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FINAL REPORT

Implementation of Roadway Development Strategy

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Implementation of Roadway Development Strategy

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1. ABSTRACT

Improvements in roadway development rates remain one of the most important issues in underground coal mining in Australia. Through a series of industry meetings and workshops in 1996-97, it was determined that applying a systems approach to current practice could both dramatically improve rates and better indicate required new technology.

This project aimed to implement a systems approach to roadway development at several Australian longwall mines with special emphasis on information flow, improving uptime rates, systems reasons for downtime and improved application of project management. Although only one out of three mines completed the site work, the project has demonstrated the application of a systems approach to roadway development in a practical mine situation. As well as showing the benefits of a systems approach, it has also clearly demonstrated the hurdles that need to be overcome for its successful application.

It has confirmed the imperative for the effective *integration* of people issues with the introduction of new technology. Effective implementation of new technology depends upon having systems under control.

It has illustrated the benefit of simple gantt and heirarchial models when looking for process bottlenecks and key improvement requirements.

It has highlighted the importance of proper information systems and analysis as the foundation for all improvement initiation.

Corporate commitment at all levels has emerged as a prerequisite for successful implementation. Acceptance of that fact that implementation may require changes in information systems, management structure, succession planning and also realisation of the time and commitment involved from the mine are fundamental issues.

It has illustrated the differences in effective power of a traditional organisation and an ‘empowered’ workforce that have sufficient process knowledge and capacity to positively influence change.

Finally, it has demonstrated the benefits of a systems approach to roadway development both in short term (six months) and with greater potential in medium term time frames, especially when the impact from panel and mine cycle changes are realised. It has been heartening to observe many organisations beginning to ‘walk the talk’ and make a systems approach their corporate benchmark for roadway development improvement.

2. PREFACE

By David Reece, Mine Manager Dartbrook Mine, former Mine Manager Central Colliery

The pressure placed on development panels to achieve rates that will sustain longwall continuity has been more than evident for a good many years. Panaceas have ranged from the acquisition of new technology continuous miners or haulage systems, the implementation of standard procedures to decrease variability or to simply look for more hospitable conditions. However, none of these solutions will work efficiently without a deep understanding of the process in which they are to be applied.

The "systems approach" as detailed in this report will be seen by many as common sense – and this is basically true; but this doesn't mean that it will happen by accident or with little effort. The key to success is in understanding:

1. the component parts of the system – machine types, operational capabilities, maintenance requirements, operator skill levels and knowledge and operational standards;
2. the interaction of these parts and their interfaces;
3. committing the time, effort and resources to optimise both the components and their interactions.

The last of these points is what each mine was required to focus on for this project.

At Central, this work delved further into our resources than I had anticipated. This was particularly evident in the availability and use of information. As indicated in the report, the more information that was conveyed to the operators involved with the process, the more efficient the process became. Whilst success was certainly achieved through this process at Central it is also apparent from discussions with other operators that, those who spend this time and effort to understand and refine the process have achieved an optimum result within their systems capability.

I commend the process as laid out in this report, the time and effort of Mr Michael Kelly and his team and also that of the participants as being both worthwhile and necessary. This commitment up front, though not the traditional way the mining industry has operated, is becoming more typical with the results also forthcoming.

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3. INTRODUCTION

ACARP and CSIRO supported an initiative through 1996 that facilitated industry wide discussion on the principal issues facing roadway development (RWD), and formulated an agreed industry plan that would potentially double industry development rates over the following five years. The use of a systems approach to roadway development has been the basis of the discussions and plan development. Within this approach roadway development is recognised as a series of processes and hierarchies in which the interactions are complex and time dependent. A systems approach recognises the complexity of the system and manages it as a whole rather than as individual processes. In a systems approach the result is not equal to the sum of its parts; it is the outcome of the *interaction* of the parts.

The strategies developed within the industry plan included:

- **Information** - the requirements, practices, capabilities and precision.
- **Technology Implementation** - through commercial sponsors, reviews, partnerships.
- **Face Downtime / Uptime** - underlying systems reasons for downtime, improvement and consistency of uptime rates.
- **Project Management** - identifying tasks where applicable, case study examples.
- **Parallel Operations** - the use of systems and new technology to reduce the critical path of face activities.
- **Implementation of a Systems Approach** - through presentations, industry discussions, education/awareness, middle management role.
- **Automation** - setting long term priorities, technology roadmaps, initiating technology development.

A full copy of the plan has been included as Appendix 1

The plan prioritised the strategies and recommended that the work on information, face downtime/uptime and project management phases should be addressed first with an initial study on the automation priorities. This project encompasses the implementation of the strategies on information, face downtime/uptime and project management through the use of a “systems approach” at several minesites, referred to as “champion mines” for the purposes of the project. The study on automation priorities was the subject of a separate study.

4. OBJECTIVE

As a demonstration project the objective was the practical implementation of a systems approach to roadway development through the key strategies of information, face downtime/uptime and project management at several longwall mines, and to communicate the results of this implementation through industry forums.

5. IMPLEMENTATION STRATEGY

The original project scope encompassed the following activities:

- Identifying several longwall mines in Australia who wished to introduce or improve (or champion) a systems approach to roadway development with the assistance of this project. These would then be referred to as "Champion Mines".
- Identifying suitable consultant groups to assist in this implementation, specifically in the areas of information, face downtime/uptime and project management.
- Formulating a joint proposal from the consultant groups and CSIRO (referred to as the Project Team) to assist the Champion Mines in the implementation of a systems approach.
- Securing agreement with the Champion Mines on proposal details including site commitments, interaction, reporting, confidentiality and costs.
- Carrying out the work program at the Champion Mines from April 1997 to March 1998.
- Organising the seminar to communicate the outcomes from Champion Mines to industry in April - May 1998.

6. PROPOSED SITE PROGRAM

Although three mines, Oakdale, Central and Newstan originally agreed to participate in the project, two of these mines, Oakdale and Newstan withdrew at various stages due to commercial reasons outside the project's scope. Although this report will detail the completed work at all three mines, the main focus will be at Central, which completed the project site work and implementation.

The site program originally proposed to each mine is shown below.

a) Definition of Systems Approach and Site Application

- Define specific site program at each mine.
- Conduct a forum on the introduction of a systems approach with the liaison team and others at the mine.
- Coordinate activities of the Project Team.
- Regular follow-up at each mine on systems approach issues.
- Final report and presentation at each mine.

This was to be conducted by Mr Michael Kelly, CSIRO.

b) Information Study

- Analyse what information is available, its accuracy and usefulness in quantifying RWD.
- Investigate what feedback loops to the staff and workforce exist and what may further assist RWD.
- Investigate improvement needs (including technology improvement needs).
- The role of information as a business driver for RWD.
- Final presentations to site staff.

This was to be conducted by Dr Mark Harrigan, formerly of Invetech assisted by Mr Michael Kelly.

c) Investigation of Face Downtime / Uptime

- An appraisal of the roadway development cycles including a benchmark of current cycle times and expectations. Emphasis was to be placed on the hierarchy of cycles (face, pillar, panel, whole of mine) and the interaction between these cycles.
- Establishment of communication requirements between the mine and the consultant to continue this study on a weekly timetable over a baseline of six months.
- Ongoing analyses of cycle interactions and areas of improvement.
- Investigation of uptime rates with emphasis on the instantaneous maximum, and determining 1) how this may be improved and 2) its relationship to average uptime rates.
- Comparisons between minesites used in the study where appropriate.
- Follow up sessions at each mine after one and four months.
- Final presentations to site staff.

This was to be conducted by Mr Stephen Eames from Dames and Moore with some assistance from Mr. Michael Kelly and Dr. Terry Medhurst (CSIRO).

d) Project Management Techniques

- Identifying and prioritising key non-continuous activities associated with RWD where project management techniques may be applied
- Selection of a critical activity for a case study.
- Developing a standard management plan for the activity with appropriate timing, resources and performance measures.
- Implementation of management plan with selected activity.
- Review and revision of plan and review other applicable activities.

This was to be conducted by Mr Bob Miller from Hawcroft Miller Systems Management assisted by a project engineer from Thomas Crowe Project Management.

e) Close Out Activity

At the end of the six-month baseline, there was to be a workshop between the Project Team, the mine liaison team and other interested persons at the mine. The aim of the workshop was to review the progress of the project during the six months and to set the ongoing agenda and action items for the mine that will achieve a significant improvement in roadway development. This is described as the mine presentations in the previous sections. It was expected that the mine would take part in the report back seminar to industry to be held in April - May 1998.

It was stressed to all the sites that the above work was to assist them to introduce or improve a systems approach to roadway development; it was not to implement it for them. As such, there was a substantial amount of work and development that the sites needed to undertake to make such an implementation or improvement tangible, transformative and longlasting. It was recognised that this is a core business activity for all mines and that there may already be substantial activity at the mine, and corporately, for roadway development improvement. The key to the success of the work was that it must be fully integrated with the existing improvement effort so that <u>they were the one activity</u>, otherwise they would simply undermine each other's efforts and have a net negative impact.

The commitment from the mine needed to include:

- A desire to improve roadway development performance by the implementation of a systems approach to the problem.
- Acceptance that this will involve a change process.
- Recognition that the process must involve face-worker and middle management as well as senior management support.
- Understanding that the process may involve a major change in the way information is collected and used.

To facilitate this process a temporary development improvement team needed to be initiated at the mine. This team would be responsible for guiding the change process and liaising directly with mine workers and our Project Team. It may consist of, for instance, a development coordinator, engineer/tradesman for maintenance advice, deputy or other statutory official for statutory and practical organisational issues and a miner for liaison with face workers and detailed practical issues. The team would come together only as required.

7. COMPLETED PROGRAM

7.1 Initial Preparation

In order to benchmark current cycles at the subject mines, theoretical process maps were completed for each of the mine cycles: face, pillar, panel and whole of mine for a "typical" longwall mine. These process maps were seen as a starting point to understand the actual processes and interactions at each mine and were not developed with any "ideal mine" in mind.

Similar to other activities throughout the implementation project, constructing these process maps was a learning experience for the Project Team. The complexity of the cycle at each level was underestimated, and initial plans to show inter-cycle interactions were shelved, as intra cycle interactions proved difficult enough to portray graphically. The cycles were very different at each hierarchy. Some of these characteristics are outlined below.

7.1.1 Face Cycle

The face cycle example (Figure 1 and Figure 2) represents the cycle for an in-place mining unit. As might be expected, it is essentially a linear system with most events in series with little opportunity to parallel activities. Key issues of standards, training, skills overlap, maintenance and intra- and inter-shift communication are highlighted in the cycle process map. The ability to recognise hazards and modify the mining process accordingly was also recognised as a key point.

7.1.2 Pillar Cycle

The pillar cycle example (Figure 3) again represents the cycle for an in-place mining unit. Unlike the face cycle, the pillar cycle was seen as system consisting of several activities that could be paralleled. Even though the driveage would be the critical cycle, there were opportunities to parallel activities in the advance of power, conveyor, pipes, ventilation, roadworks as well as maintenance and secondary support activities. The extent of the mines' ability to have maximised this opportunity to parallel activities was seen as a key point. Other key points were the extent of process improvement implementation and the effectiveness of mine management interaction to set and implement daily mine plans (especially in the areas of crew consistency, resource allocation, communication of mine status and changes in planning).

7.1.3 Panel Cycle

The panel cycle (Figure 4 and Figure 5) proved the most difficult cycle to portray because of the complex interactions between planning, operations and maintenance groups and especially because of the complexity of communication, monitoring and feedback systems required. One key area in this cycle related to the control issues of 1) ensuring that these interactions occur in an efficient and timely manner and 2) reporting, setting of priorities, and responsibility of the determination of impacts of unplanned events and alteration to planning. Another key area was related to pit room, and whether there was sufficient mains development to minimise interaction with gateroad development.

7.1.4 Mine Cycle

The mine cycle (Figure 6) although apparently the most straight forward cycle to portray was the most critical in setting the cultural environment of the mine. The long-term and complex nature of many of the required systems (eg maintenance, safety, purchasing) requires an approach partly divorced from day to day operations, yet requires the same people to implement these systems efficiently. A key area was medium to long-term planning and recognition of the lead times required for the exploration, mine layout, financial planning and panel plan cycle. Another key area was the ability to separate corporate and operational imperatives, especially for information flow.

FACE CYCLE EXAMPLE (Part A – Resources & Issues)

Resources Required:

1 x Mining Crew
1 x Continuous Miner
2 x Shuttle Cars
1 x Breaker Feeder
1 x Auxiliary Fan
1 x Panel Conveyor

1 x Tx and Cables
2 x DCB's and Cables

1 x FEL
1 x MPV
1 x Transport Vehicle
Miscellaneous Attachments for MPV and FEL

Std Equip & Supplies
Std Area Management Plans
Safe Working Procedures
Skills Required
Skills Overlap

Hazard Recognition / Safety Audit & Remedy

Panel & Face Pumping Interaction - face requires pumping

Roadway Maintenance Interaction - repair hole in floor

Intra - Shift Interaction - shift changeover

Inter-department Interaction - calls for resources (Maintenance People)

Supply Face with Mining Material - at appropriate time

Breakdown Maintenance Cycle - repairs as required

Figure 1 – Face Cycle (Part A)

FACE CYCLE EXAMPLE (Part B – Flowchart)

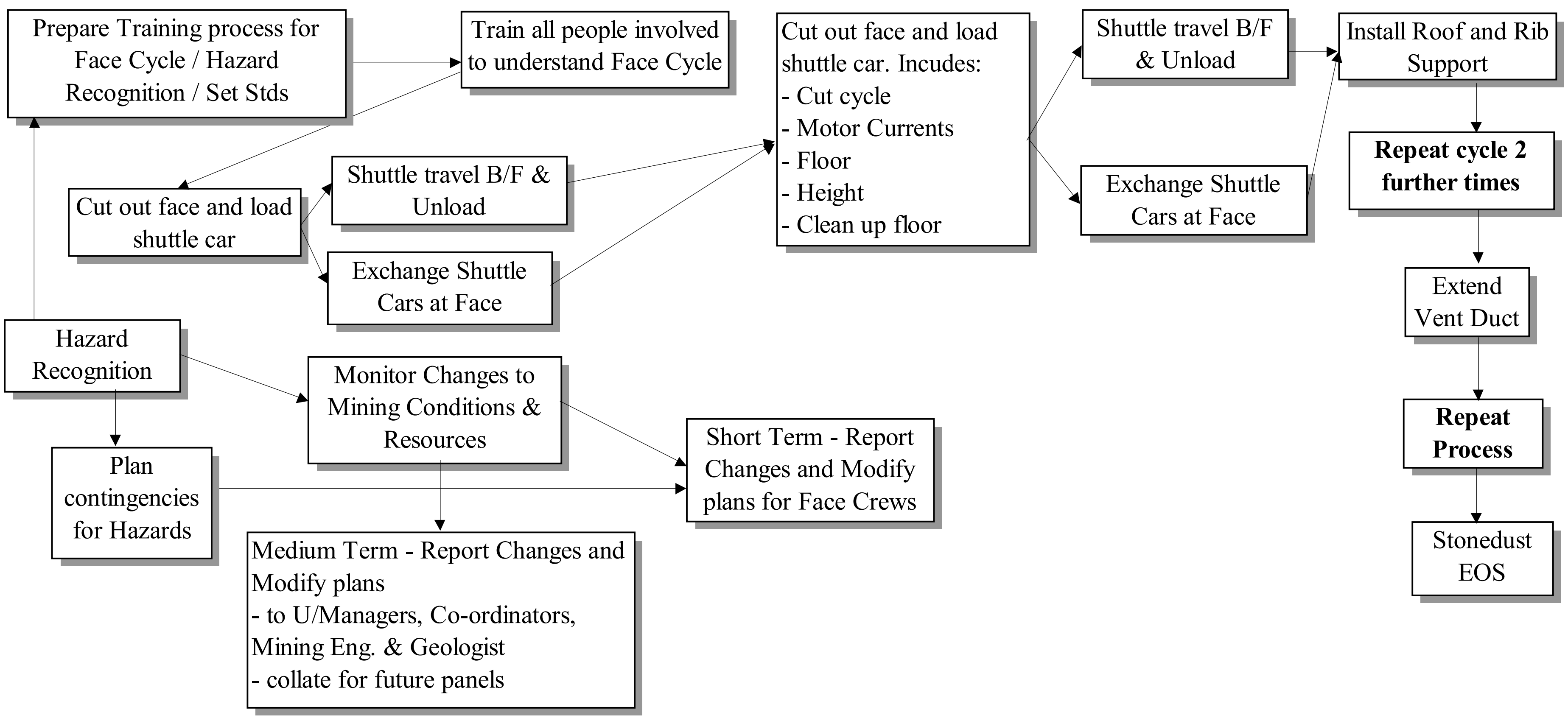


Figure 2 – Face Cycle (Part B)

PILLAR CYCLE EXAMPLE

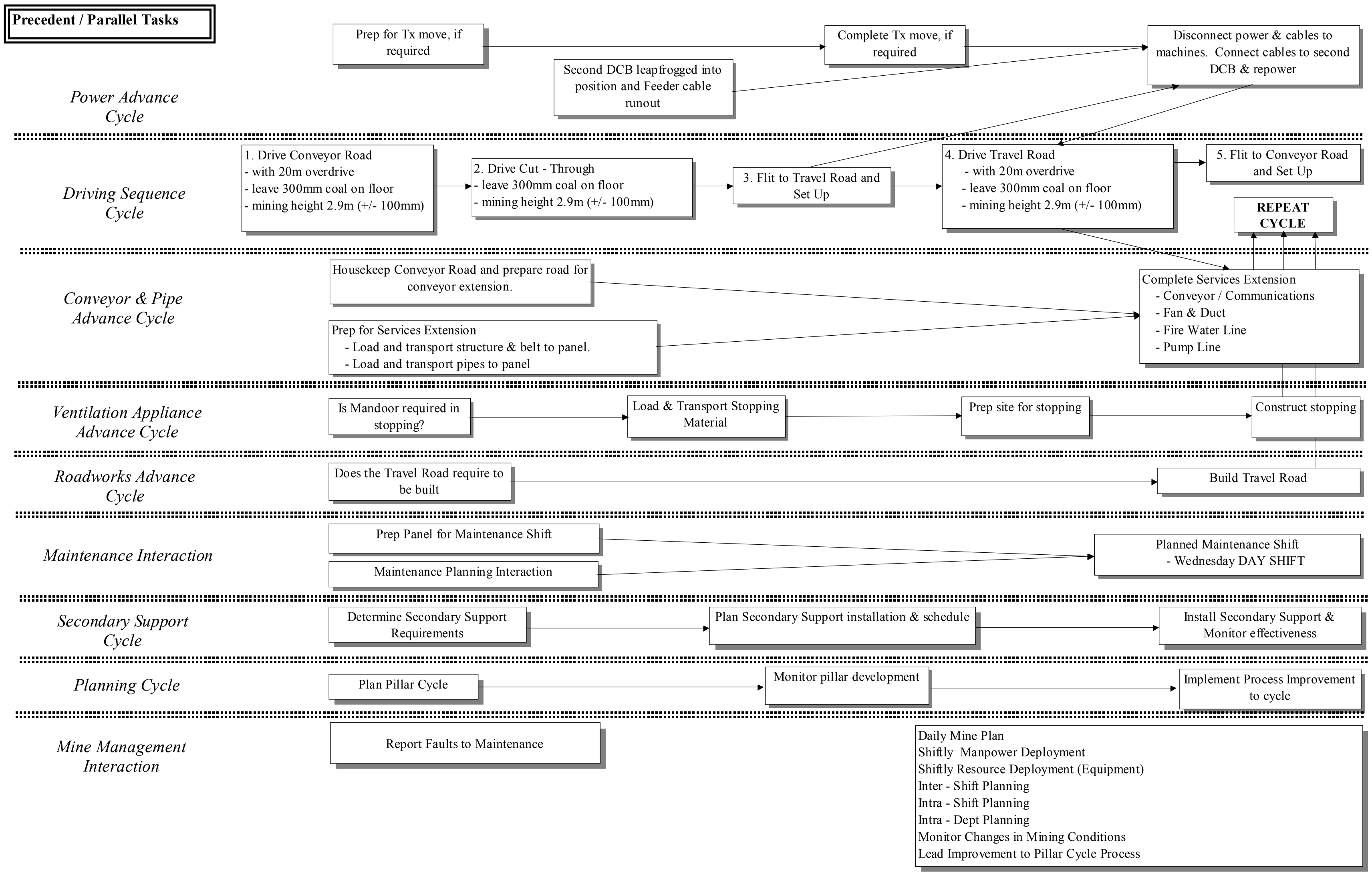


Figure 3 – Pillar Cycle

PANEL CYCLE EXAMPLE (Part A)

