Pty Ltd announce two exciting advances in the use of SMC Test[®] results. The first is concerned with the prediction of SAG Feed F_{80} and the second is an overall comminution circuit energy check. A brief outline of both of these innovations is given below. Further details are available from Chris Bailey, Manager – Comminution at JKTech by email on c.bailey@jktech.com.au or phone at +61 7 3365 5840

Prediction of F_{80}

The F_{80} value predicted from JK Drop Weight or SMC Test[®] results is used for two purposes in AG/SAG mill simulation studies using JKSimMet. The first is in estimating the actual feed size distribution and the second is as a parameter in the JKSimMet Variable Rates AG/SAG mill model which is used in the calculation of the grinding rates.

The ideal method of determining the F_{80} is by measuring the full feed size distribution but this is not possible in green fields design or ore body profiling studies. In these situations, an estimate must be used.

The preferred method of estimating the feed size distribution is by modelling the blast, based on various in situ rock parameters together with blast parameters such as burden, spacing and explosive properties (further details from JKTech). However, this is a higher cost option, so for more than a decade, JKTech has been using a correlation (Morrell and Morrison, 1996) in estimating the feed size distribution for AG/SAG circuit design simulation studies in which the true feed size distribution is unknown. This correlation is shown in Equation 1 and was derived from the operating data shown graphically in Figure 1.

$$F_{80} \text{ (mm)} = \text{CSS} - 78.7 - 28.4 \cdot \ln(\text{Ta}) \quad \text{sd} = 0.1 \cdot \text{CSS} \quad \text{Equation 1}$$

where CSS = primary crusher closed side setting

Ta = abrasion parameter measured as part of the JK Drop Weight test procedure.

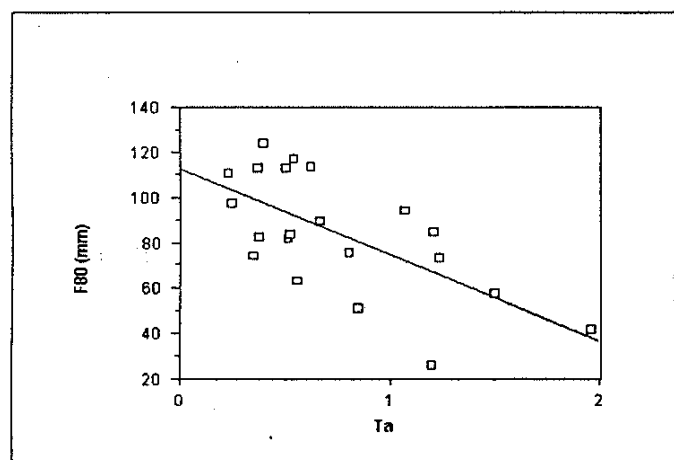


Figure 1: F_{80} as a function of Ta

The F_{80} value for the expected primary crusher closed side setting was used in estimating the expected feed size distribution and the F_{80} value for a primary crusher closed side setting of 150 mm was used as the model parameter in the Variable Rates AG/SAG mill model.

As shown by the standard deviation in Equation 1 and by the data in Figure 1, Equation 1 contains a moderate amount of scatter. Recently, with the assistance of a large Chilean client, it was shown that this scatter can lead to inaccurate predictions of circuit throughput when using specifically measured T_a values (particularly when these values have been extrapolated from non-standard abrasion test conditions) and the corresponding F_{80} values calculated using the relationship in Equation 1.

As a direct result of these inaccuracies, Steve Morrell of SMC Testing Pty Ltd conducted an analysis of his database and derived a new correlation between DW_i and F_{80} which contains far less scatter. This new relationship is based on the data from operations which are shown graphically in Figure 2 and numerically in Equation 2.

$$F_{80} \text{ (mm)} = 0.2 * CSS * DW_i^{0.7} \quad \text{Equation 2}$$

where DW_i = Drop Weight Index from the standard SMC Test[®]

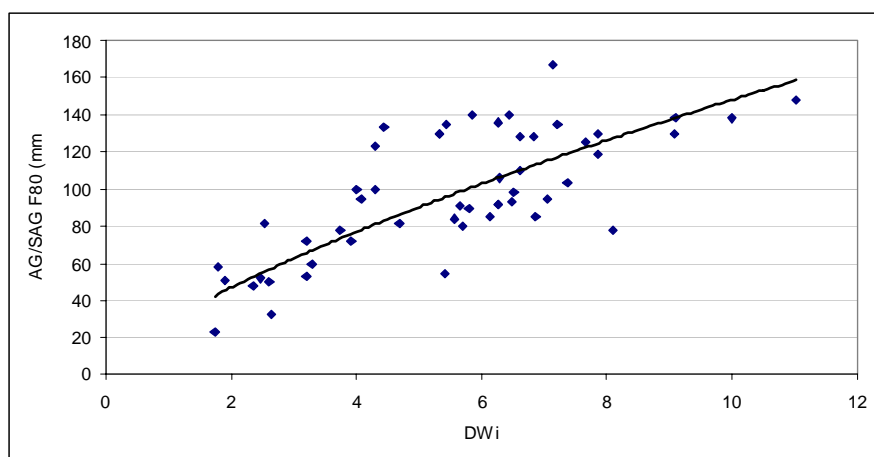


Figure 2: F_{80} as a function of DW_i

The range of CSS values in the correlation data base is from 100 mm to 200 mm.

The JK Drop Weight test provides a detailed assessment of the resistance of an ore to both impact and abrasion. T_a , as an independent measure of the resistance of an ore to abrasion breakage, is still appropriate for inclusion in the full JK Drop Weight test procedure. It will continue to identify outliers in either of the correlation relationships and flag these ores as potential problems. However, for SMC Tests[®], which are primarily designed for ore body profiling, the use of the correlated F_{80} value from Equation 2 is recommended.

For clients who wish to use Equation 2 in conjunction with a full JK Drop Weight test, the DW_i can be determined from the Drop Weight test results as an optional extra.

Users of the JKSimMet AG/SAG model should continue to use the F_{80} model parameter determined from either Equation 1 or Equation 2 for a primary crusher with a closed side setting of 150 mm. Further details will be available in the updated JKSimMet manual which is due for release to JKSimMet users shortly.

Overall Grinding Circuit Power Check

Following detailed analysis of his database of SMC Test[®] results, Steve Morrell of SMC Testing Pty Ltd has released a technical note describing the use of the M_{ia} parameter which is now provided in the standard SMC test report. M_{ia} , in conjunction with Bond Ball Mill Work

Index test results, can be used in estimating the overall specific energy demand of grinding circuits that include combinations of the following tumbling mills:

- AG and SAG mills
- Rod Mills
- Ball Mills

The approach is useful when a check of the overall power requirement of a grinding circuit is required. This applies specifically to cases in which the design has been carried out using techniques such as JKSimMet simulation, "classic" or modified Bond formulae or proprietary procedures.

The complete procedure is described in a technical note by Steve Morrell which is attached to this document and is available for download from the JKTech web site at the following URL:

http://www.jktech.com.au/Products_Services/Laboratory-Services/Comminution-Testing/SMC-Test/detail.htm

Reference

Morrell, S. and Morrison, R.D., 1996. AG and SAG mill circuit selection and design by simulation, *SAG 1996*, Vancouver, Canada, p 780.