

Our People: Strata Defects: Detailed Planning

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Introduction

Minimising risk to our people is Anglo American's number one priority and the emphasis on safety has led us to actively seek and implement innovative ways to ensure our underground mines are industry leaders in safety. Anglo American has developed an innovative, industry leading strata defect management system using the latest mapping technology to convey risk categorised strata defect locations pictorially to all site personnel on the Mine Plan, together with live interactive defect information to ensure up-to-date positive communication in risk and hazard awareness is available during operations.

Background

In the underground coal environment, a strata defect (refer Figure 1) is defined as failed Roof or Rib, or damaged support (ie. wall) due to:-

- Strata weathering (ie. coal beginning to crumble, etc),
- Corroded support (ie. mesh and/or bolts)
- Missing Bolt from the Support Pattern; or
- Machine damage.

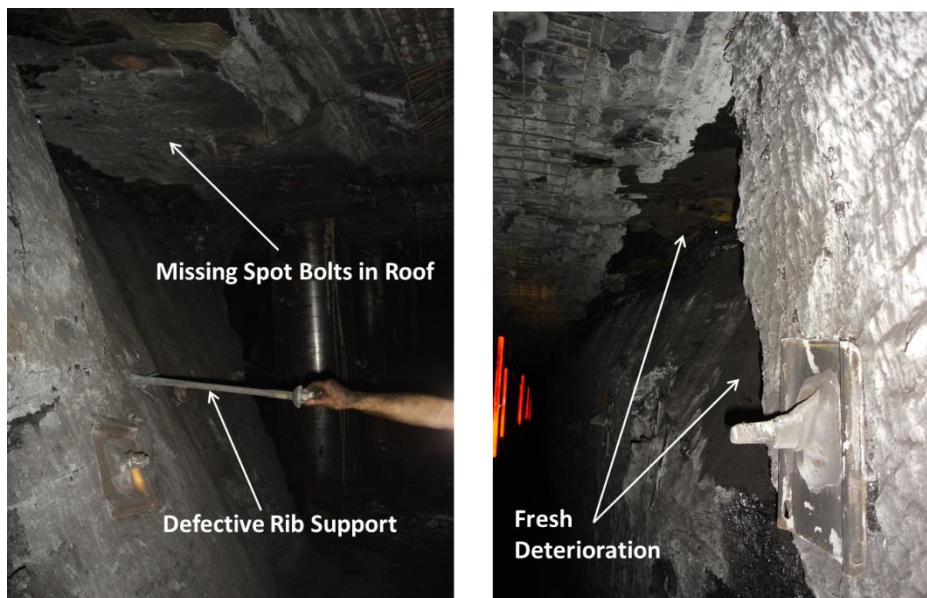


Figure 1: Illustration of a Strata Defect

Recording and managing remediation of strata defects has traditionally been through an EXCEL register and plotted on the mine plan on a monthly basis. This presented issues around transparent system accountability and mid-month communication of strata defects prior to entering a work area. The major aim of the project was to identify a system that improved communication around strata defects by providing Coal Mine Workers with more visual, up-to-date factual data on strata defects, in line with defect categorisation and barricading standards. This would ensure that all Coal Mine

Workers are aware of any new and existing strata defects in the area they were working in and provide accountability around the process for validating and rectifying a strata defect.

Integrated Strata Defect Management System

Anglo American has developed an integrated Strata Defect Management system that incorporates a fully automated record data management system, SORD, with purpose built software and mapping technology, STS Mine Plan. Strata defect information is reported and tracked in the SORD database, and instantaneously transferred to the STS Mine Plan upon being registered into SORD per the risk management colour coding protocols.

In terms of the Mine Plan, the official AutoCAD Plan is synchronised every night with STS to ensure the latest Plan is being depicted. The STS Mine Plan provides a live “google map”, visually displaying strata defect locations in real time, with specific information, including risk categorised defects, pictorially on the Mine Plan. The live, interactive mapping software allows all persons entering the Mine to access up-to-date defect information prior to leaving the surface to their area of operation, improving risk and hazard awareness. Personnel can zoom in and out of the Mine Plan through interactive touch screens or desktops and tap or click on a categorised strata defect to display all necessary information. This ensures our people are fully informed of the risks and hazards within their designated work areas.

The STS Mine Plan is a state of the art mapping system. It was purpose built by Fewzion who, having identified that there was no software on the market that provided live synchronisation with the mine surveyor markings, set out to design a system that met these specifications, while being able to integrate with other Site systems. Developing the system took extensive research and preparation, including synchronising each mine’s AutoCAD mine plan to STS and standardising the view for all underground operations. It was also vital that the system was able to convert the quantity of information into STS in a timely manner each day.