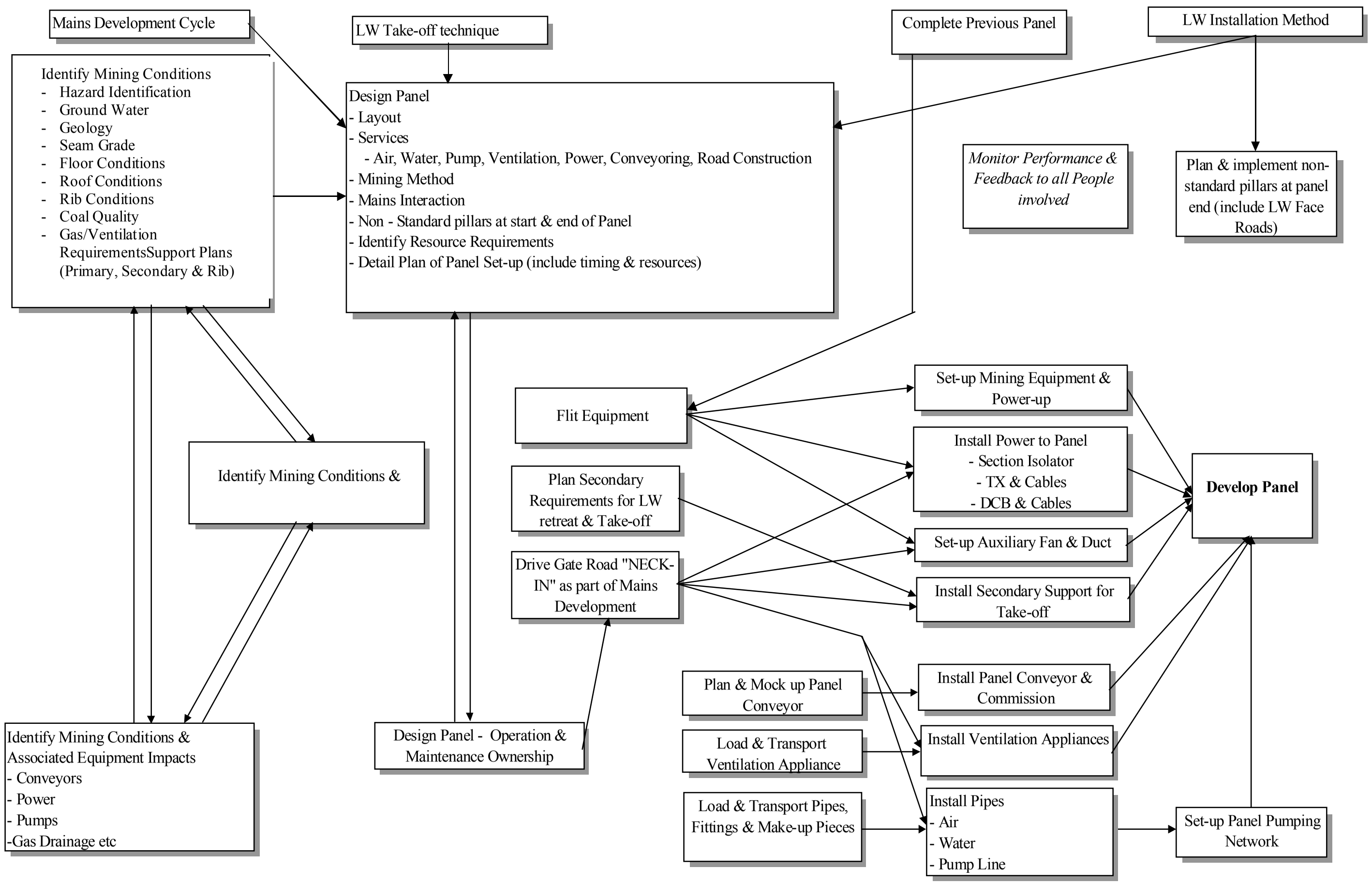


Figure 4 – Panel Cycle (Part A)

PANEL CYCLE EXAMPLE (Part B)

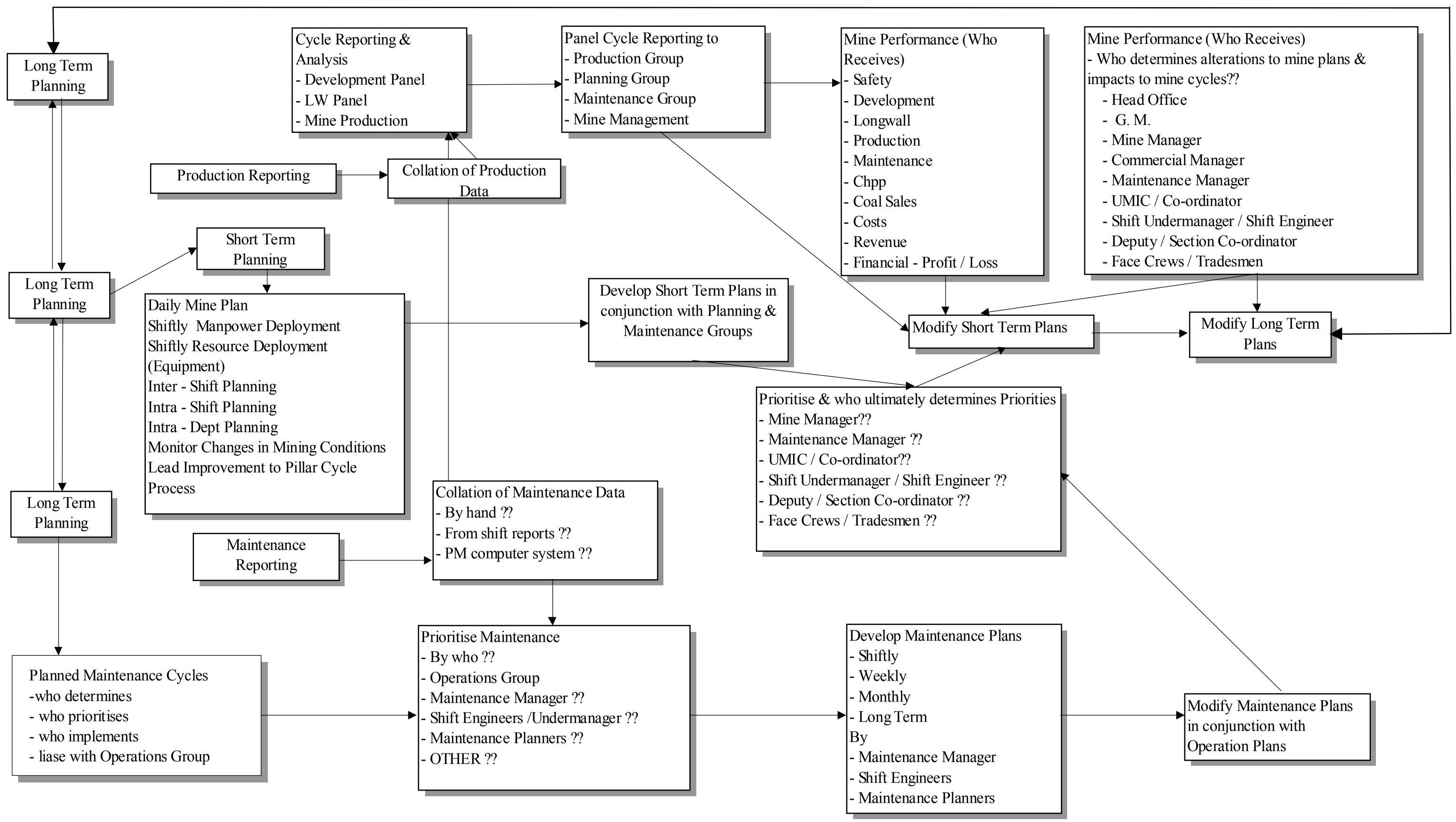


Figure 5 - Panel Cycle (Part B)

MINE CYCLE (PLANNING, PERFORMANCE, MONITORING & CHANGE MANAGEMENT) EXAMPLE

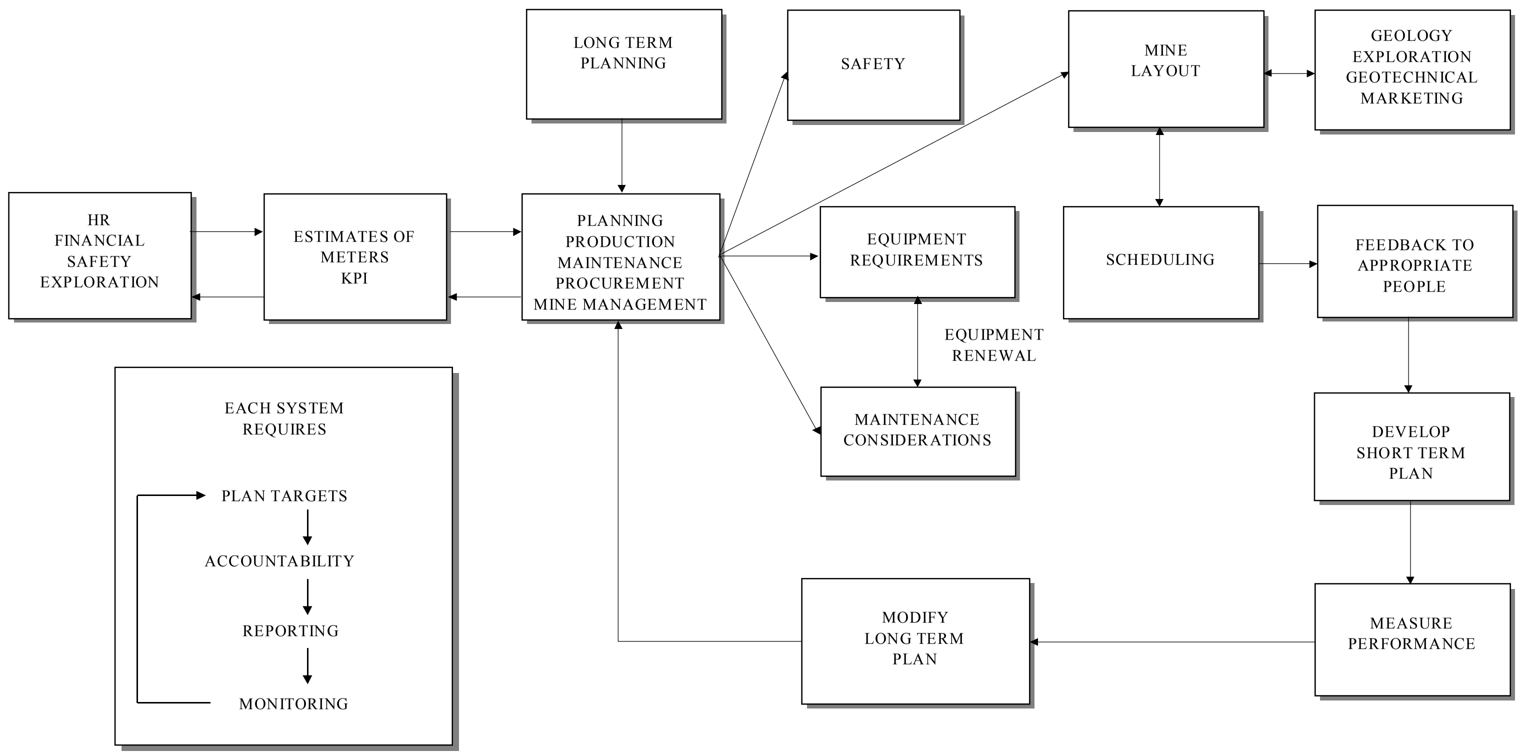


Figure 6 - Mine Cycle

7.2 Implementation at Oakdale Colliery

7.2.1 Background

Oakdale Colliery is situated about 100km south-west of Sydney and mines the Bulli seam at an average thickness and depth of 2.0 and 410 metres respectively. Although originally a mine employing traditional pillar extraction techniques, a Colmill based longwall was introduced in July 1993. Peak production since that time has been 1.4 million tonnes in 1995/6. Coking coal and steaming coal streams are produced for export.

7.2.2 Implementation Activities

At the time of the commencement of the study, the mine was owned by Advance Coal Ltd. and was suffering a severe liquidity problem. The mine management felt that the main impetus for RWD was one of short-term survival within this liquidity restraint. Future production was development constrained and in turn, development was being partly constrained by the shortage of consumables. The Project Team agreed to continue the project, subject to payment of consultant costs. After discussions with the Executive Chairman, Mine Manager and Production Manager, the agreed focus was initially to be a short-term productivity improvement through the application of a systems approach.

A full day site familiarisation was held on the 29th July 1997 followed by a workshop on a systems approach and the proposed project activities to a "diagonal slice" group of 11 staff on the following day. This group consisted of the mechanical engineer-in-charge, day shift electrical engineer, night shift undermanager, safety coordinator, gas drainage coordinator, two deputies, two miner drivers, a fitter and an electrician. The group feedback was that the approach was timely and essential and the focus should be on setting immediate goals for longwall (not pillar) development, integration of gas drainage and establishing processes that would encourage rather than stifle initiative.

Prior to the site benchmarking activity being commenced, the mine was taken over by its major creditor, and subsequent activity was curtailed. A later proposal to continue the work at no cost to the mine was discussed in April 1998 with the new mine management. However the support staff levels were not seen to be sufficient to implement the type of changes envisaged and the offer was appreciated but declined.

7.3 Implementation at Central Colliery

7.3.1 Background

Central is one of three mines operated by Capricorn Coal Management 25km west of Middlemount in Queensland's Bowen Basin. It commenced operations in 1982 and was the first longwall mine in Queensland. It has averaged 2.5 million tonnes ROM for the last five years and average recovery is 70%. The product is a high-grade, medium-low volatile matter, hard coking coal.

Initial discussions were held with the Chief Mining Engineer – Shell Coal, the site General Manager, and Central's Mine Manager and Development Coordinator. The main issues appeared to be the increasing depth of workings (330 metres and increasing via a one in ten gradient) and the historically traditional management approach at the mine. These issues were combining to limit the development that was required to maintain the mine's viability. The focus then was to implement a program that would involve real continuous improvement and address the technical and organisational issues associated with the increasing depth.

7.3.2 Implementation Activities

Initial site familiarisation was again followed by a one-day workshop to a diagonal-sliced group consisting of a senior mining engineer, a shift mechanical engineer, two deputies, three miners, a fitter and an electrician. This was followed by a week of in-depth study at the mine (that included an information study) by Michael Kelly and Terry Medhurst from CSIRO and Mark Harrigan. (Unfortunately Dames and Moore could not participate at Central because of a resignation, hence Terry Medhurst's involvement.)

A report of the site-work (Appendix 2) was presented to the mine management. Two additional workshops on a Systems Approach and the report findings were also presented to senior staff and to all shift operational staff at the mine. The aim of the project was also discussed with union representatives. The report findings were accepted by the mine and an implementation program was put in place over a period extending from August 1997 until August 1998. The main stages of the implementation program were:

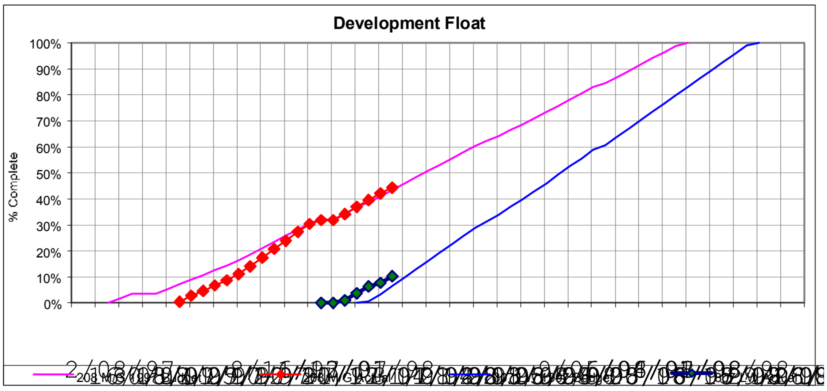
1 Improved production reporting system
2 Area production meetings
3 Resultant detailed implementation changes
4 Mid panel maintenance review
5 Introduction of Standard Area Methods
6 Project Management - extension of mains driveage
7 Ongoing mine implementation

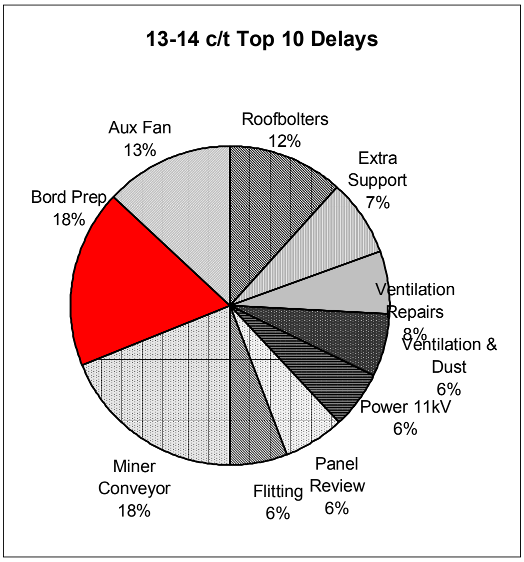
7.3.3 Improved Production Reporting

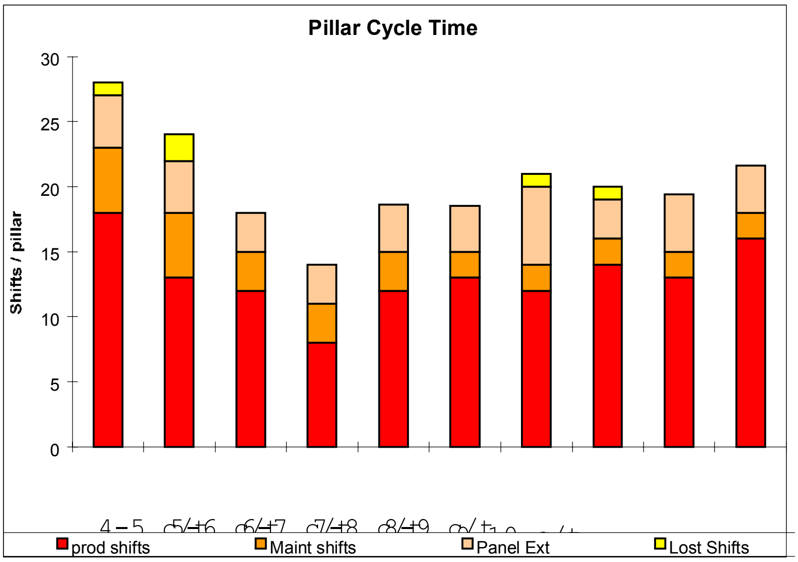
The improved system emphasised process improvement and focused on the pillar cycle. It aimed to reinforce the panel team, rather than focusing on individual shift performance. Key performance indicators were cycle measurement, metres per operating hour and systems availability. A pillar cycle report was produced after the completion of each panel extension and made available, and where possible presented to the crews. A typical report is shown in Figure 7.

