From the Desktop to the Coal Face

I thought to write this note as a researcher, author, and collaborator, and who, over a few decades has seen and participated in the development of several new equations, procedures, and processes on a number of topics: in my case, obviously in the field of rock engineering. These are invariably published in established journals or presented at conferences of some or other form, some more formal than others.

One of my worst nightmares is that practitioners in the field will see new equations or procedures and simply apply them without having gone through the proper preparatory steps and investigations.

What is often not realized is that a journal or conference paper is no more than the briefest of summaries of work that was often done over a long time period, sometimes by numerous researchers. The background preconditions and limitations are often implied—not even always, but not explicitly stated in paper publications.

A paper can only be of a certain length and there is simply not space to include everything. Just a simple example is a paper based on a doctoral thesis. The thesis itself may vary in length from 200 to 400 pages, but the published paper based on it, not more than 10 or 12 pages. It is totally impractical for everything that was stated or found in an investigation report to make its way into a paper for general consumption: only the highlights of the outcomes can be published in the popular domain.

There may be errors in the paper, in the form of misprints or other errors, that were simply not identified during the refereeing process. Referees, as well as authors, are just people and mistakes can happen.

It is even possible, albeit not likely, for fundamental errors in thinking in the original reporting or experimental phase that, at the time of writing or refereeing, were overshadowed by other more convincing-sounding arguments. There could be errors in the data and, often, the data may be incomplete.

Always remember that any new equation derived from experimentation or data analysis for anything is no more than a theory. In essence, it is a description of what the developer saw—or believed they saw—in the data, be it in the form of numbers or any other type of observation. But as long as it is on paper, it is no more than a theory.

It is against this background that I want to stress the point that any new process or design equation cannot simply be put into practice. No. This should never be done without careful consideration and evaluation of the local context.

Theory should not just blindly be put into practice. It is not a step from theory to practice: it is a process, and the *process* should be carefully planned and managed.

We have to progress and new processes have to be applied. Without incremental improvement, nothing will change. If we prefer to wait for perfection, it will never come. We would still have been mining with hammers and chisels.

Just one example of an error in the application from theory to practise is a lesson from a tragic mine-collapse disaster half a century ago that we may have missed or simply not heeded, and which can serve as illustration. At the time, the mine was in need of increased coal production, but the predevelopment to unlock new reserves was not yet in place. Consideration was then given to mining the coal in the roof in areas that had previously been mined at a nominal height of 3 m: this in a 6 m thick coal seam. The coal was already exposed, the infrastructure was in place. The solution made perfect sense.

Journal Comment *(continued)*

There was no formal design procedure for coal pillars at the time, but warnings were issued that increasing the pillar height would weaken the pillars and could possibly result in failure. It was not known at the time by how much the pillars would be weakened, if at all.

The mine did not simply go ahead and increase the pillar height. They took the responsible precaution of embarking on an experiment. The height was increased in an experimental area and visually observed. After about three months, nothing had changed and no collapse occurred. The experiment was regarded as successful and so the coal roof was mined in several areas. Then the collapse occurred.

So what went wrong?

Firstly, the effects of time on pillar scaling and subsequent reduction in pillar width were not known or appreciated. In retrospect, and only in retrospect, three months was too short a time for the experiment, particularly as no formal measurements were reported, if at all performed.

Secondly, the experimental area was small and surrounded by solid coal on all sides. The effect of scale and increased pillar load due to the greater expanse of mining was not known at the time.

Thirdly, no follow-up monitoring or continued observation of the experimental area was done.

This is just a very brief description of hasty application of what, at the time, could be considered as a theory: I*ncreased height would not substantially reduce pillar strength*. This was the theory, believed to have been backed up by experiment.

Several other contributary events took place before the major collapse occurred. The brief description here is just to illustrate the point that any change in an existing situation has to be carefully implemented and properly analysed.

It also serves to illustrate another vitally important omission in our current mining operations, a point that has been stressed so often by researchers like Prof Francois Malan of the University of Pretoria; namely, that we do not do anything remotely close to enough measurements in our mining operations.

So, my plea is this: don't just scan a paper until you find an equation that suits your needs and go ahead with implementation. Study the paper, get more information, consider the background against which the paper was written, and then plan implementation very carefully and slowly.

Perform measurements. Have a suitable control area for comparison, measure and continue monitoring, and especially continue with the observations in the control area. Adapt if necessary.

Also bear in mind that equations reflect the ideal situation. In the case of bord-and-pillar mining, for instance, this means assuming a constant mining height and perfectly straight roadways. No off-line development, equipment in perfection condition, so perfectly constant and equal traction on cat tracks, etc. No errors in the placement or observation of survey pegs. No simple human error.

But we all know that reality is different.

Therefore, there also has to be some form of allowance for real mining practice. There cannot be universal guidelines for this because the degree of deviation will be different for different mines, and even different sections on a particular mine. The practical allowance for error will depend on the on-site extent of deviations.

Build up confidence, think, observe, think again before you do final implementation—and only then go ahead. And even then, continue monitoring. We have to progress, but we have to do so very carefully.

J.N. van der Merwe