STS has recently been implemented in identified Anglo American Operations in South Africa with synchronising required to their mine’s CAD system, Microstation, showcasing that STS is an adaptable and compatible geospatial program. Taking the learnings from Australia as well as South Africa’s Fall of Ground history, STS has been engaged positively across the other Underground Business Units.

The Process

Of course the underlying principles of control and eliminating exposure are paramount which is why all Coal Mine Workers:-

- are required to complete a detailed SLAM (Stop – Look – Assess – Manage) prior to undertaking a task to which both Trigger and Direct Questions prompt hazard identification (refer Figure 2); and
- completed training in the correct identification of strata defects together with the required barricading standard to minimise potential risk to as low as practicably possible (refer Figure 3).

In addition to this, the Geotechnical Engineer and Underground Mine Manager meet every week to review the Strata Defect Report, remediation progress to date and finalise the remediation plan for the upcoming week based on Site requirements. In the event the number of strata defects being added

to the database exceeds those being remediated, the Underground Mine Manager escalates this to the Site Senior Executive for the allocation of additional resources.

SLAM Trigger Questions			
1.	Is the task covered by a Golden Rule? and if so am I in compliance with these requirements?		
2.	Does the task require a permit to be completed?		
3.	Does the task require isolation of an energy source?		
4.	Does the task involve interaction with roof / rib or other strata?		
5.	Are the hazards associated with ventilation known?		
6.	Does the task involve interaction with mobile plant or rotating and moving parts?		
7.	Has the area of work been inspected? When was it last inspected?		
8.	Do you know what to do in an emergency when conducting this task?		
9.	Is Manual handling required?		
10.	Can I injure myself or others?		
11.	Is Barricading required (High Risk or Low Risk)?		
12.	Has communication of the task been undertaken?		
13.	Have I reviewed my Hazards and Controls with others?		
14.	Has my work environment changed? If so, how am I controlling it?		

AngloAmerican U/G Ops SLAM (Stop, Look, Assess & Manage)			
Name:		Date:	
Location:		Time:	
STOP - PLAN THE WORK			Initial if safe to continue
What task am I about to do?			
What could hurt or kill me?			Supervisor
Have I considered all of the SLAM trigger questions in the prompt page?			Supervisor
What do I need to do to make sure they do not go wrong?			Supervisor
Do I think it is safe to do the task?			
YES <input type="checkbox"/> NO <input type="checkbox"/> Signature: _____			
Important: If you are unable to do the task safely then you need to stop and discuss the issue with your Supervisor.			

Figure 2: SLAM Trigger and Direct Questions

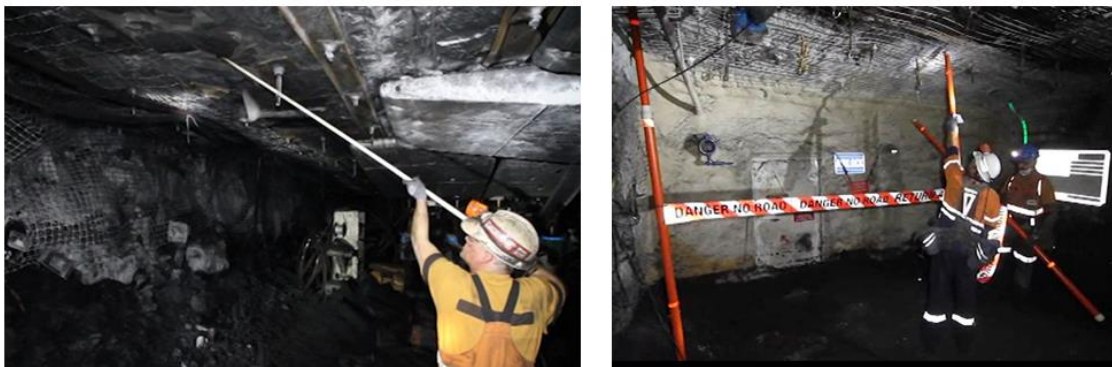


Figure 3: Strata Identification and Barricade Training Photo Extracts

When a Coal Mine Worker identifies a strata defect in their work area it is inspected by the Zone Deputy and reviewed by a second Statutory Official as true and accurate. During this process it is the Coal Mine Worker and Deputy's responsibility to either fix the identified strata defect straight away or alternatively erect an effective barricade.

The report on the strata defect must then be completed, assigning the relevant risk category (see Figure 4) and submitted to the Geotechnical Engineer who reviews the information and enters the details of the strata defect directly into the SORD database together with Easting and Northing locations so the strata defect can appear immediately on the STS Mine Plan.