208 MG Pillar Review 13-14 c/t

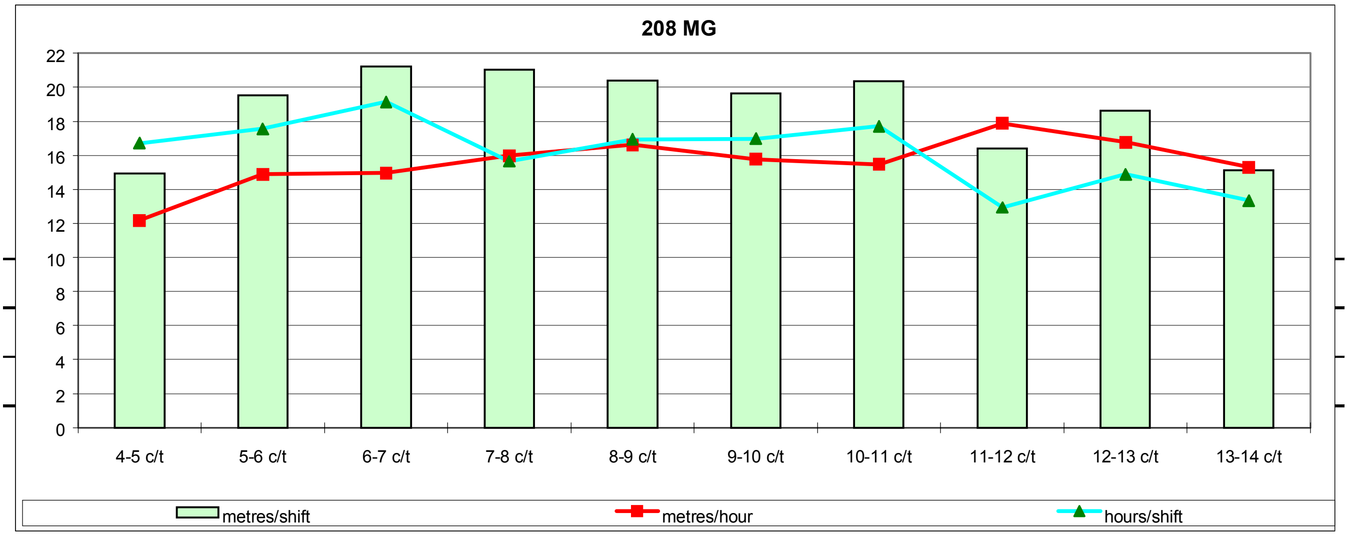
Pillar Start Date	**23-Jan-98**	**N/S**
Pillar End Date	**4-Feb-98**	**N/S**
Total Shifts Drivage		**16.0**
Total Shifts for Panel Extension		**3.6**
Total Shifts		**19.6**
Av Metres/Shift		**15.13**
Av Metres/Hour		**4.17**
Av Hours/Shift		**3.64**







Successes



Pillar Records

metres/shift	21.2	6-7 c/t	Total Shifts/pillar	12.0	7-8 c/t
metres/hour	4.9	11-12 c/t	Shifts/Drivage	9.0	7-8 c/t
hours/shift	5.2	6-7 c/t	Shifts/Panel Ext	3.0	7-8 c/t

Figure 7 - 208 MG Pillar Review

Key areas of the report highlighted the current development float for the next longwall commencement, the top ten delays for the completed pillar, the pillar cycle time broken up into production, maintenance and panel extension times. Lost shifts due to factors outside the panel were also highlighted. Crews also reported on what went well and possible areas of improvement during the pillar advance. If applicable, these comments were addressed by the panel deputies and the development coordinator with the emphasis on effective feedback to the crews.

7.3.4 Area Production Meetings

As part of the team building exercise and to promote an exchange of views regarding improvement strategies, area development meetings were carried out prior to the start of the panel; twice during the life of the panel and a final meeting prior to longwall installation heading driveage. The meetings were held on dayshift in lieu of all production on that day.

The outcome of the meetings was very positive; both with respect to teamwork and the initiation of improvement strategies. The most immediate outcome of these meetings was that the crews were reminded of the most efficient development methods at various stages of the panel cycle. This was particularly beneficial to development rates at the start of the panel, with consistent high rates from the panel commencement instead of a "ramping up "period. Another positive outcome was that representatives of all crews visited other operating mines to gain first hand insights into possible improvement applications. This was especially important considering the mine's geographical isolation.

7.3.5 Resultant Detailed Implementation Changes

As a result of this initial work, some changes were introduced that resulted in improvements in panel development rates. Most of these changes focused on improving the pillar cycle and allowing crews to parallel some activities. These included:

- A new sequence involving driveage of the travel-road first. In theory this allowed for the pipes and cables to be extended in the travel road while the belt road was being driven. In practice, perceived safety issues relating to rib bolting the belt-road on cycle and the requirement to drill ahead for gas content determinations limited the effectiveness of the change. The resultant advance was only similar to that achieved previously, and the crews reverted to that previous sequence with a commitment to implement further process improvements.

- There was additional focus on the panel extension (belt move) process across the three shifts. A previously prepared document detailing the current practice was used as the starting point for improvement. Initial discussions within the combined meetings was followed up by several "example" (or closely monitored) extensions. Feedback on these extensions was conducted through the pillar review process described above.

- The emphasis on targets was changed from shift performance to a "pillar a week". While it could be argued that this is still a target that does not promote process improvement, it was recognised as an interim step between shift targets and process targets of metres advance per operating hour and operating hours per shift. These latter targets were also included and the crews were introduced to the concept of timing their process and reporting conditions that slowed that performance. The proved to be a very effective way of introducing timing without the traditional confrontationist stopwatch methods. The emphasis conveyed to the crews - and to the union - was that of process improvement, understanding the process by measurement and improving the crew's awareness of constraints to the process. In short we measured the process not effort.

- A new panel stonedusting system was introduced using a Quickduster with applications every afternoon shift. This achieved a better coverage at a fraction of the time required of previous methods.

- A new consumable system was introduced using preloaded supply pods. This reduced rehandle and wastage. It also improved the pillar cycle as the consumable amounts were matched to meterage advance per cycle.

- An LHD machine with an appropriate array of attachments was assigned permanently to the panel. This allowed pillar cycle activities to be done in parallel to face activities and during downtime periods.

- Shorter (1.8m) tensioned bolts were successfully trialed in the panel. This type of bolting is ideal for strong laminated roof and allowed single pass drilling in most circumstances.

7.3.6 Mid Panel Maintenance Review

Following the completion of 18 out of 29 cut-throughs a mid panel maintenance review was completed and a summary of recommendations is shown below:

Table 1 - Mid Panel Maintenance Review

Delay	Duration - Minutes (%total delays)	Key Issues	Recommended Action
Miner Conveyor	3150 (12.6%)	Numerous delays occurred that were associated with excess wear.	• The miner had just been substituted with another machine to allow an overhaul and for these issues to be addressed. • New miner to undergo performance testing to ensure potential problem areas to be identified early.
Panel Prep delays	1650(6.6%)	The delays fell into either clean/trim delays or a bucket of incidentals.	• Standards of cutting need to be better defined to prevent rework. • Standard of delay reporting should improve with improved feedback.
Ventilation	1280(5.1%)	Insufficient air and excessive effective temperature	• Ventilation model required with predictive capability. This model should also include understanding of heat flow.
Extra Support	1275 (5.1%)	Flexibolt installation	• Panel cycle to be reviewed to ascertain whether flexibolts can be installed in parallel with other activities.
Traction	1135 (4.5%)	Only one main incident that took 3 shifts to repair.	• Review of incident said to have been completed.
Safety/ Training	1040 (4.2%)	Joint planning meeting for panel	• Acceptable for effective communication.
Flitting	1005 (4.0%)	22 delays for 14 pillars, ranging from 15-90 minutes. Clear that not all flits are recorded and time per flit is variable.	• Communicate whether flitting is a delay, and follow-up on excessive flit times when they occur.
Repicking Miner	930 (3.7%)	Regular delay ranging from one shift to 10 days apart.	• Can this be included regularly between shifts?
Supplies	885 (3.5%)	Only 30 delays over three months. Are some shifts supplying miner without delays?	• Investigate supply methods and standardise best practice
Lack of manning	790 (3.2%)	Two shifts not manned, no further explanation.	• Further details of delay should be supplied eg excessive absenteeism, other priorities etc.
Total Top 10	**13140 (52.5%)**		
Other - Travel	Major delay source	Travel is not being reported as a delay and hence no action plan on road maintenance etc. is being formulated	• Include travel time as a delay to assist in prioritisation of road and machine maintenance and justifying capital expenditure as required.

One of the key delays was the miner conveyor. It was found that excessive wear had decreased tolerances to within acceptable maintenance standards. The miner was due for an overhaul and another miner with a new type of bolting rig was ready to replace it. This swap was done and the old miner was kept in reserve while the new bolters were being commissioned. Unfortunately, the bolters encountered commissioning problems and the miners were swapped once again. The condition of the older machine was such that numerous small and some major delays were sustained in the remainder of the panel.

Several of the other delays could be grouped together into a standard practice issue. It was obvious that some crews were reporting some cycle activities as delays (eg flitting, supplies and re-picking miner) while other crews either fitted these activities in with the cycle or did not consider them as a delay. Many of these issues were addressed in the *Standard Area Methods* introduced later in the project.

Travel was not reported as a delay by any panel crew, although it was a significant issue as the mine was deepening. Some crews were utilising the travel time by doing additional work in the panel with small 'tweenie' crews. The imperative to record this period as part of the full 24 hour cycle was resisted partially as a cultural issue as the Deputies were reluctant to record when production commenced or ceased at the start/end of the shift and partially because the travel time was simply accepted and they could not perceive a benefit in its record.

7.3.7 Introduction of Standard Area Methods

Standard Area Methods (SAMs) have been introduced into many mines under various names and under many different formats. It is worthwhile to firstly review the aims of SAMs, how they may influence the productivity and safety of the operation and what format is best to achieve this outcome.

There are four aims of SAMs:

1. *Standardise the method of development across the shifts*. There is a simple teamwork imperative of all crews on different shifts to be doing things the same way. This promotes the concept of crews being part of a development team, rather than being part of a shift team. To maximise panel development, each crew must know that its actions – or lack of – will effect other shifts and the overall panel performance.

2. *Establish "best" practice.* As part of the mechanism to standardise, is the imperative to establish best practice. Different crews when left in isolation will develop different ways to accomplish the same task. Some of these methods will be a "better, safer, faster, or cheaper" way than others, and it is important to establish the best combination of existing practices when standardising between shifts. Of course the seeking of "best practice" extends past the implementing mine, requiring an ongoing routine to review, and incorporate best practice from elsewhere. Standardised measurement of performance is required to measure best practice.

3. *Improve people's knowledge of that practice.* Little improvement will be accomplished if individual crew members are not aware of issues outside their own specific daily task. The introduction of SAMs must necessarily involve all crew-members and as such will improve their

knowledge of the whole process, how they best fit within it and how possible improvements or problems will affect that process.

4. *Formalise a process that will allow crews to initiate improvement.* To enable SAMs to be an active part of the mine culture it must have a capacity to be extended and changed and to be incorporated into development practice on an ongoing basis. Without this capacity, it will quickly become destined for the back of the filing cabinet, only to be dusted off occasionally to restart the process or to beat someone after an unfortunate incident. The only way to practically achieve this active attribute is to enforce its use and make it easy for the development crew to formally change the process if an improvement is agreed. This will both encourage discipline and give the crews an ongoing ownership of *their* process.

As mentioned above SAMs have been attempted at many mines under various formats and names. Many have been overly driven from the top down and have included details on every associated topic with the panel. These have often referred to as “the bible” and unfortunately have had little ownership from the panel crews and have been almost impossible to change. Consequently, the four aims of SAMs will not be fully realised. The goal must be to minimise the size of the document by being selective on what information is required. The formulation and implementation process must involve all of the crews and disciplines or their representatives.

At Central the following process was adopted:

- Introduce for 208 panel first. This was the current panel that was used in the project. This way, the standards were set for a panel that people were most familiar with and not for an “idealised panel”.
- The process team consisted of seven people including a process leader (undermanager), a mining engineer and representatives of engineering and production from all shifts.
- A draft SAM was to be completed in one week.
- The team would then disperse back to their shifts and discuss the proposed SAM with their crews. All comments would be documented and feedback amongst the implementation team.
- The SAM would then be finalised.
- A formal presentation of the SAM was to be given to all crews, emphasising the discipline required and the change mechanism.
- The SAM was to be used as a starting point for all future panels, especially for 308 panel.

The inclusions in the document were to be:

1. Face Cycle. Includes cutting, roof bolting, rib bolting, coal transport, face ventilation, stonedusting, pumping, alignment etc.
2. Pillar Cycle. Includes sequence, panel layout, panel extension (especially those activities that can be done during face cycle).
3. Maintenance. Includes servicing to be done by the crews, maintenance standards, set-up for and completion after maintenance shifts, panel spares, reporting faults and feedback loops.
4. Supplies. Includes lists and location of all items to be kept in the panel, who checks and is responsible for them, ordering, supply and feedback process.

5. Communication. Includes process of shift change (pit top, between crews and to the crews), reports, information feedback, hardware. Should also include monitoring.
6. Safety. Includes safety hardware and location, process for reporting safety issues and feedback, emergency procedures.

The completed document is shown as Appendix 3

7.3.8 Project Management - Extension of Mains Driveage.

To demonstrate the broader application of project management techniques to roadway development issues Mr. Bob Miller from Hawcroft Miller System Management Pty. Ltd. conducted an assessment with mine's personnel into 2East Extension from 48 to 52 Cut-through (C/T) and up to 2C/T of 209 and 309 panels. The sub-project objectives, strategies and outcomes are summarised below with a full copy of Bob's report to Central attached as Appendix 4.

<u>Project Objectives</u>

Through the employment of Project Management Techniques

- Optimise the resources assigned to the project:
    1. Personnel
    2. Materials
    3. Equipment
    4. Time
- Eliminate duplication, wastage and rework.
- Monitor the work performance and achievement of targets.
- Evaluate the business improvement opportunities resulting from the process.

<u>Project Strategy</u>

- Identify the technical issues impacting upon the project:
    1. Strata Behaviour
    2. Ventilation and Gas Environment
    3. Mine Water
    4. Equipment Specification
- Assess the skills and competencies required to execute the project.
- Develop a plan and schedule resources.
- Implement the plan and monitor performance.
- Analyse performance and evaluate outcomes.

<u>Project Outcomes</u>

- Involvement from and contribution by all stakeholders in the planning process.
- A clear understanding of critical path activity scheduling.
- Recognition of the value of effective planning and resource schedule.
- A commitment to meeting deadlines and managing time.

7.3.9 Ongoing Mine Implementation.

The onus on the mine to continue implementation of a systems approach is onerous in the climate of cost reduction that existed at the mine at the end of the project. The agreed areas of ongoing focus at the mine included:

- *Formal and wider CI (Continuous Improvement) implementation.* This included continued implementation of SAMs, improvement in mains layout, maintenance systems review and improved use of control officers.
- *Resource to Development Coordinator.* Continued allocation of mining engineering resources to benchmark panel process and to assist with panel folders, documentation and reports, formalise worklists and Standard Work Procedures.
- *Middle management responsibility and deputy improvement.* The aim was to lessen involvement with the detailed logistics of shift operation and to develop a broader process improvement role. This requires others to be responsible for the necessary logistics work and the development of deputy and control room operator skills.
- *Place changing.* Application of systems thinking to the place changing trials including the development of appropriate SAMs.
- *Reporting system.* Ongoing review of the reporting system to minimise overall requirements, eradicate duplication and improve assessment and feedback loops to the operators especially in the maintenance areas.

7.4 Implementation at Newstan Colliery

7.4.1 Background

Newstan Colliery is situated 29km south-west of Newcastle and mines the Young Wallsend seam at a typical depth of 250 metres. The mine has been operating continually since 1887 and in some cases, four generations of miners have been employed through this time. Newstan has operated a longwall since the mid-1980's and has averaged 1.9 MTPA ROM production for the last ten years. There are two products; a thermal coal for both domestic and export consumption and an exported semi-soft coking coal fraction. Newstan is wholly owned and operated by Powercoal Pty Ltd.

Initial discussions were held with the Group Manager – Mining, Safety and Technology and subsequently with Newstan's Mine Manager and Production Manager. The main issues appeared to be an uncertain geological environment coupled with the very traditional culture existing at the mine. Attempts were being made to introduce a more modern continuous improvement approach but with limited success. The focus of the project at Newstan was to review the roadway development operations at the mine and to implement a broad set of strategies that would assist the continuous improvement effort.

7.4.2 Implementation Activities

Initial site familiarisation was again followed by a one day workshop to a diagonal-sliced group consisting of the mine manager, maintenance manager, technical services manager, logistics controller, a contracts engineer, afternoon shift undermanager, two team leaders (deputies), two miners, and a fitter and an electrician. This was followed by a total of five days of in-depth study at the mine spread over two periods. Mr. Michael Kelly from CSIRO, Mr. Terry Francis from Dames and Moore and Dr. Mark Harrigan, conducted this study.

Two initial reports, one focused on operational and overall issues, the second focusing on information flow and systems were presented to the mine following these visits. This was followed up with a detailed meeting that included the mine's senior management team at which the reports were discussed and an implementation plan involving 23 agreed outcomes was initiated (Appendix 5). Several follow-up meetings were held to discuss issues arising from the implementation.

During this time, Mr. Bob Miller (Hawcroft Miller System Management Pty. Ltd.) also conducted a project management workshop at the mine. The area of application for Newstan was a two heading gateroad development with particular emphasis on the extension of services within the individual roadways for each pillar advance. The resultant report (Appendix 6) details 15 recommendations agreed to by the mine for implementation. Although there was some overlap with the previous implementation plan, the two were very complimentary and provided the mine with the broad strategic response intended.

Unfortunately, continuance of the project at Newstan was not able to be supported from their Corporate office following an across the board cost reduction exercise and further site work from the project team was curtailed.

7.5 Other Implementation Activities

Within the proposed project activities, plans to conduct a roadway development industry seminar along the lines of the 1994 seminar were progressed with the formation of a steering committee. At the first meeting of this committee it was decided that a more appropriate strategy was to make individual presentations to company groups. By involving smaller groups that may originate from one or two companies, discussion would be more specific to individual issues and the benefit to those companies increased.

To date four sessions have been conducted, with Shell Coal, BHP Coal Southern Collieries group and two sessions with Cyprus Australia. There are ongoing sessions planned with these groups and with several other companies.

Several presentations have also been made to industry forums and several articles have been published in the Australian Mining Monthly. These are included in the report references.

8. DISCUSSION OF RESULTS

As one may imagine, the volume of detailed results from this project is quite substantial. The results from Central were very positive with a sustained improvement through the subject panel. After starting six weeks behind schedule, the panel was completed three weeks ahead of schedule with an average improvement of around 30%. While it is not in the interests of mine confidentiality or readability to publish details of week to week successes and problems, the basic cause of the improvement was superior consistency, especially in the start up phase and the first half of the panel. In the first 11 weeks, the average rate per week for the 208 panel was 180 metres with a maximum of 225mpw (metres per week). In the similar time on the previous panel the average rate was 136mpw with a maximum of 225mpw.

At another mine with similar conditions, but on a seven day roster, the panel average was 101mpw even though the weekly maximum of 255 had been achieved. A process study at that mine revealed that an average of 360mpw was achievable with peaks well over 400mpw. While these figures were treated with some scepticism by the mine concerned, I recently visited a mine that had just achieved 480 metres (2 completed pillars with a single mining crew) in one week. The two mines were in fact using the same support pattern and had the same seam height. The latter mine was well down the path of a systems approach with a well developed appreciation of mining rate and pillar cycles.

In the light of study, there are some key learning areas that will help other mines introduce or to improve their current systems approach to roadway development. I would like to concentrate on these during this discussion.

8.1 Information Is The Key

Better use of information was recognised as the number one area for potential improvement in the original business plan meetings, but it wasn't until the implementation of these ideas began that the power of information was properly recognised in practical terms.