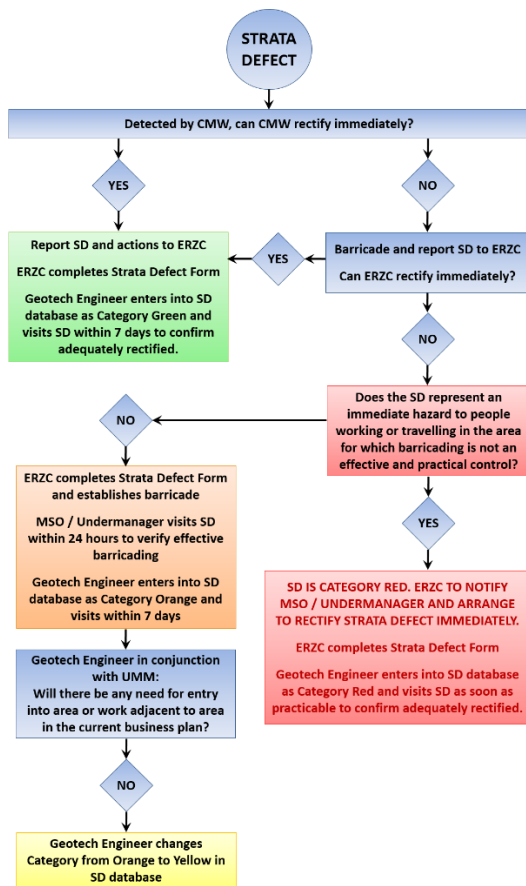


Figure 4: Strata Defect Category Flow Chart

Based from the Report Date the Site Geotechnical Engineer has a designated timeframe to complete administrative and physical approval of the strata defect and during this process request additional remediation as deemed necessary. In the event the designated timeframes are not adhered to there is an automatic escalation process based on a governance structure whereby emails are sent to different levels within the business reporting the non-compliance. Within 3 days of exceeding a timeframe, the Head of Underground Operations is aware of the breach.

In cases where the strata defect can be rectified immediately by the Coal Mine Worker or Zone Deputy, the process for reporting the strata defect remains the same. The rectified strata defect is reported and entered into the SORD database as per above, however it is categorised green, i.e. rectified. Saying that, the system still requires the Geotechnical Engineer to validate that the strata defect has been adequately rectified within the specified timeframe (see Figure 5).

The system also identifies if previous strata defects have been registered against the defined Easting and Northing coordinates to provide a history of events and to trigger if perhaps a more detailed engineering analysis is required in this area.

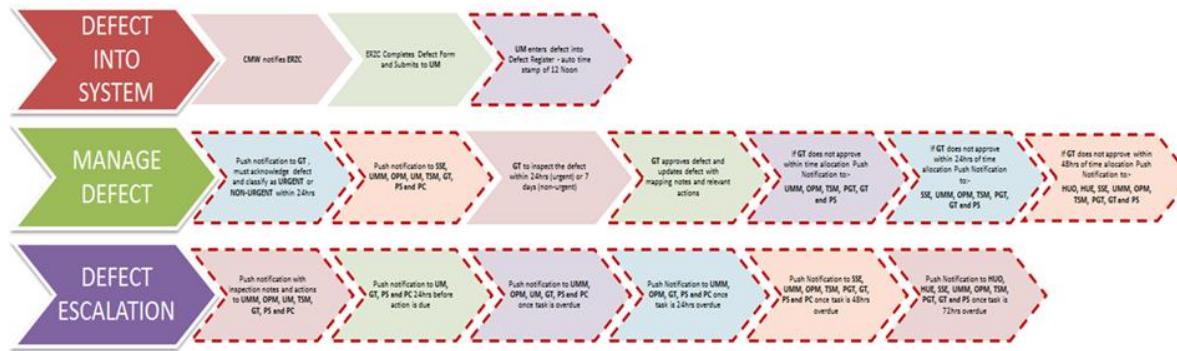


Figure 5: Strata Defect Process Flow Chart

Remediation and Accountability

An additional benefit of the SORD system is the auto-generated push notification reminders that are sent to the personnel responsible for assessing or remediating a strata defect together with, as detailed above, a non-compliance escalation procedure. This provides improved accountability and systematic review of the strata defect management process. The system also automatically generates strata defect reports on a daily, weekly, monthly and yearly basis and the data is able to be exported to EXCEL as well as is available live via Tableau for detailed analytical review or as a status overview for the Weekly Mine Manager’s Meeting (see Figure 6).