Most mines, not just those participating in the study, have a large information gathering machine that collects, collates, and summarises production and maintenance data. In most cases the information flow is 90% upward with very little being returned to the originator. This type of information flow is not helpful in improving the roadway development process, but rather provides senior site and offsite staff with an historical record of what has happened. With roadway development, invariably this record is not adequate for business needs, and senior staff produce future budgets based on current performance plus an improvement level of 10%. When one looks at individual shift performances, peaks are often more than 300% more than the average, so a mere 10% improvement seems quite achievable. Unfortunately, nothing in the system has fundamentally changed and the following year's figures seem depressingly similar. The missing improvement link for these mines is the power of the data that they are already collecting.

The project has revealed several key points about the use of this data which will enable not just a 10% improvement, but closer to a 30% improvement in rates with the same people, same machines, and virtually the same method of mining. The key points are:

8.1.1 Information Should Be Analysed Not Averaged

Information is data that informs. Data requires analysis to become an effective and powerful business driver. Pareto analysis of downtime is one such tool. There are many others, but to be effective they must be tied to improvement action. It is better to match the analysis to action, than to have many graphs and no resultant improvement work. It is also important to recognise natural variation in measurement analyses. To be effective, improvement processes must be based on longer-term issues and not the immediate cause of a single breakdown. In other words the reason for a change in results should be clear and the period of analyses must allow for the random nature of that process. An example at Central was the mid panel maintenance review. The period was long enough to focus on the key issues effecting downtime and not solely on "last week's" problem.

8.1.2 Information Should Be 50% Downwards

To make a difference in peoples' performances there needs to be an effective two-way communication at each level of the organisation, especially with face workers and immediate supervisors. Relevant information needs to be presented to these groups and a mechanism put in place where they have a real responsibility for improvements in their workplace and practices. This should not be a "suggestion box" mechanism where no effective responsibility is given. Relevant information is not company profit levels or the coal price but real information about the panel performance and future panel plans.

8.1.3 Setting Effective KPI's Is Essential

Effective KPIs for development include face cycle times (uptime rates), pillar cycle times, metres per week and cutting hours per week. They do not include metres per shift. Emphasising metres per shift is probably the most damaging negative benchmark in our industry.

Metres/shift does not recognise natural variation and encourages short-term performance at the expense of longer-term sustained performance improvement and cycles beyond the immediate face cycles. It is the reason many mines' peak development shift performance is 300% higher than their average. Similarly, machine availabilities are almost as poor a benchmark as metres per unit shift. Good machine availability figures often reflect low panel availabilities. The only effective availability figure is systems availability and utilisation, which reflects all parts of the process including travel time and panel extensions.

It is imperative that there is a move to industry benchmarks that reinforce sustained continuous improvement.

8.1.4 Feedback Loops Are A Necessity For Exception Reporting

Most mines use some type of exception reporting where only faults are reported and items in good condition are not reported on. This is a necessity due to the sheer volume of items and conditions that require testing and, of course, is the basis of all on-line monitoring. However, once a fault is reported it is imperative that, when it is fixed, a report of that action is available to the source. This will ensure that the right problem is fixed and encourages further observation and fault reporting. If it is not done then the fault will often be buried by the next report, often only to surface in a more catastrophic way.

8.2 A Systems Approach Requires Integration Of People And Technology

Many years ago I attended a Grid management course where your concern for people was plotted on one axis and your concern for production was plotted on the other. The aim was to be a "9,9" manager and have equal high concerns for both people and production. The key was to recognise that there was no conflict between these concerns. Unfortunately most styles varied from a "9,1" (dictator mentality) to "5,5" style where *everything* was a compromise. In another similar analogy, production and safety were seen to have conflicting needs. It wasn't until the last ten years that it has become well established that excellent safety systems also result in improved production performance.

A systems approach is more than just good management. It is about effective improvement for roadway development. This improvement may be continuous, stepwise or a combination. In any case it does involve implementation of new technology and methodology.

Effective implementation of new technology depends upon having systems under control. How many good improvements of the past have failed because of ineffective systems (including management systems) in place? Thus to be successful, a systems approach requires effective *integration* of people issues with the introduction of new technology.

8.3 Leave No Stone Unturned

As the project progressed and the industry seminars were conducted, several managers summed up this issue with the following well worn phrases:

- "We have one rule around here – sacred cows make good BBQ meat." and
- "There is no process that can't be done faster, safer, cheaper or better." and
- "If you want potential improvement areas – look in the mirror first."

They are all saying similar things. The only way for sustained improvement is to aggressively look at all aspects of the organisation and assess how they effect roadway development. Bottlenecks in overall performance should be the target, but any changes need to be assessed for negative impact on other parts of the system. The models that were promoted early in the project have proven invaluable in this evaluation process. These two models were a simple form of process mapping; Figure 8 (or a simple project management Gantt chart)

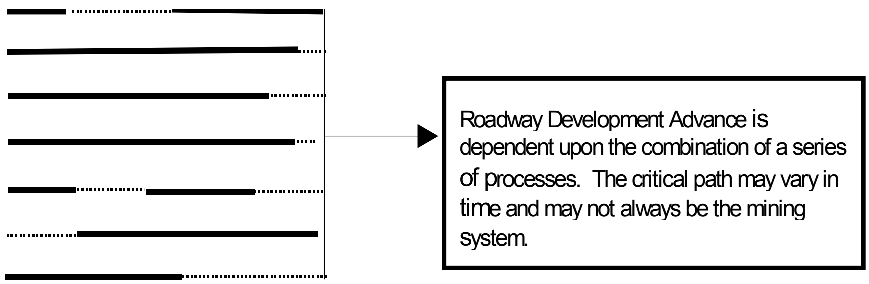
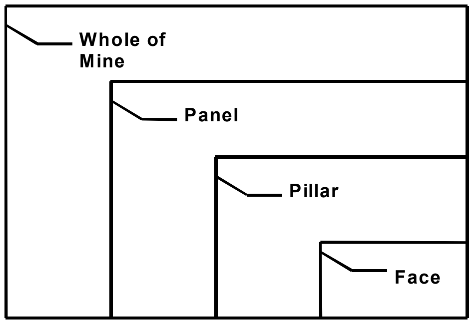


Figure 8 - Gantt Chart Model of Roadway Development Critical

- and a simple hierarchy of the various levels that exist at each mine



The key questions to be answered are:

- What is the process map at each level of the hierarchy?
- What is the interaction between hierarchies?
- Who is responsible for the overall process at each hierarchical level?
- For each of these levels what is measured and what is the focus?

Figure 9 - Heirarchial Model of Roadway Development Process

These models were extensively used during the project both as a starting point and during ongoing detailed improvement considerations. They were found to be useful both as points of focus during the work and as communication tools.

How is this approach different from traditional approaches? One light-hearted comparison may be to compare the above with a list from the past of certain ways for roadway development improvement initiatives to fail. These include:

- Put a suggestion box in the lamp cabin and ask for improvement suggestions.
- Only consider improvements in one hierarchy – at the face.
- Reinforce new targets by emphasising the required rate in metres per shift.
- Make sure that all crews that exceed the rate are congratulated and all crews that fall short are asked to explain their reasons.
- Ensure that when a problem arises a new procedure is put in place so there is no repeat.
- Put all of the best workers in the face crews and all those difficult people on outbye duties.
- Look for ways of maximising face time by reducing unnecessary maintenance and by working extra shifts on the weekend.
- Ensure all communication is through the key shift undermanager and engineers.
- Have regular shift meetings where safety performance, last month's production performance, the new required development targets and the worsening market situation are emphasised.
- Initiate regular improvements on the recommendation of people at the face, outbye, surface or other mines.
- Don't measure the process.

8.4 An Organisational Structure Should Support The Core Business

Many mines are now restructuring into process orientated groups. Unfortunately some are trying to fit these into pyramid type structures. Even though there are some issues with statutory responsibilities that still reinforce these structures, an alternative structure is shown below. This new type of structure reinforces the longwall and development as the mine's core business and shows every other function as a service to that core business.

One finding of the study was the significant impact of panel and mine cycle processes on roadway development outcomes. These processes are often extremely difficult to change with a number of examples of people coping in spite of poor maintenance systems or insufficient exploration and hazard mapping. Corporate based system requirements are often a telltale symptom. For example - is the information system established at the mine tailored to reinforce mine improvement needs or corporate statistics?

It is imperative that before a mine tries to introduce a systems approach to roadway development that the approach is understood and agreed to by the corporate manager and site manager as well as mine/production/development/maintenance managers. They need to understand that an outcome may be a required change in their behaviour and their support in this area is crucial. This also brings up the issue of succession planning. A culture that requires across the board support for success may be put at risk if new people are introduced into the equation that do not have the same commitment to the approach.

However, the biggest threat to this approach comes from traditional middle management. As one undermanager declared in one of the workshops – "I don't have any aspirations to become a process leader, I'm in charge of my shift, that's what I've been trained to do, and that's all I want to do. I get the information at the start of the shift, I tell the deputies what to do, and during the shift I deal with the problems as they arise." Later in the workshop he complained bitterly about the standard of the deputies – "I wouldn't give two bob for the lot of them, they are all a pretty useless bunch." He couldn't see, or refused to see, the connection between his entrenched attitudes and the lack of responsibility and perceived competence of the deputies. There are no easy answers to these attitudes. Fortunately many undermanagers and engineers see the advantages and have had a complete reversal in attitude during the workshops. Others will see the advantages with time, training and practice and will become the loudest advocates. Still others will never change and it will be necessary to leave them behind to effectively progress this across the mine.

Miners and tradesman will initially embrace the concepts because it gives them an effective say – "at last" – in their workplace. Many will see it however as another fad and will wait to see if there is management commitment to it. The increased discipline that is required will be one area of resistance which needs to be outlined *early and often* for mining crews to remain committed.

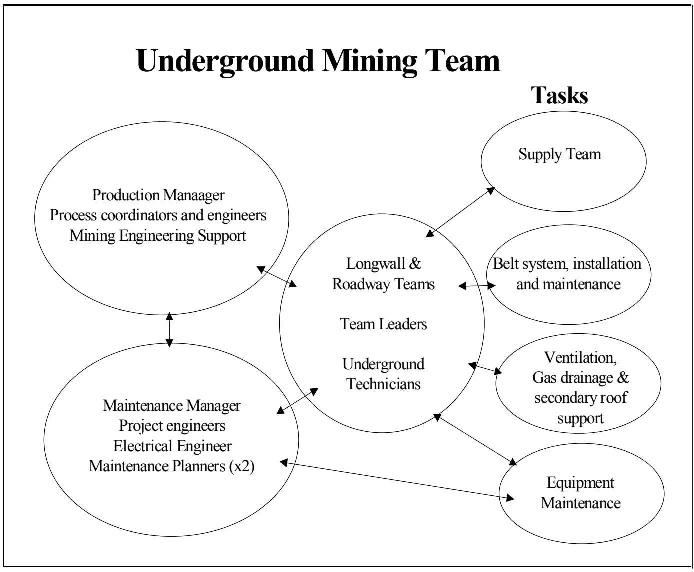


Figure 10 - Example of Organisational Structure Supporting the Core Business

8.5 Maximise The Power Of The Organisation

Another outcome from the project is the power resulting from enabling workers to improve process knowledge and hence their ability to influence that process in a positive way. The simple diagrams below can illustrate this:

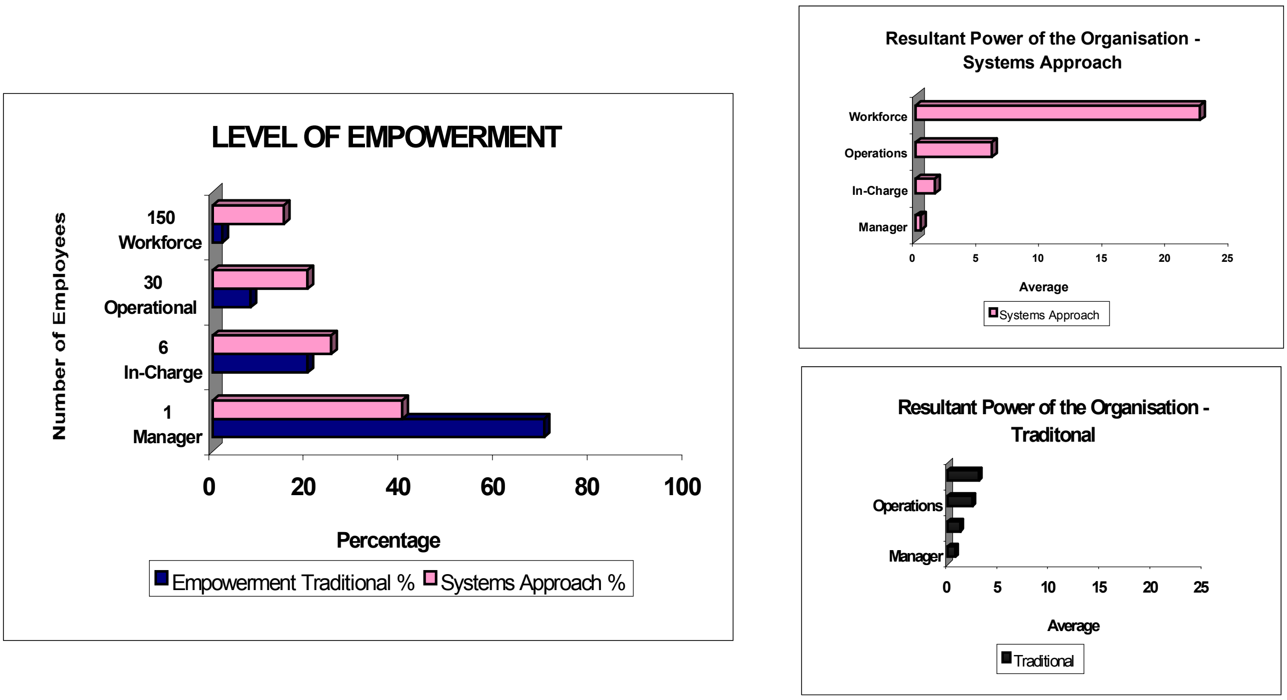


Figure 11 - Maximising the Power of the Organisation

The diagram on the left shows the level of empowerment for each level of worker for a traditional and systems approach workforce. The diagrams on the right show resultant power of the organisation. The traditional workforce has very little power. In a traditional workforce, the only people with effective power are the manager and in-charge levels and typically with the numbers at this level, it is very difficult for them to make sustained process improvements.

In a systems approach the workforce has been "empowered" resulting in a far greater momentum of change. One can see the source of frustration of the traditional manager. Like the undermanager in the previous example he despairs at the lack of competence of his workforce but can't recognise the underlying reason.

8.6 Implementation Takes Time And Commitment

The implementation of a systems approach for roadway development improvement is not a short-term exercise. It can be seen from the implementation plans from both Central and Newstan the required changes are substantial and require time and perseverance. Whilst improvement of up to 100% over a two to three year period could be expected and a 30% improvement within 6 months was demonstrated at Central, many of the changes require substantial modifications in organisation, measurement systems and maintenance and planning practices. Once these are in place technology implementation can begin. Only bottlenecks that are indicated from the new measurement systems are targeted and further measurements will indicate the success or otherwise of any improvement initiatives. One good industry example of such a change is the monorail system at Dartbrook (Hayward, J., 1999). Here a highlighted bottleneck was targeted and the successful system resulted in a 30% measured improvement in long term driveage rates. Other mines have tried to copy the system with less success, perhaps because that was not the bottleneck at that mine.

The change in culture from a traditional to an empowered one also takes time. Some estimates are for a five-year time frame to essentially embed a new culture. This may be fast-tracked with an intensity of purpose, but a complete change in less than two years is unrealistic.

9. CONCLUSIONS

The project has demonstrated the application of a Systems Approach to roadway development in a practical mine situation. As well as showing the benefits of a Systems Approach, it has also clearly demonstrated the hurdles that need to be overcome for its successful application.

It has confirmed the imperative for the effective *integration* of people issues with the introduction of new technology. Effective implementation of new technology depends upon having systems in control.

It has illustrated the benefit of simple gantt and heirarchial models when looking for process bottlenecks and key improvement requirements.

It has highlighted the importance of proper information systems and analysis as the foundation for all improvement initiation.

Corporate commitment at all levels has emerged as a prerequisite for successful implementation. Acceptance of that fact that implementation may require changes in information systems, management structure, succession planning and also realisation of the time and commitment involved from the mine are fundamental issues.

It has illustrated the differences in effective power of a traditional organisation and an 'empowered' workforce that have sufficient process knowledge and capacity to positively influence change.

Finally, it has demonstrated the benefits of a systems approach to roadway development both in short term (six months) and with greater potential in medium term time frames, especially when the impact from panel and mine cycle changes are realised. It has been heartening to observe many organisations beginning to 'walk the talk' and make a systems approach their corporate benchmark for roadway development improvement.

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11. ACKNOWLEDGEMENTS

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The continued support of the Strategic Planning Group mentioned in Appendix One is also gratefully acknowledged.

APPENDIX 1 – STRATEGIC PLAN

(Excerpt from ACARP Report C5013 – "Co-ordination of Roadway Development Strategy")

The outcome of the final workshop was a series of seven strategies and implementation mechanisms. The strategies were then prioritised and it was recommended to introduce a systems approach into a small number of "Champion Mines" initially concentrating on the strategies of information, uptime/ downtime and project management. These mines would then report back to an industry forum in early 1998. Although envisaged as a five year plan, the attitude was to take one step at a time and to keep industry in touch with progress. The workshop also concluded that there was a need to set automation priorities for roadway development as automation was a 5-10 year process as evidenced by the example of roof support.

The strategies were in the areas of:

- Information
- Technology Implementation
- Face Downtime / Uptime
- Project Management
- Parallel Operations
- Communication and Awareness of a Systems Approach
- Automation

and are detailed on the following pages.

Strategy 1 - Information

The key to this strategy is providing the industry with a comprehensive review of the essential measurement requirements for roadway development. It also aims to assist in identifying current gaps in capabilities to apply and act on these measurements, including the development of an action plan to close these gaps. The basic aim is to determine:

- What is measured, why and what should be measured - including best way to do it.
- What to do with information once it is acquired - Specifications/Standardisation.
- Whether technology development is required to achieve the desired measurements.

Scope

Beginning with the management system and keeping the focus solely on roadway development, key scope elements include:

1. Determine current information requirements, practices and current availability and precision required with respect to:

- production equipment eg cutting rates, production time in cycle, motor loads etc.
- maintenance monitoring eg vibration, oil quality, motor performance, component wear indicators, availability.
- environmental monitoring eg ventilation quality, gas, roof, spontaneous combustion alerts.
- services eg belt, ventilation including leakages, water, compressed air, gas drainage, road standards.
- other

2. Define areas of standardisation. This will include:
   - measurement units
   - definitions
   - comparisons (how to make more meaningful between sites)
3. Recommend areas of development required and initiate where possible.
4. Guide-lines of areas and mechanisms of feedback to faceworkers, shift supervisors. This should include some model development with feedback loops and signal points.

Implementation Mechanisms

Implementation will be via a focused industry research survey at 8 to 10 selected mines to:

- Define Key Result Areas
- Identify Key Performance Indicators in use and how acquired
- Identify what is currently happening - what do people at face know/need to know/what do management etc know/need to know

The results of the survey will be published in a benchmarking report (preserving confidentiality) and used to drive the agenda of a 2 day industry seminar, entitled:

"Use of measurement in management systems for Longwall Roadway Development"

Outcomes of the seminar will be used to determine current gaps in requirements and further development priorities as well as enable information transfer and possible model development on best practice.

Actions

Table A1.1 - Strategy 1: Information Actions

What	Who	When
Commission survey (use outside resources with ACARP to underwrite and recoup via seminar)	Michael Kelly/ACARP	November 96
Conduct survey	TBA	February 97
Publish report and prepare seminar	Michael Kelly/ACARP	March 97
Conduct seminar	TBA	April 97

What	Who	When
Develop information model	TBA	May 97

Comment on ACARP Project C6037

It was decided to incorporate the information, downtime/uptime and project management into one package under this project rather than separate implementation activities for each of these strategies.

Strategy 2 – Technology Implementation

This strategy arose through concerns about the gap between the promise of new technology and its delivery. There is not a consistent record of completion of new technology development and many new technologies languish when 80% to 90% complete for lack of a proper technology transfer mechanisms.

Scope

It was generally agreed that this is, in part, an ACARP issue. Current practice is that for projects to be funded they must satisfy the cost/benefit hurdle. The main area for improvement is for the researcher/developer to identify "champions" to accelerate implementation ie. identify a viable potential user at start. Key lessons which need to shared are:

1. Kill lame ducks early
2. Find commercial sponsor/customer early
3. Commercialisation vehicle/customer to work together

While this was generally regarded as an important issue it was felt to be an area that could be best addressed through the ACARP process.

Comment on ACARP Project C6037

This was seen to be a lower priority issue for the first year of implementation and is not being addressed directly in this project.

Strategy 3 – Face Downtime / Uptime

The objective of this strategy is to apply a systems approach to the analysis of downtime and uptime across the hierarchies of the mine (face, cycle, panel, whole of mine). It is believed that downtime may be reduced by up to 50% using this approach.

Scope

The scope of this strategy is to focus on maintenance and utilisation effectiveness - especially the application of reliability centred maintenance. This in turn depends upon information and thus is linked to strategy one. The key questions are:

- How often are you actually cutting coal?
- When cutting, how quickly?

Key elements are:

1. Using a systems approach and looking across hierarchies perform a major industry study in this area (downtime/uptime) - focusing on selected mines (say 5 or 6) who have an interest.
2. Analyse causes of downtime/uptime and associated delays.
3. Make recommendations for improvement

The study should involve a consistent methodology, be done by personnel familiar with operations but external to the mine concerned, looking at details across 24 hr periods in a control period of up to 6 months. It is suggested that the study be syndicated, identifying perhaps 5 or 6 mines to participate at a cost of around $30,000 each. It will be necessary to preserve mine confidentiality issues, ensuring that information is shared in anonymous form.

Implementation Mechanisms

Implementation should be via an industry syndication with some ACARP support. However execution of the study needs a "champion" - someone with process/industrial engineering background to set up the framework and drive experiments/data collection and work in/with each mine to establish measurements. It must also be someone the industry/syndicate members feel comfortable with:

Possibilities include:

- Terry O'Bierne (ACIRL)
- Engineering master's project (supervised by Michael Kelly)
- Seconded mining engineer from a participating company

Actions

Table A1.2 - Strategy 3: Face Downtime/Uptime Actions

What	Who	When
Develop initial scope	Michael Kelly	November 96
Contact Terry O'Bierne to identify possible people/mechanisms	Michael Kelly	November 96
Invite companies to enter syndicate	Michael Kelly	February 97

Comment on ACARP Project C6037

It was decided to incorporate the information, downtime/uptime and project management into one package under this project rather than separate implementation activities for each of these strategies.

Strategy 4 – Project Management

This strategy simply recognises that the application of project management techniques would improve the execution of many underground activities. The desired outcome is a wider experience and application of project management techniques to mining systems. The possibility exists to also consider outsourcing of selected key tasks which may be better project managed by external groups.

Scope

The scope of this strategy is to focus on those underground activities which may be considered as a project. Key elements are:

1. Identify tasks where project management techniques may be applied.

2. Develop and communicate case study examples

3. Develop guide-lines for management training and tools specifically for underground mines and share via appropriate mechanism (eg seminar)

An assessment would need to be made regarding which non continuous activities, (ie. other than cutting coal, support, maintenance) would be amenable to project management techniques. The obvious activities are: belt extensions, panel installations, panel relocations, longwall relocations (these directly effect face time). Other not so obvious areas are also possibilities: outbye roof support, gas drainage, road preparation, be it either rail installation or trackless road preparation, mains driveage including rock cutting, material handling and others.

Implementation Mechanisms

The suggested implementation mechanism is via an ACIRL seminar "Project Management and its application to roadway development" with case studies to show benefits. This could include specific workshops on project management techniques as they can be applied to roadway development

It is recognised that project management is done today to varying degrees in varying areas by different operators. However, the application is not uniform nor is it focused on a systems approach to improving roadway development rates.

Resources will be required to plan and manage the workshop/seminar - possibly via ACIRL/ACARP as a self funding initiative. Possible implementation steps include:

1. Develop/Research case studies focused on Roadway Development.
2. Run seminar/workshop - with expert assistance.

An experienced project management consultant could be used to help drive this task

Actions

Table A1.3 - Strategy 4: Project Management Actions

What	Who	When
Contact Consulting Group to outline scope	Michael Kelly	October 96
Consulting Group to identify possible project management consultant	Michael Kelly / Consultants	November 96
Seek ACIRL/ACARP approval when scope defined	Michael Kelly	November 96
Drive collection of case studies for development of seminar/workshops	TBA	March 97
ACIRL/ACARP to target running seminar in new year.	TBA	May 97

Comment on ACARP Project C6037

It was decided to incorporate the information, downtime/uptime and project management into one package under this project rather than separate implementation activities for each of these strategies.

Strategy 5 – Parallel Operations

There are numerous areas where the critical path of face operations could be reduced if the capacity was developed to parallel operations. This strategy is to identify opportunities for parallelling operations, to quantify benefits of these opportunities and to further develop this capacity where the benefit is found to be high. Areas of focus could include:

- Face operations eg. cutting and support.
- Cycle operations eg. belt move and cutting.
- Secondary support.
- Resource and needs identification and better techniques for resource allocation.
- Environmental monitoring.

Scope

It was recognised that this strategy is a likely natural flow on from the outcomes of the Face Downtime/Uptime strategy which should reveal which areas to parallel. Manufacturing and technology development priorities should come out of the study if linked to face Downtime/Uptime. There are also links with the information and project management strategies.

Parallelling is already happening in some mines and it would be good for “model” / “champion” mines to progress these initiatives and share learnings.

This strategy should be integrated and addressed as part of the Face Downtime/Uptime study to identify:

- opportunities for parallelling
- constraints
- technology and systems gaps

It is desirable that the study encourage writing up of successful case examples.

Comment on ACARP Project C6037

This was viewed as a downstream activity for the uptime/downtime study and no specific activity is been undertaken in the C6037. There should however be conclusions that will directly benefit this strategy.

Strategy 6 – Communication and Awareness of a Systems Approach
(previously human factors/organisational structure)

It was recognised that this is a key area for action but that, with the current thrust in the industry toward enterprise management, the best a forum such as this can hope to do is to provide frameworks or structure for companies to consider - each enterprise must implement a systems approach, particularly as it applies to human factors and organisational structure, in a way which best suits its own needs.

The strategy here is to increase communication and awareness on the issue, demonstrating the high leverage that can be obtained, and demonstrating to statutory authorities that the control loops provided by the method exceed prescriptive guide-lines.

Scope

Possible elements of the scope here include:

- Presentations to industry forums
- Education/ awareness raising within industry groups.
- Session/Seminars on this approach → apply systems approach/system thinking.
- Write papers/articles/newsletters.
- Highlight leverages/ benefits to be gained
- Training/ education on a systems approach.
- Concentrate on role of middle management
- Focus on student groups.
- Build into ACARP processes.

Because this is a sensitive area to most companies, education and facilitation will be the keys for success.

The main focus is to build into company cultures adoption of a systems approach, recognising that human factors and organisational structures are an integral part and cannot be quarantined from causal relationships. How companies deal with that information will always be their prerogative.

Implementation Mechanisms

This is an area that requires a very broad based implementation scheme. Universities have an important part to play. There should be speakers at most mining conferences and seminars to demonstrate practical examples and advantages of this approach. The utilisation of the champion/model mines will be important. ACARP's role is important as it needs to be built into ACARP processes and proposals. Training of middle management groups are the key for success and training packages need to be addressed, perhaps in the marketplace by consultant management groups. Involvement of worker groups is also important to give/pass information on relative areas, for ergonomic issues and generally to recognise their key role in determining what face processes are likely to work, ie nuts and bolts issues.

Actions

Table A1.4 - Strategy 6: Communication and Awareness of a Systems Approach Actions

What	Who	When
Prepare a paper based on distillation of these workshops plus case studies.	Michael Kelly	January 97
Introduce "seed" talks in seminars.	Michael Kelly	Ongoing
Continue workshops at key mines as follow up to this workshop, emphasising systems approach.	Michael Kelly	Ongoing
Discuss Course Structure with University Mining Schools and other Mining Colleges.	Michael Kelly	Ongoing
Encourage system courses suitable for middle management	Michael Kelly	Ongoing

Comment on ACARP Project C6037

This is an underlying foundation of the project and will be addressed at the study mines by an initial forum, ongoing discussion and final workshop. It is also being addressed through several formal presentations throughout the year and through the seminar in 1998.

Strategy 7 – Automation

This is seen to be a long term activity where effective automation should be based on effective information systems and identification of where the bottle-necks exist which are amenable to mechanisation/automation. The focus should be on key areas (eg. roof bolting) where the industry has some maturity in approach and other areas where it is a long way from where it needs to be.

Scope

Automation has a tremendous potential to improve safety, consistency and productivity but has historically been associated with issues of over complication and poor implementation performance. Priorities should be established through cost benefit analyses to decide the scope of automation to provide the optimum result.

Key elements of the scope of this strategy include:

1. What is the vision/goal for automation?
2. What is the technology roadmap to get there?
3. Define the four stages - manual, mechanised, remote, automation
4. Where are we now and where do we want to be/priorities - (some manual → some automated).

As a first step there is a need to do a scoping study to identify needs/priorities and initiate projects eg. face to bootend (shuttle cars).

Implementation Mechanisms

There are already groups set up eg. CMTE, David Dekker's Mining Automation group that are focusing on automation technology. The implementation mechanism needs to revolve more around linking manufacturers, technology groups and operators into looking at specific needs, responses and underground implementation.

It is proposed that CMTE carry out the scoping study defined above with the help of an industry steering panel and linked with the Uptime/Downtime study with funding to be CMTE 50% - ACARP 50%.

Comment on ACARP Project C6037

A recent paper[1] has outlined this prioritisation process and an out of round proposal to carry out the above study will be submitted in April 1997.

[1] Kelly, Michael S., 1997., *"The End of the Line for Roadway Development".,* AusIMM Travelling Technology Forum., Automation in Coal Mining., March.

Table A1.5 - List of Workshop Participants

NAME	COMPANY
Allan, Bruce	BHPAC Collieries Division, Wollongong, NSW
Butcher, Bob	Powercoal Pty Ltd, Charlestown, NSW
Cribb, Ian	Cumnock No.1 Colliery, Ravensworth, NSW
Cuddihy, Paul	White Mining, Mackay, QLD
Davies, Alan	BHPAC, Brisbane, QLD
Downs, Michael	BHPAC, Brisbane, QLD
Doyle, Peter	Cyprus Australian Coal, Lithgow, NSW
Eade, Philip	BHPAC Collieries Division, Wollongong, NSW
Edgar, John	Monitek, Brisbane, QLD
Fabjanczyk, Mike	Strata Control Technologies, Wollongong, NSW
Gooley, Ray	Jeffrey Mining Products, Toronto, NSW
Graham, Ross	Australian Coal Association, Sydney South, NSW
Hamilton, Neville	Oceanic Coal Australia Ltd, Teralba, NSW
Hebblewhite, Bruce	University of New South Wales, Sydney, NSW
Hines, Chris	Boart Longyear Pty Ltd (Mitsui Miike), Cardiff, NSW
Hobson, Tim	South Blackwater Coal Ltd, Blackwater, QLD
Howarth, Dominic	JKMRC, Indooroopilly, QLD
Lilly, Peter	CSIRO, Exploration & Mining, Floreat Park, WA
Marsden, Garry	Tamrock Coal Australia Pty Ltd, Gateshead, NSW
McCowan, Brian	ACIRL, Maitland, NSW
Melrose. Rowan	Voest Alpine, Wetherill Park, NSW
Morrall, Bryn	South Blackwater Coal Ltd, Blackwater, QLD
Moult, David	Joy Mining Machinery, Pittsburgh, PA
Neal, Phil	Joy Mining Machinery, Mossvale, NSW
Neilson, Brad	CRAM Australia, Unanderra, NSW
O'Rielly, Tony	White Mining, Mackay, QLD
Oliver, Dave	Newstan Colliery, Toronto, NSW
Ord, Steve	Long Airdox Australia Pty Ltd, Argenton, NSW
Ostle, Stan	ANI Arnall, Charlestown, NSW
Pomfret, Dennis	Powercoal, Charlestown, NSW
Robertson, Bruce	Shell Coal Australia, Brisbane, QLD
Sandford, Jim	Capricorn Coal Management, Middlemount, QLD
Sleeman, Jon	U/G Coal Mining Consultancy, Holland Park, QLD
Takahashi, Ken	Coal Mining Research Centre of Japan, Tokyo
Weatherstone, Col	BHPAC Collieries Division, Wollongong, NSW
Williams, Ray	Geogas, Oak Flats, NSW
Wischusen, Roger	AMIRA, Brisbane, QLD
Wood, Murray	Gordonstone Mine, Emerald, QLD

APPENDIX 2 - CENTRAL COLLIERY

ACARP Project C6037 - Implementation of Roadway Development Strategy
Interim report on site visit 7-11th July 1997

Introduction

Roadway Development is one of the most important issues facing the profitability, viability and future of underground coal mines. For the last decade roadway development has been unable to keep pace with improvements in longwall extraction rates. ACARP has supported a series of projects to assist this issue. One of these projects has developed an agreed industry strategic plan for the improvement of roadway development rates for underground coal mines. It achieved this through a series of operator meetings where key development issues were discussed, by examining a variety of American practices and via two workshops attended by a broad representation of coal industry personnel.

The plan calls for the introduction of a "systems approach" to minesites assisted by strategies based on the following areas:

- Information
- Technology Implementation
- Face Downtime / Uptime
- Project Management
- Parallel Operations
- Communication and Awareness of a Systems Approach
- Automation

The implementation mechanism is to introduce a systems approach into a small number of "Champion Mines" initially concentrating on the strategies of information, uptime/ downtime and project management. These mines will report back to an industry forum in early 1998. Although envisaged as a five year plan, this approach will allow a stepwise implementation and will keep industry in touch with progress. A longer term view is being taken with automation where there is a need to develop automation priorities. The mines that have undertaken this "champion role" are Central, Oakdale and Newstan.

As the start up activity for the project at Central, a week was spent at the Colliery by Michael Kelly and Terry Medhurst from CSIRO and 2 days by Mark Harrigon (private consultant), to understand the current situation at the mine with respect to roadway development. The focus was on systems reasons for downtime, an understanding of uptime rates and the information flow. Prior to the week, the group, with the assistance of Stephen Eames and Terry Francis from Dames and Moore, had completed process maps for a typical mine in four hierarchal cycles - face, pillar, panel and whole of mine. These process maps of a typical mine (Appendix 1) were used to assist the group to understand the corresponding processes at Central. The mine had previously provided the group with a comprehensive set of production reports from shiftly to three monthly which was an excellent background to information flow and current systems.

The focus for the week was:

1. to look at all of the contributions to roadway development on the basis of cycles and especially the interaction of processes between and within each cycle,
2. to understand the flow of information on roadway development, the level of feedback and the level of information that is or could be used for process improvement,
3. to recommend next step in the project, and assist the mine to improve their systems approach to roadway development including process improvement,
4. to highlight areas within each of the cycles that could be targeted for process improvement, and
5. to highlight improvements that could be considered to optimise the use of information as a business driver for process improvement.

This is a short report on these observations and focus areas.

General Observations

Firstly, I would like to thank the support offered to the three of us during the week. At all levels, mine personnel were extremely co-operative and open. In addition, there seemed to be a very positive relationship between staff levels and departments. This positive culture can only assist any change process.

Our overall view was that the mine had tremendous potential to improve its capacity by improving process performance at each of the hierarchies mentioned above. Someone described the mine as a "sleeping giant". While the term might seem evocative, we thought it was an apt description of a mine in which there seemed to be a good level of competency, culture and reasonable mining conditions but also requiring a change of focus to encourage process improvement at all levels. This was, therefore, considered a very good mine for the current project and we saw a potential to improve productivity by 30% without implementing any new technology. This view could form the basis of a 6 month target for this project.

In an overall sense, the mine seemed very traditional in management structure and although there was a stated intention to devolve responsibilities downwards, there was little evidence of this happening in practice. One example was the undermanagers continuing to take the attendance roll at the start of the shift. This effectively bypasses the deputies and prevents the undermanager having a group communication to his deputies on daily requirements. Allowing the person doing the process to take some responsibility for process improvement is instrumental in a systems approach. This will not occur when operational management will not, over a period of time, devolve responsibility downward.

Face workers will not suggest changes in a suggestion box environment where they have no ability to influence. The supervisor may be the most knowledgeable person on the site, but unless he shares his knowledge and invites feedback and supports a real mechanism to allow change at worker level, there will be no continuous improvement and the process will stagnate. In the case of marking the roll the undermanager is removing the role of the deputy in encouraging attendance. In a mature continuous improvement environment, this responsibility will devolve from the deputy to the miner resulting in a clerical attendance list rather than a roll.

Communication (rather than direction) to the workforce on a weekly and shiftly basis was not embedded in the culture. Information flow was more than 90% upward or across levels with very little back to the workforce. One example of this was fault reporting on machines. A fault that may have been reported by a miner to either the deputy or fitter was recorded in the deputy's or fitter's report and transferred to the shift engineer's report and scheduled to be rectified by a work order. When rectified, the work order was tagged as complete. There was no feedback to the miner or even the fitter or deputy that the problem had been fixed, what the cause of the problem had been or more importantly to ask if the problem had been fixed to their satisfaction or to suggest a change in practice to avoid a recurrence. Generally, communication styles were observed to be directive rather than consultative. This style inhibits open feedback and undermines the effectiveness of exception reporting. The two areas that could be used as a starting point to change this style are the communications at shift change and fault reporting across work areas. The focus should be on effective, two way communication.

Generally, a focus on process improvement was not observed either from a measurement point of view or any in place continuous improvement methodology. There was a great deal of data collection and this was increasingly summarised into shiftly, daily, weekly and monthly reports higher into the organisation. Feedback was not observed other than the reported three weekly meeting with the workforce. (One exception in which there was some focused measurement was some work that Mick Scully had initiated on mechanical downtime priorities using pareto charts.) Any observed improvement processes were very traditional with suggestions being readily accepted from the workforce, but responsibilities to drive any changes being taken at a higher level. One example where there has been an attempt to improve a process at the deputies level was Phil Reed's work with the deputies on belt extensions. This has resulted in a well detailed document that has the potential to reduce the time for extensions. Unfortunately, the document does not appear to have been well communicated to the workforce and, therefore has not been generally adopted into practice.

The traditional structure and information flow in place at Central inhibits the ability of staff/workers to implement change. It was clear from our talks with people across the workforce, that people were open-minded about change but were having difficulty in seeing how this may be achieved. Evidence of this could be gauged by expressions like "yes, we're looking at that" and "yes, we would like to do that given time/resources etc." This willingness and openness among the staff/workers provides the opportunity for improvement through the application of a Systems Approach. The focus must be on enabling workers to improve process knowledge and their ability to influence improvements. We need to look at achievable targets first and our recommendation would be to focus on the pillar cycle.

Concept of a Systems Approach

Before looking at the observations at Central, I'll reiterate what we mean by a systems approach in the context of roadway development and how it is different from traditional practice.

Firstly, a systems approach incorporates people issues and technology into processes. It does not turn a blind eye to the expectations placed upon operators at the face and in essential outbye processes. It says that the **human element is pivotal.**

Secondly, a systems approach aims to understand the complexity of systems structure and to examine the dynamic complexity of the interactions between processes. It does not recognise linear cause and effect relationships in isolation. Instead, it tries to understand the system hierarchies, the dynamic interactions within and between each hierarchy. It further puts the human element in this context and asks who controls and should have input into the various hierarchies. It allows operators in each process to have a primary input in continuous improvement.

Thirdly, a systems approach recognises natural variability as a normal part of any process. It does not react to each new data point but measures variability and establishes longer term strategies to reduce overall variability and improve performance.