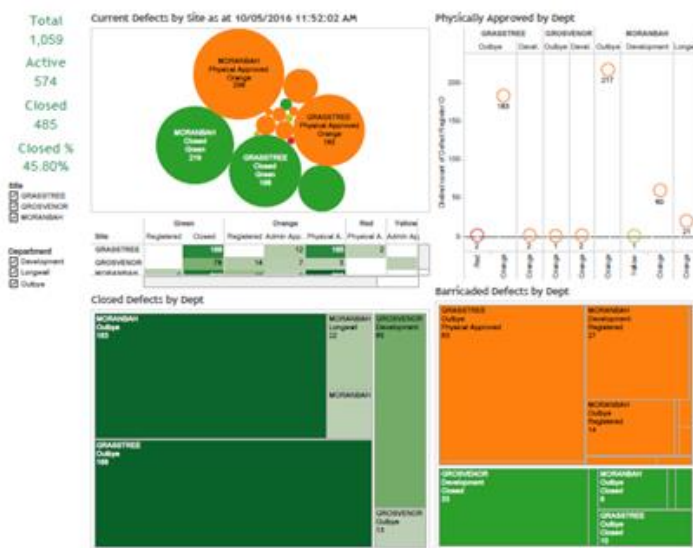


Figure 6: Strata Defect Management Tableau Report (Regional View)

From a planning perspective it is the responsibility of the Department Superintendent notified of the strata defect per the abovementioned Process Flowchart to coordinate and execute remediation via the available resources under their process control. As Fewzion is our Business Short Term Planning System we are in the process of integrating the strata defect remediation requirements automatically as tasks in our 5 week rolling Mine schedule, however at this point in time the requirements identified

in the Notification Email are entered manually into Fewzion and tracked via our Task Close Out Flowchart (See Figure 7).



Figure 7: Strata Defect Task Close Out Flowchart

Results.

Prior to leaving the surface, all Coal Mine Workers can easily review the area they are working and visually see any identified hazards. This heightened awareness and improved communication with the workforce is critical for hazard awareness and risk mitigation.

From a planning perspective, the visualisation of the underground environment allows Coordinators to manoeuvre the Mine Plan to their area of work to pre-determine potential hazards or risks that must be mitigated prior to scheduling Mine Process works. This effectively and efficiently improves task scoping and streamlines workflow planning. As a further feature to STS, people and equipment locations have been overlaid within the mine to provide a holistic view of where our people are working in relation to identified hazard and risk areas – invaluable information for our Control Room Operators and a tactical response tool to ensure safety in our underground operations (see Figure 8).

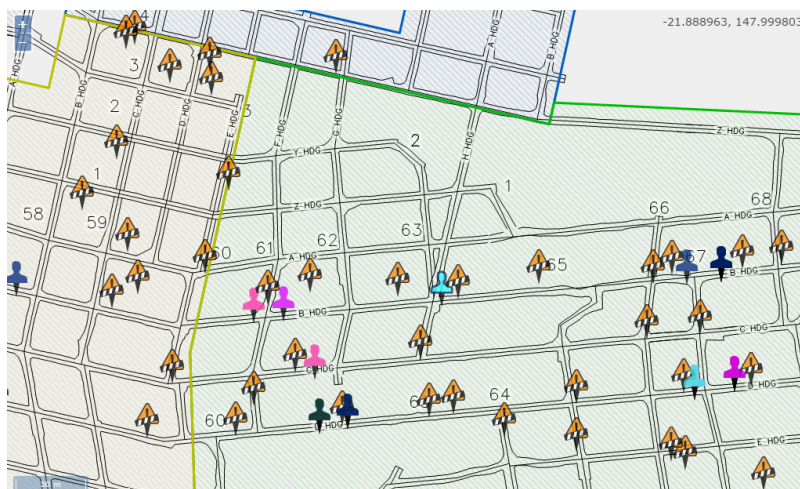


Figure 8: Extract of an STS Mine Plan identifying Strata Defect and Employee Locations

Future Enhancement Options

Strata defects is the first hazard or risk that has been identified to show on STS however the options are endless (eg. ventilation quantities, gas makes, excessive tell-tale movement, etc) simply by integrating with other Site Systems and identifying the required triggers or parameters.

An additional feature will be to physically plan works by “drawing” on STS and assigning the required resources by name. Through proximity detection in the event that designated Coal Mine Workers progress outside of their identified work area and potentially putting themselves in harms way, an alarm will trigger both for the employee underground via his lamp and in the Control Room. This is futuristic technology, however it is one of the enhancements identified for future implementation.

From a reporting perspective, the live entering of strata defects and monitoring data from a Tablet or similar device underground is also planned for this System, removing the time delay of paper needing to come to the Surface.

Conclusion

Through state of the art technology and integration with Site Systems we can communicate live and up to date hazard and potential risk locations to our Coal Mine Workers as well as visually display areas requiring additional detailed planning and risk mitigation to our Coordinators.

In addition, by having a system based tracking mechanism for every strata defect reported on our Sites, we know at any point our progress in addressing these areas as well as being able to analytically review data in the event of a “sleeping” bigger issue, etc.

We now have an open visual strata defect communication tool allowing all levels within our business to picture and think through the tasks they have been assigned in their area of work and the potential hazards or risks that must be taken into consideration. After all the best person to look after your own safety is you so the more information that can be provided to our people the better prepared and aware they can be and, as we all know, a picture tells a thousand words!