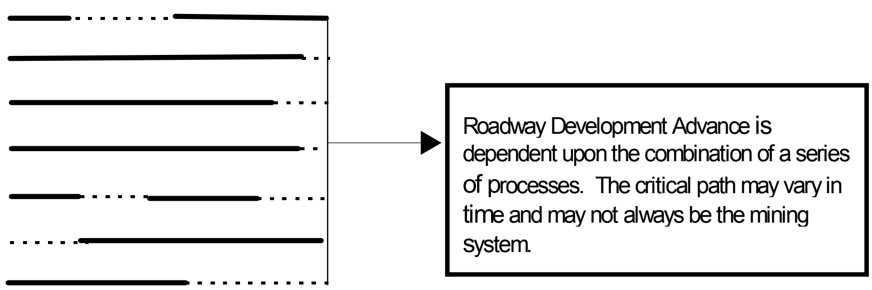
Lastly, a systems approach recognises that the collection and use of information is a key factor. It recognises that information and its analysis is the major business driver that will either improve performance in a long term sustained manner or if used wrongly will result in a short term reactive confusion.

In the work last year, two models were established to study the key components and their interactions.

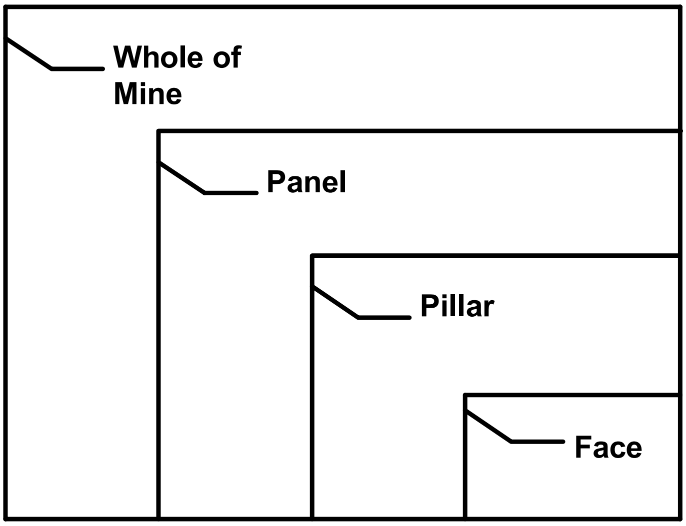
The key components were:

1. Mining Systems (cutting, bolting, transporting)
2. Organisational Factors (manning allocation and organisation, measurement systems and motivational factors)
3. Machinery Supply and Support
4. The Human Element (workforce, management, culture, industrial environment)
5. Maintenance Practice
6. Systems Support (panel layouts, extensions, gas and water drainage, ventilation, floor control)
7. Strata Support and Gas Control
8. Safety Systems

The two models were a simple form of process mapping (or a simple project management Gantt chart)



- and a simple hierarchy of the various levels that exist at each mine



The key questions to be answered are:

- What is the process map at each level of the hierarchy?
- What is the interaction between hierarchies?
- Who is responsible for the overall process at each hierarchical level?
- For each of these levels what is measured and what is the focus?

A suggested initial target is pillar cycle improvement

Before I discuss the next steps, it should be useful to detail our observations and some possible areas of improvement in each of the hierarchal cycles. However I would like to reinforce the point that such areas should be understood within the context of an integrated approach and not be seen as a shopping list to be addressed.

Cycle Observation and Possible Areas of Focus at Central

Face Cycle

The face cycle was fairly straight forward with obvious issues of floor softness and grade having a large influence on cycle times with normal cycle times being around 15 minutes. This was extended to 40 minutes on several occasions when difficulty was encountered in tramming the miner to the high side of the road. Although there was time in the cycle to pin the strap after one car and bolt up after the next car, this was not being done because of perceived roof issues. There was uncertainty as to what stage they should revert to the quicker method, and there was some anxiety with the position of the bolter operator that would support this conservative approach. The main issues that we saw in the face cycle was the amount of work left out of the cycle to be done at some other time (especially rib bolting), and the inefficiency of material supply.

Recommended areas of focus in the face cycle:

- *15m target.* There was a perceived target of 15 metres per shift in the 300 panels. In our opinion this is self limiting and counter productive to process improvement. Crews that have achieved 15 metres will see their days work as complete and crews that have not achieved it will always have good reasons why it was not achieved. Historically, shift averages will always be just under shift targets and it would be interesting to see if this is the case at Central. There needs to be a clear distinction between budget averages and targets. Instead of setting shift targets, there could be a concentration on improving uptime rates and improving available cutting times.

- *Cutting cycle optimisation*. Along these lines there is some work required to optimise the cutting cycle. The mesh size seemed to suit neither 2 or 3 cars per sheet which resulted in some confusion in the process. Secondly, although the bolting pattern allowed one pass bolting on the outer bolts, two pass bolting was required for the remainder. There seemed to be some scope to reduce bolting length and density in the gateroads which could be part of an exercise on cycle optimisation. (This should of course be supported by extensometers results etc.)

- *Rib bolting - on cycle*. There was opportunity to install rib bolts within the current cycle and this will have the dual benefit of improving safety and allow better utilisation of overtime. As a separate note of caution, wriggle bolts have not had a good performance record as the small diameter bolt tends to glove the chemical and will not allow adequate chemical mixing resulting in poor and variable anchorage. There may be an opportunity to improve both performance and installation time by replacing with a larger diameter 1.2 m bolt.

- *Eimco in panel*. There seemed to be a lack of ownership (or perhaps knowledge) of pillar cycle activities that could be done either within the face cycle or during downtime periods. To enable this work to be incorporated requires a full time Eimco and attachments to be stationed in the panel and an improvement in knowledge of these tasks.

- *Face supplies / Remote miner / Pod system*. One of the biggest issues was the inefficiency of material handling. This requires some type of pod system which is loaded at the surface (or at the supplier) and eliminates handling of individual supplies until end use. To allow the pods to be situated on the miner requires removal of the cab and conversion to remote operation. This will have additional benefits in locating mesh into position and general miner control (including floor). A ballpark quote for the conversion is $100,000.

- *Tradesmen in panel, underground workshop, panel spares box and requirements*. Whilst some tradesmen worked in well with face cycle activities, this was not generally found to be the case and they had very few set tasks that could be done during production. If there was panel downtime, then they often could still not achieve their set tasks because they were repairing the breakdown. Another issue, more in the mine or panel cycle was the increasing distance from pit top facilities. It would seem that the utilisation of these tradesman in a underground workshop facility would result in better utilisation of the time and skills and more efficient vehicle servicing, whilst still allowing good response times to panel breakdowns. There was also an obvious issue in the standards of panel spares. There was no obvious spares list required to be checked regularly. Housekeeping practice indicated a lack of ownership and accountability and must be having an impact on maintenance times.

- *Feedback on maintenance issues*. As indicated earlier as an example, although there is an adequate system of communication upwards to report and fix faults, there is no return loop to the originator.

This return loop is required to encourage good preventative maintenance practices in the panel by operators.

- *Communication*. While being part of a bigger issue, the scarcity of informal or formal discussions by the panel Deputy to his crew at the start of the shift or in the form of regular tool box talks was having a negative impact on the level of process knowledge and ownership.

Pillar Cycle

The pillar cycle was recognised as a cyclic operation at most staff levels. However, there appeared to be no system in place to either to measure its efficiency or to focus attention on improvement. We had a very good session with Laurie Pierce who had an extremely detailed knowledge of the cycle and the individual processes within it. If this *detailed knowledge* could be *transferred to the face workers*, then I suspect a significant cycle time improvement would result. If this was then coupled with a *measurement system* that focused on this cycle and a *process improvement activity that encouraged direct worker involvement*, then a further significant improvement would be gained. It was our view that this was the area could be focused on first to get some runs on the board and to demonstrate the benefits of improved communication, use of information, and increased worker involvement.

Recommended areas of focus in the pillar cycle.

- *Breaker feeder? - change in panel extension practice, additional gear - leap frogging*. While only observing a few production shifts, we would question the need for the breaker feeder in the panel as either a surge unit or a crusher. Coal was certainly being cut from the face finely enough not to require crushing and the chain speed was set on the feeder to virtually feed the full car of coal directly onto the belt. The benefits of not requiring a breaker feeder in the panel are many. In Central's case it would be of great benefit to the pillar cycle times if the structure could be built to a second boot end while driving the travel road. The belt could be pulled onto the boot and structure and the belt extension part of the panel extension could take only a couple of hours. There seemed to be a lot of other opportunities to improve the overall extension time. Non critical areas (such as water barriers) could be decoupled from the move and done some other time. Duplication of items such as transformers would allow leapfrogging to keep these moves off the critical path. There was a document put together that details the current practice, but it is not being used to drive and improve the moves. This document could be used as a process improvement tool. Directly before the next move the procedure can be discussed with each crew with the attitude of "lets follow this strictly both to:

    1. to see how fast we can do this, but also
    2. what are the refinements that can be done to improve the next move"

    and then commit to spend another half hour at the end of the move to review and modify the practice. Using this "example move" approach over 3-4 cycles will have a benefit in improving face worker knowledge and involvement, teamwork interaction and training - and ultimately cycle times.

- *Road maintenance*. Road maintenance was seen to be an issue that may be resulting in longer travel times, higher machine maintenance, and some discomfort and potential injury to staff being transported. It has the potential of becoming a very big issue when gas drainage in brought on cycle. Although, there was some stated problems with the grader, we saw the bigger issue to be the lack of a inbye ballast dump. If ballast could be delivered by either large diameter borehole or by an efficient transport process that was decoupled from road repair, then maintenance could be achieved more efficiently.

- *Gas drainage*. The biggest potentially significant issue was the impact of on-cycle gas drainage on the remainder of the process. Handled correctly, by integrating its requirements into the cycle and modifying the cycle up front will result in minimal impact. Handled incorrectly by trying to add it on and coping with problems as they arise will potentially have a severe impact on cycle times. This has been the experience of most mines that have on-cycle gas drainage systems. There has also been a cultural resistance to seeing it as a part of the cycle and not an annoying add on.

- *Standards for longwall operation*. We could not find any roadway development standards with respect to longwall requirements in the panel. As a minimum we were looking for off centre standards that said "roadways to be +/- 200 mm or they will be trimmed prior to the extension." The tendency in the US is towards "longwall ready gateroads" where all of the longwall requirements are set out and installed during the pillar/panel cycles.

- *Maintenance shift*. The two maintenance shifts a week were unanimously acclaimed as a success and we agree with that view. There was some need to improve their utilisation and especially to ensure a hot seat start for both the maintenance crew and the following production crew.

Panel Cycle

The most striking issue with the panel cycle was there was not a ready acceptance even of its existence. As a result the cycle consisted of a series of disconnected activities that had very poor interfaces, interaction delays and slow learning curves. There did not seem to be anyone with responsibility for the overall cycle to ensure that the detail was included and that lessons from past mistakes incorporated in planning and practice.

Recommended areas of focus in the panel cycle.

- *Acknowledgment of cycle for ownership and integration of activities*. There firstly needs to be acknowledgment that there is a cycle of activity which commences with the setting up and driveage of mains, gateroad panel breakaway, set up of gateroad panel, driveage of gateroad, driveage of face heading and panel overdrive, interaction requirements with the longwall installation, removal and equipment overhaul and start again. Integrated within this cycle are a myriad of activities that interact with each other. An emphasis on laying out these activities and producing integrated plans and communicating them through the workforce will have a tremendous benefit in reminding crews of what was best practice last time, in informing them of changes this time, in training and teamwork development and most importantly in allowing formal feedback loops where operators can have their input included in panel plans.

- *Mains layout redesign to accommodate workshop, supply areas, ballast area etc*. The current mains driveage has insufficient room to allow for inbye service areas. A suggestion is to consider moving

B heading 20 - 25 metres towards C heading and placing all of these service areas in the resultant series of elongated cut throughs. These may include a workshop, ballast dump, supply area, stonedust, diesel storage etc. This layout has the option of direct return access and should not compromise mains stability (although separate advice should be sought on this point).

- *Use of control room*. The use of the control room is being limited by the its position, its historical use as a gatehouse and the limited underground knowledge of the operators. Consideration could be given to locating the room in a more operational position, and having the operators being fully trained for logistics support for the mine. This will allow more efficient movement of resources and the freeing up of undermanagers to focus more on other issues.

- *Cost issues <> wastage, stores systems and access*. There is a initiative at the mine to allocate costs and introduce department budgetary responsibilities. It was not clear whether the role of the proposed system was to be purely an historical cost system or whether it had a component of waste reduction and improvement justification included. At the first workshop conducted at the mine on the 19th June, a question was posed on areas of wastage. While the initial reply was roof bolts at the face, there was finally a list of 13 areas of which roofbolts was no 13 and no 1 and 2 were rework and poor overtime utilisation. A cost measurement system needs to include effective waste measurement and costs of a complete process to enable alternatives to be justified. The issues at the store seemed to be well recognised and plans were in place to implement appropriate changes. The current stores issues system is impacting upon cycle efficiency by taking face workers away from the face area right back to the surface each shift. The introduction of an inbye pod and stores area will alleviate this.

- *Maintenance system effectiveness/efficiency - scheduled tasks/achieved*? The process of setting and prioritising maintenance tasks was not clear to us and seemed to based on a combination of reacting to verbal and written reports, carrying out scheduled maintenance from a calender based system, some component replacement based on a system of usage and/or some condition monitoring and oil sampling. There was a strong imperative to replace the current computer maintenance system with an upgraded "FMMS" system but the timetable on this was unclear. Besides as previously mentioned some work by Mick Scully, there was little observed measurement of system availability and maintenance effectiveness. The method of measuring availability on the basis of total time minus breakdowns does not effectively indicate maintenance performance for cycle based processes. The use of pareto charts and pie charts of system availability are a much more important measure. The ratios of achieved/scheduled tasks and scheduled vs breakdown maintenance are also important. Cutting rate could also be benchmarked and used in determining machine health on a periodic basis.

- *Communication.* Communication was seen to be a major issue through the panel-pillar-face cycles. To make an effective change it needs to be initiated from the panel cycle area and flow through to the other cycles. Integrated plans need to be completed for each panel and formally communicated from development coordinator to undermanager to deputies to face workers. Each step requires a feedback loop that allows real input. The outcome of the deputy giving regular tool box talks to his crew on safety, cost, production, planning and process improvement issues cannot be achieved until driven downwards through this flow chart. Skills need to be given to all of these people to enable them to be confident to undertake these two way discussions effectively.

- *Panel folder*. Appropriate parts of the panel plan could be placed in a plasticised panel folder in the cribroom. This should include hazard plans, sequences, procedures, etc.

- *Gas drainage*. There seemed to be some disconnection between gas drainage and ventilation practice. As the mine becomes deeper these two areas will become very dependent on each other and perhaps should be under the one hat. A suggested starting point should be to build up a database of gas balance vs gas sources vs mining rate.

Mine Cycle

We did not spend much time studying the mine cycle because the current extension project is attempting to address a lot of the mine cycle issues. We would suggest that this review process is a useful one to be ongoing as it periodically brings people together of differing disciplines to optimise the future direction of the mine.

Recommended areas of focus in the mine cycle.

- *Roster*. There were discussions of different roster systems that could increase face time. One roster that may be considered is an overlapping 10, 10, 8 hour roster with the maintenance concentrated on the 8 hour shift and production on the two ten hour shifts. There would be an extra person in each crew to be rostered off one day a week on the ten hours shifts.

- *Maintenance management system*. This has been mentioned above, but the introduction of a new system is really a mine cycle issue and from what we observed is a high priority.

- *Systems Approach*. The main focus should be on:

    1. data management for process improvement,
    2. improving communication flow and feedback loops, and
    3. initiating process improvement in an area that is easiest to implement and has immediate benefit. We recommend the pillar cycle.

- **the bottom line is to focus on ENABLING WORKERS TO IMPROVE PROCESS KNOWLEDGE AND THEIR ABILITY TO INFLUENCE.**

Suggested Starting Process

As a wise man must have once said, the hardest thing about initiating change is the first step. In this case the first step requires knowledge and ownership by the key people at the mine who are going to drive the change. The second step has to be to tell the workforce what you are about to do. The third step requires setting in place a measurement system that will assist improvement and the fourth is to pick something which is straight forward, has a good chance of success and will build teamwork and communication. We would recommend the following:

- Run another workshop on systems approach for Incharge staff and make this a kick off point for implementation.

- Report to the workforce regarding;
  - intention to introduce "systems approach"
  - the aim to train deputies to give weekly crib room talks about
    - C.I. issues
    - performance
    - costs
    - waste reduction

- Implement a production reporting system that emphasises process improvement that includes:
  - cycle measurement
  - metres/operating hour
  - operating hours/week ----> metres/week
  - actual vs scheduled by sequence for pillar cycles, mains and non standard driveage.

- Implement area production meetings with crews to reinforce plans and practical aspects of panel plans and feedback.

- Review the role of undermanagers with a view to the introduction of area responsibility for process improvement.

- Improve current information flow to address and reinforce a "closed loop" system and extend the time horizon and completeness of current short term exception reporting.

After the above points have been initiated form a process improvement team for the purposes of drafting and implementing action plans (including accountabilities and timing). We recommend the inital focus should be on improving the pillar cycle.

APPENDIX 3 – STANDARD AREA METHODS (SAMS)

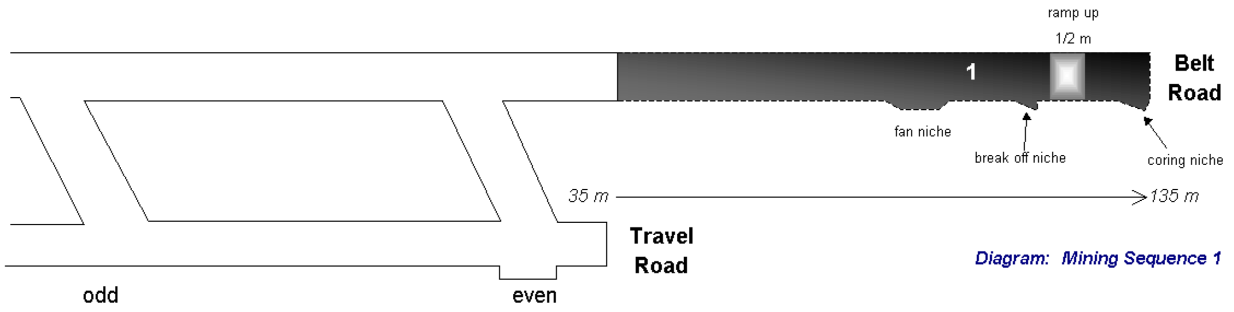


Diagram: Mining Sequence 1

Triggers: Belt extension complete: Belt tracked and running, sufficient ventilation, machines powered up, communication operational, supplies to face, laser set up, fire fighting equipment, adequate water pressure, face DAC set up

Permit to mine issued by Mine Manager as per the Outburst Management Plan

PRODUCTION

- Mine C Hdg as per the diagram above
- Fan Niche @ 55-65 metres (<= 0.5 m wide)
- Break Off Niche @ 94 metres (<= 0.5 m wide)
- Flexibolt @ 98, 100, 102 metres
- Drill Tell Tale/ Extensometer holes as required
- Ramp up roof height by 0.5 metres for vent tubes 95-105 metres
- Cut small niche @ 130 metres in bottom rib for coring rig (<= 0.5 m wide)
- Install Belt Anchor Plates at around 100 metres
- Cut to 135 metres
- Install vent tube T-piece @ 102 metres (including regulator)
- Flit to Break off niche: "Figure 8" the miner cable and store in new fan niche

WORK IN BELT ROAD

Rib dowel top rib

Seal CH4 holes as found

Pull down outbye water barrier and load into MPV tub

OTHER WORK

Brick Stopping erected in last C/T

Move belt clamps etc forward to last C/T

Take out empty structure modules

Bring in full structure modules and roll of belt

WORK IN TRAVEL ROAD

Push coal off floor from last pillar, into stub with eimco

Move Crib Room if not already done

Extend pump line to last C/T

Rib Dowel top rib

Additional support in Driller' Niche

Diagram: Mining Sequence 2a (odd CT), and 2b (even CT)

Triggers: Sequence 1 complete
Sufficient Ventilation

PRODUCTION

Install flat vent tubes across Belt Road
Close regulator in stub, open flat regulator
Put up prism
Cable Niche on outbye rib @ 25-35 metres

2a Odd C/T's

Last row of supports 40 metres
Undercut to 42 metres

2b Even C/T's

Ramp up roof height to 2.7 metres @ 37 metres, squaring up roadway
Cut to 47.5 metres, leave face square, not undercut
Last row of supports at 45.5 metres
Support to face immediately (with gopher) if roof poor

WORK IN BELT ROAD

Rib dowell top rib
Patch CH4 holes as found

OTHER WORK

Erect Brick Stopping in 2nd last C/T
Move belt clamps etc forward to 2nd last C/T
Take out empty structure modules
Bring in full structure modules and roll of belt

WORK IN TRAVEL ROAD

Set up laser in D before flit
Push coal off floor into stub with eimco
Extend pump line to last C/T
Rib Dowell top rib
Additional support in Driller' Niche
Pull down water barrier and load in MPV tub

OUTBYE WORK

Move Crib Room if not already done

Flit tram miner backwards to just past previous C/T, hanging cable on tail of miner as it trams
tram miner forwards down the previous C/T to overdrive in travel road, off load cable in cable niche in C/T

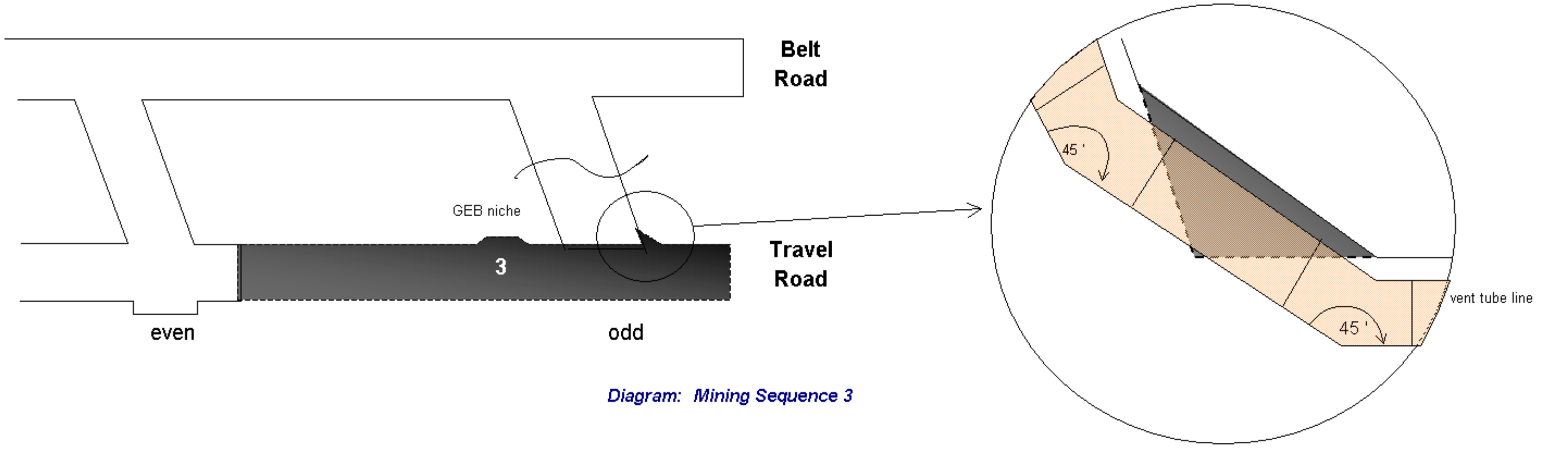


Diagram: Mining Sequence 3

Triggers: Sequence 2 complete, Flit complete
Sufficient ventilation and ventilation changed over
Structure and Roll of belt in panel
Intersection stonedusted
Miner supplied

PRODUCTION

Put up Pipe Hangers (every 4th row of bolts) on bottom row of bolts
GEB niche @ 93 metres in top rib
Flexibolt at 98, 100, 102 metres after hole through
Trim inbye top corner rib for shuttle car
Push stowage down from C/T down to D Hdg with eimco
Hook up vent tubes to ventilate down new C/T (see diagram)
Put up sail in new C/T (reduces dust at B/E for S/C operator)
(close last C/T regulator in vent line, open C hdg Regulator)

Start Panel Extension

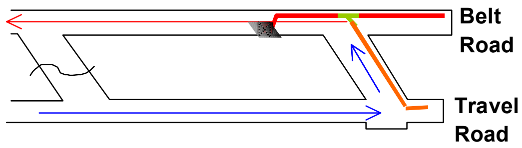
WORK IN BELT ROAD

After Flit to travel road, turn off power to electrical laser, roll up cable onto Klockner
Complete Rib dowelling
Clean up Belt Road with eimco, stowage in CT
Bring in drill rig & rods to take core sample from Belt Road Stub
Run out 2x2" bull hoses for air, 1x1" water hose to drill rig
Obtain core, pack up rig, roll up hoses, move rig and rods to outbye CT undtil next sequence
Stonedust Belt Road and C/T
Lay out structure
General clean up
Move 1" air hose reel forward

WORK IN TRAVEL ROAD

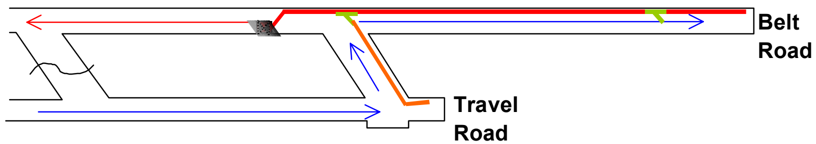
Grading/roadworks outbye
(when machinery available)

Pillar Sequence	**Ventilation Sequence**
finish belt move	Fan placed in fan niche during belt move
	flat tubes installed over b/feeder and vent line connected to T-Piece
	Ventilate through travel road

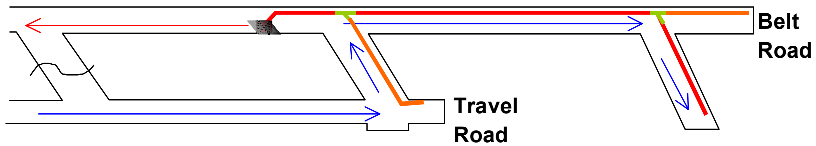


Mining sequence 1

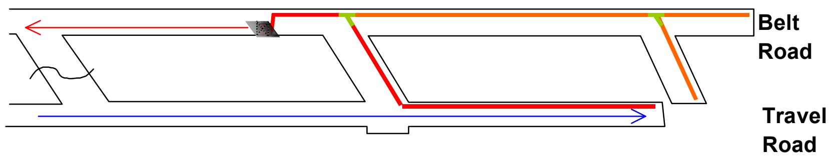
Mine belt road — Install vent tube T-piece @ 102 metres (including regulator)



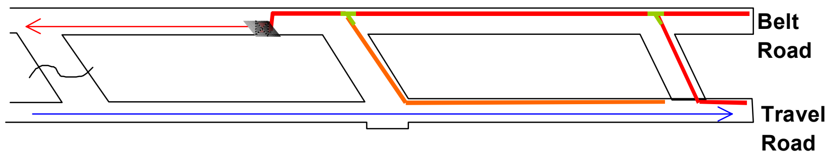
Mining sequence 2
mine CT



Mining sequence 3
Mine Travel Road



Mining Sequence 3
Hole through



LEGEND

- return air flow direction
- intake air flow direction
- auxiliary fan
- active vent line
- in-active vent line
- T-piece and regulator

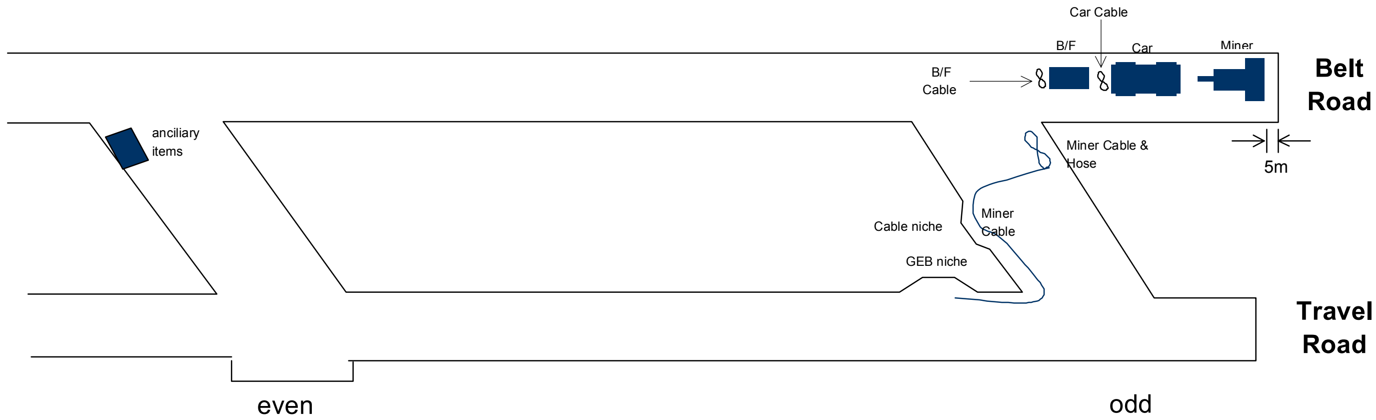


Diagram: Park up locations

Triggers:

Mining Sequence 3 complete
Structure has been laid out
Roll of belt in section for the next panel move
Belt Road cleaned to over-drive
Belt Road re-stonedusted

Park up (6 men)

Empty Miner Conveyor, Shuttle Car, Klockner and belt of coal

Tram Miner half way up the new C/T, use eimco to pull slack cable forward

Tram miner to top road and park in over-drive - 5 metres back from face.
Ensure miner shovel is empty and support heads

Use eimco to pick up the 150 metre long Miner cable
"Figure 8" cable and store in top of inbye rib of new C/ (see diagram)

Use eimco to bring 70 metre long jumper cable forward
Hang from new GEB niche in bottom road, up the new C/T and across to Miner Cable

6 People Total | **4 Additional People (when available)**

3 People	3 People	4 People
Park S/C around corner in 2nd last CT, and hang cables on hooks	Remove scraper, t/dusterr, extinguishers etc onto aux fan	Extend pipes
	Dismantle tubes from fan across belt	
Clean up around feeder	Trigger to run belt into position, isolate and then clamp and detension	Relocate GEB
Park shuttle car up in C hdg behind miner and advance cable with eimco	Break belt @ clip and join in new roll of belt	Recover 100m feeder Cable from outbye and hang from old GEB position to new position. Plug in GEB cable and miner, SC, Fan and Klockner into GEB
Pull shuttle car jumper cable and hoses and rehang in the new C/T		
Erect sail in 2nd last CT(and overdrive if required)	Trigger to turn power off GEB	
Ensure belt has been detensioned	Trigger to disconnect fan	Move emergency box, fire depot, extinguishers and spare tyre forward
Tram Feeder forward, picking up cable with eimco. Park behind shuttle car		Move rickshaw and spare S/C cable forward
Clean up around boot with eimco and put stowage into travel road o/drive	Relocate structure	
Move stonedust pallet from old auxfan position	Assist with tubes	**(If manning unavailabile, this work to be done after structure installed)**
Move fan forward to new position and hang fan cable into hooks	Hang roll of belt and fire hose reel for next belt move	
Move vent tubes from belt road (5 people required), store in new CT along inbye rib	Hang water barriers if required	
Pick up boot		

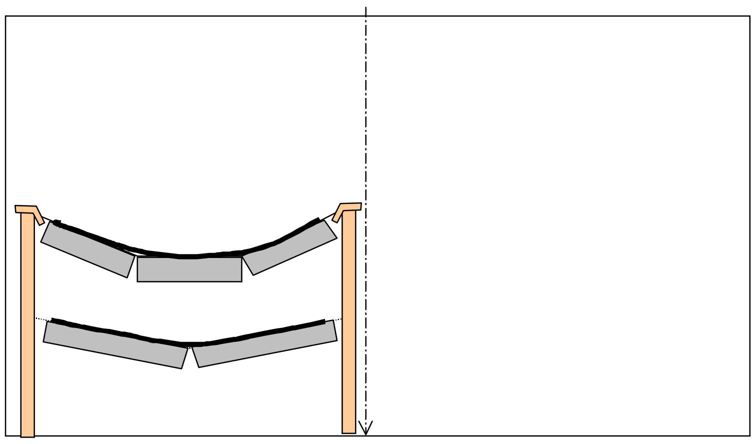
---------- Install structure ----------

6 People

Install structure	Ensure roll is feeding onto belt and belt is not pulled too far
Rejoin belt at last bay of structure	Bring in roll of belt and hang at top of 2nd last CT for next extension
Clamp left on to minimise tension	Deputy and 1 man to install stopping
Line, level and pin structure	Bring in 2 pallets of bricks and unload against brattice stopping
Install cross braces	(also bring in t/duster in even CTs)
	If 2nd last CT is even, bring in water barriers and hang them in belt road
Re-anchor shuttle car position over boot	Pin boot if air and water installed
Install signal line	Install tubes to fan
	Run Klockner over boot with eimco
	Take clamp off belt
	Tension, run and track belt
	Move Crib room to next CT inbye

NOTE: every 4th panel extension , move TX to 3rd last CT

-------------------- Turn fan on, power on miner, run coal over belt and check tracking --------------------



EIMCO REQUIRED FOR INSTALLATION

Move boot inbye with eimco a distance of around 1 bay of structure

Belt feeds off new roll onto the top of the belt structure

Slide structure leg under the bottom belt and stand it up (approximately in line with centre of roadway)

Put bottom rollers in

Put on stringers

Install troughing rollers

Repeat for pillar length (100m)

OUTBYE WORK

Run HT cable
Run Data Cable
Run Catenary for HT
Relocate Transformer

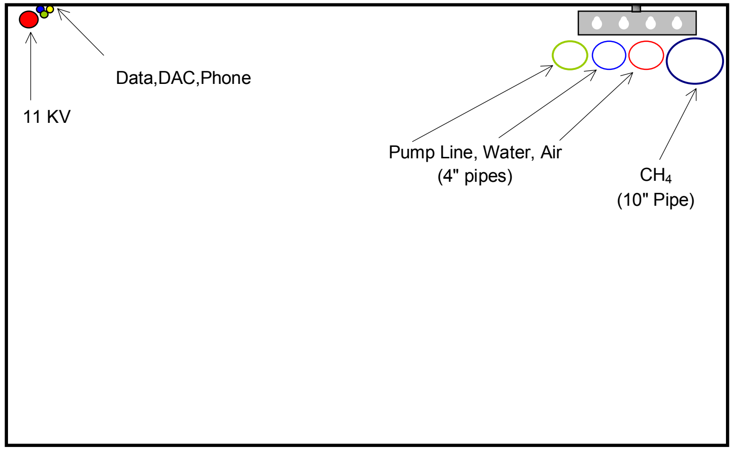
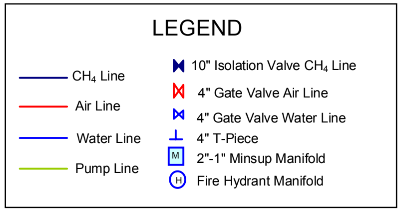


Diagram: cross section of travel road (looking inbye)



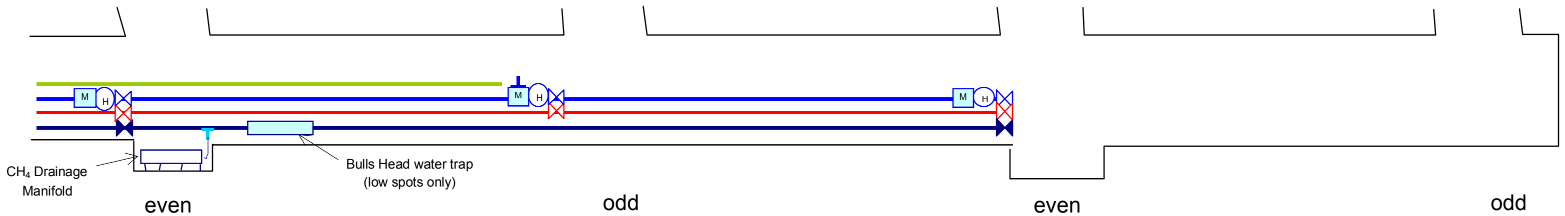


Diagram: Pipes/Fittings Layout in Travel Road

Triggers: Park up complete
1 Electrician to complete

WORK IN BELT ROAD

Remove DAC cable from C Hdg

Relocate B/E electrics

Relocate DAC Cables from GEB to midface

Relocate DAC Cables from midface to B/E

Run out cable and set up electric laser

Set up face DAC

WORK IN TRAVEL ROAD

Run out DAC cable and 2 telephone cables to new GEB position in D

Relocate GEB telephone

Relocate Crib Room telephone

OUTBYE WORK

Run HT cable
Run Data Cable
Run Catenary for HT
Relocate Transformer

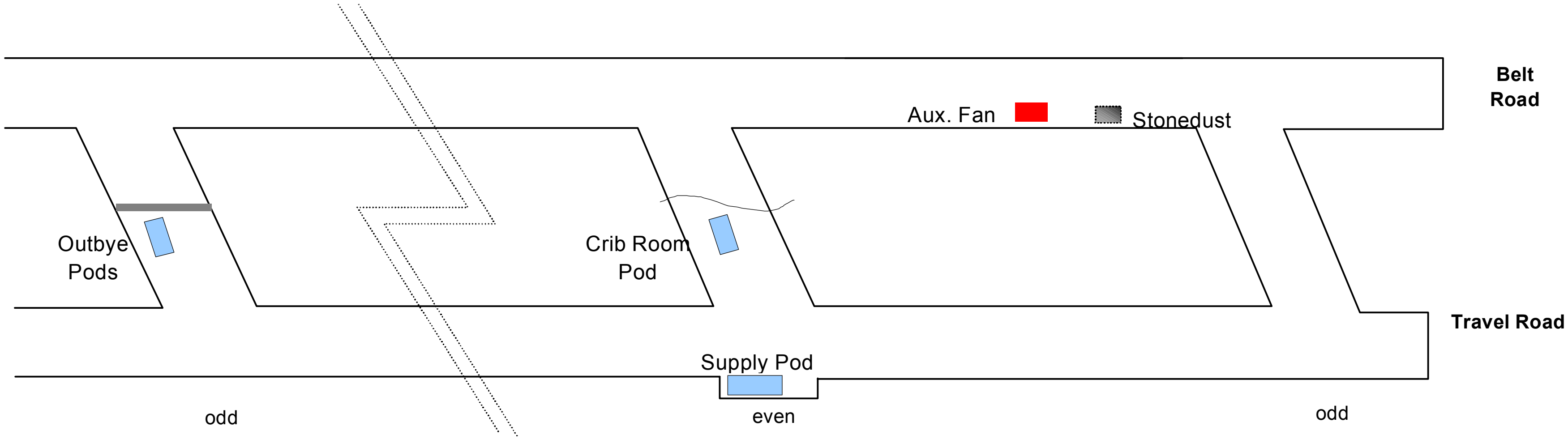


Diagram: Location of Panel Extension Supplies Pods

FACE

SUPPLIES SKIP (2 per pillar)

- 350 bolts, washers and plates
- 14 Boxes 880 chemicals
- 17 Pipe hanging brackets and nuts
- 6 Drums hydraulic oil

OTHER

- 1/2 Pallet stonedust (for Aux.fan)

CRIB ROOM SKIP

- Vent Tube Rubbers
- Eye Nuts
- Vent Tube Chains
- Drill Bits, Reamer bits
- Drills
- Marlin
- Brattice gun staples
- Tools
- Structure pins

OUTBYE STORAGE (Spare outbye CT)

RIB BOLT POD

- 14 Flexibolts and 1 box of chemicals
- 50 Rib Dowells, washers, plates
- 2 Boxes of 880 chemicals
- 2 Boxes of 330 chemicals

OTHER (Spare outbye CT)

- 1 pallet 880 chemicals
- 5 1 tonne bags stonedust (hung beside belt jib)

PET TO BROUGHT IN DURING PANEL EXTENSION

PIPE SKIP (Air and Water)

BROUGHT IN DURING PANEL EXTENSION

36	4"/100 mm pipes
44	4"/100mm clamps
36	5"/1.5 m lengths of chain
2	4"/100 mm gate valves
2	Manifolds 2"/50mm and 1"/25mm minsup
1	Fire hydrant manifold
1	4" T-piece
1	4" Blank (odd C/T's only)

PIPE SKIP (Pump Line)

BROUGHT IN AFTER EXTENSION

17	4"/100 mm pipes
20	4"/100mm clamps
17	5"/1.5 m lengths of chain
1	manifold with non return valve and pump inlet
1	4"/100 mm gate valve

BELT STRUCTURE

IN PANEL AND CHECKED PRIOR TO COMPLETING SEQUENCE 2

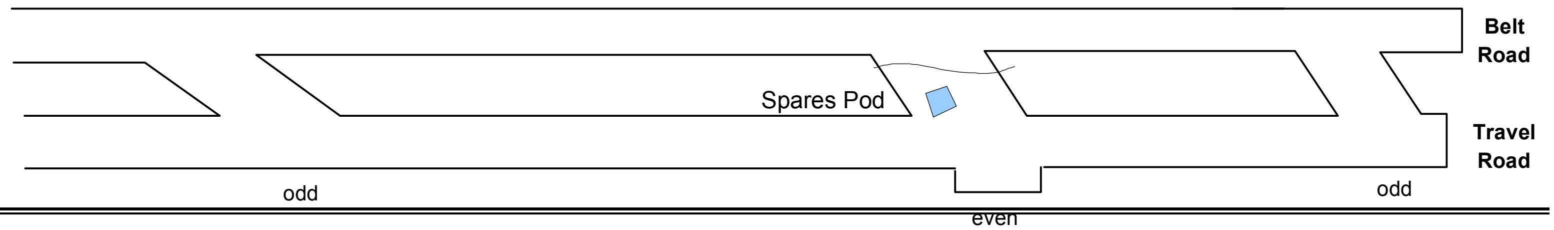
35	Legs - set for correct grade
70	Return Rollers
70	Top Rollers
70	Stingers
1	Cross Brace set

ANCILIARY ITEMS (MPV tub)

IN PANEL AND CHECKED PRIOR TO COMPLETING SEQUENCE 2

	Fire hose Reel
	1" red hose for reel
	Stopping gear:
18	Belt structure pi props, brattice, battons, wedges
4	Boot pins
4	Bolts (3 foot)

ALL TO BE CHECKED PRIOR TO LOADING



PANEL SPARES

List also found inside Spares Pod

Tools

- spanner
- tube socket 1/8 to 1/2" D
- thread rod for torque rod
- cold set
- 1" slide hammer
- 2 air bags and controls
- pick block spanner
- 1 to 3/4" reducer
- 2 grease guns
- 1 drum pump
- split pins
- grease nipples
- silastic 2
- corg gun
- o ring kit (blue)
- hack saw
- never seize
- pick punch bent end
- 1/8 socket
- 1/16 socket
- o ring kit (red)

Fittings

adaptor	1/4 JIC to 1/4 BSP
adaptor	1/4 JIC to 3/8 BSP
adaptor	3/8 JIC to 3/8 BSP
adaptor	3/8 JIC to 1/2 BSP
adaptor	1/2 JIC to 3/8 BSP
adaptor	3/4 JIC to 1/2 BSP
adaptor	3/4 JIC - 3/4 BSP
adaptor	1 JIC - 3/4 BSP
adaptor	1 JIC - 1 BSP
elbow	1/2 JIC - 3/8 NPT
swivel elbow	1/4 Male to 1/4 female
swivel elbow	3/8 Male to 3/8 Female
swivel elbow	1/2 male to 1/2 female
swivel elbow	3/4 male to 3/4 female
joiner	1/7 JIC male
joiner	3/8 JIC Male
joiner	1/2 JIC Male
joiner	3/4 JIC Male
Mins up	1" tail
	1/2" tail
	1" male BSP
	1/2" male bsp
	1" female BSP
	1/2" female BSP
	1" hose clamp
	1/2" hose clamp

Hoses

N°	4	hose	300 mm
N°	4	hose	450 mm
N°	4	hose	750 mm
N°	4	hose	1000 mm
N°	4	hose	1250 mm
N°	4	hose	1500 mm
N°	6	hose	300 mm
N°	6	hose	450 mm
N°	6	hose	750 mm
N°	6	hose	1000 mm
N°	6	hose	1250 mm
N°	6	hose	1500 mm
N°	8	hose	300 mm
N°	8	hose	450 mm
N°	8	hose	750 mm
N°	8	hose	1000 mm
N°	8	hose	1250 mm
N°	8	hose	1500 mm
N°	12	hose	450 mm
N°	12	hose	750 mm
N°	12	hose	1000 mm
N°	12	hose	1250 mm
N°	12	hose	1500 mm
N°	16	hose	500 mm
N°	16	hose	1000 mm
N°	16	hose	1500 mm
N°	16	hose	2000 mm

Mins Up

- 1/2" Ball Valve Bikini
- 3/4" Ball Valve Bikini
- 1" Ball Valve Bikini
- 1" Ball Valve BSP Female
- Coupling 3 way 1"

Parts (as listed in Pod)

- Shuttle Car
- Continuous Miner
- Feeder Breaker
- Drill Rigs

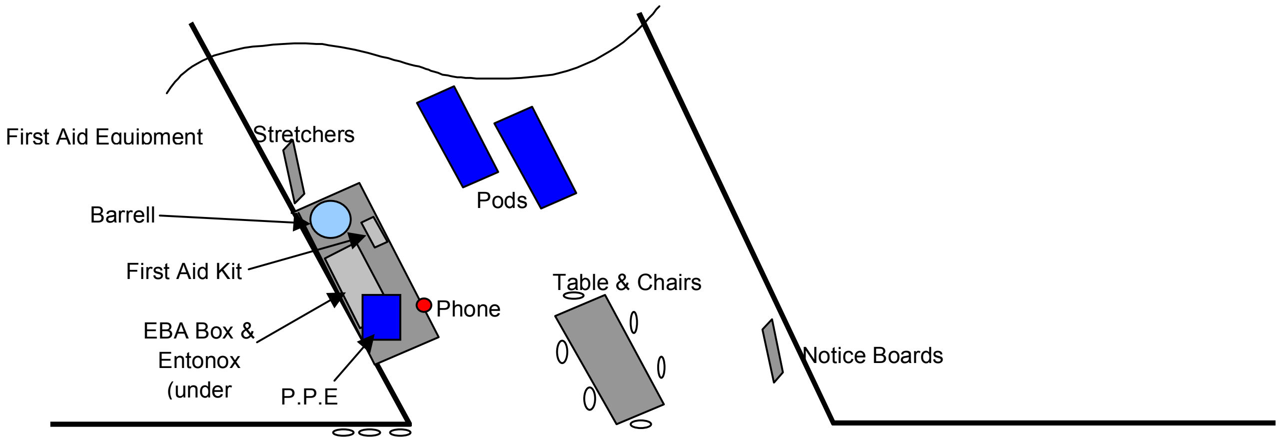


Diagram: Crib Room Layout

CRIB ROOM SAFETY HARDWARE

FIRST AID EQUIPMENT	Contents
EBA Box	Plans of 2nd Egress 15 EBAs EBA Inspection Book
First Aid	First Aid Kit Blankets and splints (in barrel) 2 Stretchers Eye Wash Antiseptic Hand Wash Entonox
Personal Safety Gear	Ear Plugs Dust masks

SAFETY INFORMATION	Contents
Plans (on Board)	Roof Support Plan Hazard Plan Emergency Procedures Mine Plan 2nd Egress Plan Fire Fighting Plan
Emergency Phone	includes phone list
Signs (in travel road)	EBA sign Fire Hydrant Sign CT location sign

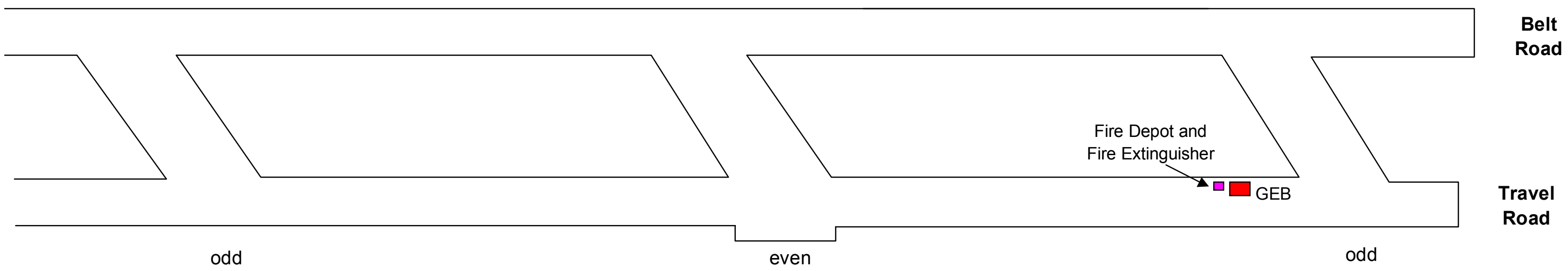


Diagram: Location of safety equipment

GEB AREA - SAFETY HARDWARE

CURRENT	CONTENTS
Emergency Box	Brattice, snap jacks, long handled shovel, short handled shovel Measuring stick, 4 lb hammer, hand pick, axe, bow saw, spare bow saw blades, roll of Marlin, bag of 10 inch zip ties In sealed bag - staple gun, box of staples, stanely knife
Fire Extinguishers	
Fire Depot	
Emergency Phone	
Signs including rescusitation	

MOBILE MACHINES - SAFETY HARDWARE

Fire Extinguishers

OUTBYE - SAFETY HARDWARE

CURRENT	CONTENTS
Fire Depot every 4 pillars	
2nd Emergency Box	
Fire Hydrant every pillar	
Fire hose reel every pillar	

TRANSFORMER AND ISOLATOR - SAFETY HARDWARE

CURRENT	CONTENTS
2 Fire extinguishers	
Signs including rescusitation	
stonedust buskets, eye wash	
first aid kt and antiseptic hand wash	

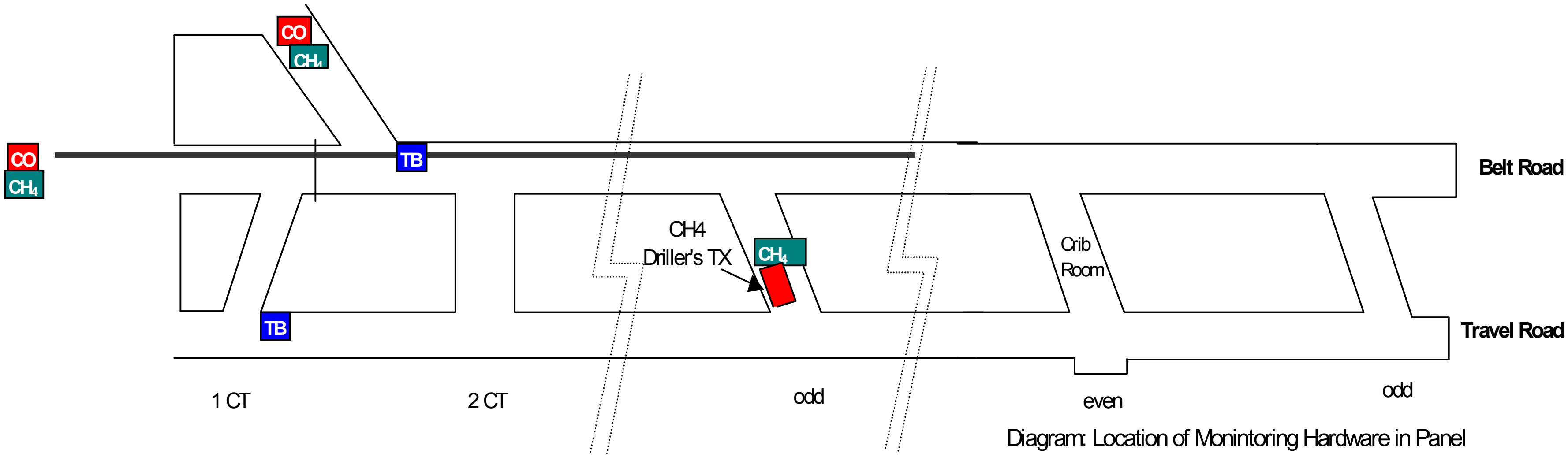


Diagram: Location of Monintoring Hardware in Panel

MONITORING HARDWARE

SYSTEM	PURPOSE	LOCATION	ISSUES
AMR	Instantaneous monitor of gas levels Set to alarm first, then trip equipment	Homotropal leg - CO, CH4 Drivehead - CH4 LTU - CO Drillers Transformer - CH4	B/Feeder trips on CO in homotropal leg from diesel exhaust fumes Put monitor on intake side of feeder to compare? Control number of diesels in the panel?
Tube Bundle	Monitor and trend gas levels	Travelling road 1-2 c/t Belt Road 1-2c/t	
Belt Monitor	Monitors Conditions of components	Motors Lockouts Tracking Switches	

APPENDIX 4 – CENTRAL COLLIERY PROJECT MANAGEMENT

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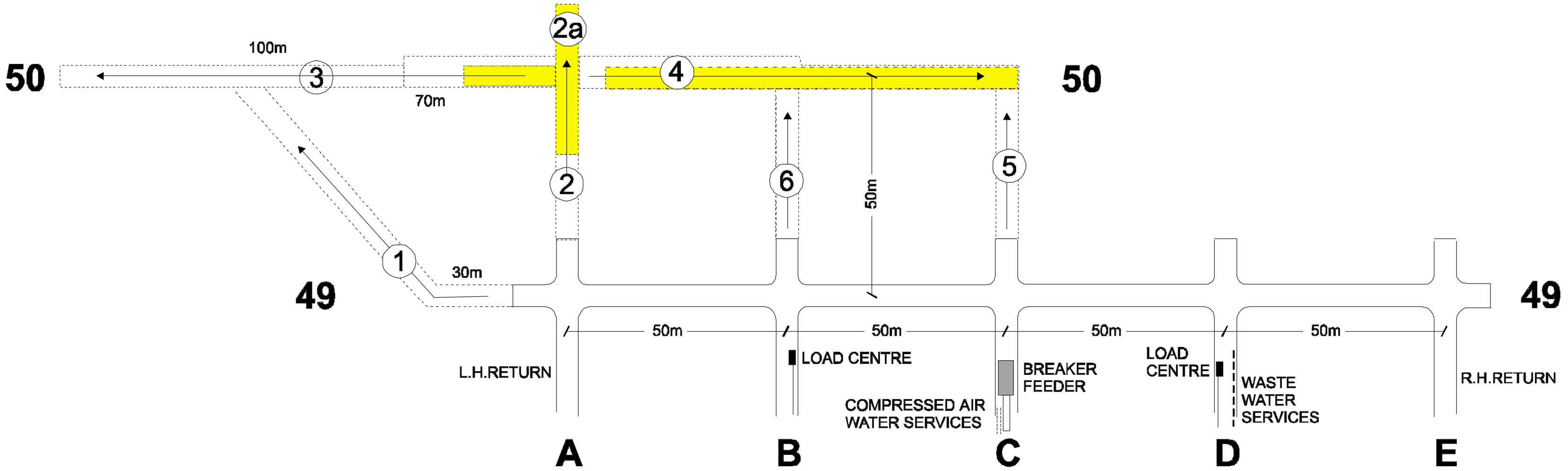
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



TRIGGER:
- Roadway Development completed to 49 C/T line.
- Conveyor, compressed air, clean & waste water, electrical, ventilation & explosive barrier services extended.

PROCESS	CONTROLS	SCHEDULE
Drive Sequence 1 approx. 100m to align with near rib of #50 C/T	Use brattice line ventilation returning through A hdg Establish supply dump in wing in A heading Provide survey control for slant roadway Wheel 2 shuttle cars through # 49 C/T Power miner and cars from load centre in B Hdg	72 HOURS 4 HOURS
Flit miner to drive sequence 2	Install auxiliary fan in #49 C/T & return through sequence 1 to A Hdg	72 HOURS
Drive sequence 2 to 30m mark in coal – ramp up on coal to 4.5m level & mine stone roof to 60m mark	Extend ventilation ducting to 60m in A Hdg & install L.H. "T" piece at 42m mark Control excavation height from German Creek Upper Seam benchmark	72 HOURS
Flit miner to start of sequence 2a.	Provide survey controls for intersection A50	1 HOUR

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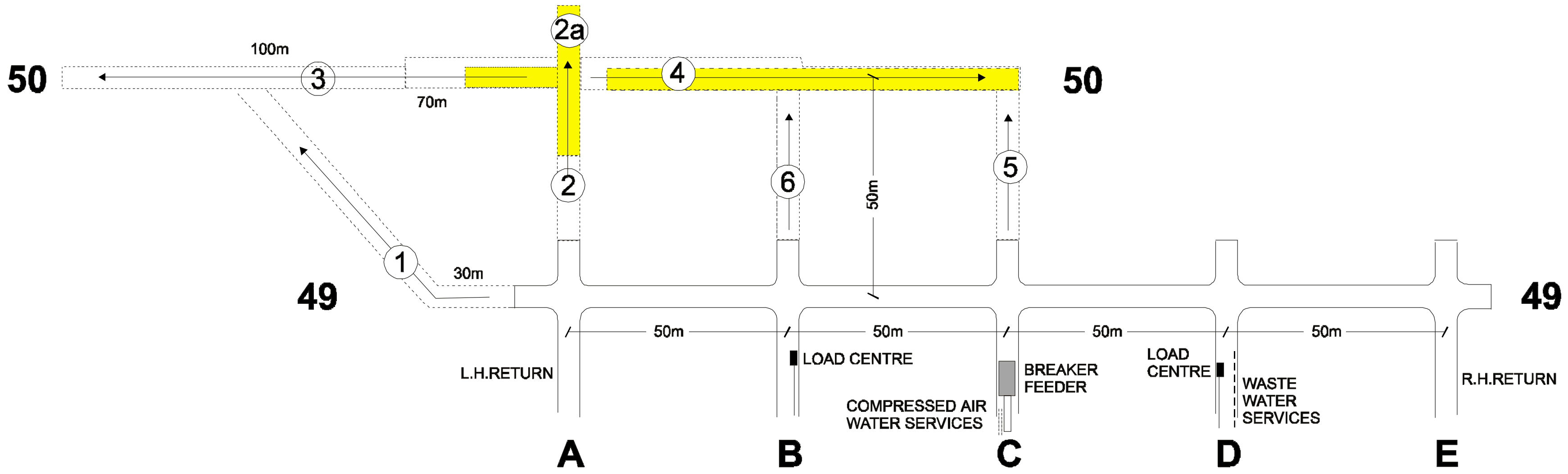
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Mine bottom coal in sequence 2a & undermine the lip of the roof excavation for a min. of 4m Flit miner to drive sequence 3	Systematically lower the ventilation ducting to seam level as coal is removed Support exposed lip of excavation a minimum of 2m	8 HOURS
Form L.H. breakaway & drive sequence 3 to hole slant roadway at 70m & continue to 110m mark Flit miner to drive sequence 4 & relocate auxiliary fan	Excavate roof to provide roadway height of 2.7m for initial 20m of drivage Apply appropriate correction to intersected gas drainage holes Check ventilation quality when slant roadway is intersected Establish supply dump in A hdg overdrive	48 HOURS 5 HOURS
Form R.H. Breakaway & drive sequence 4 to 8m mark in coal – ramp up on coal to 4m level & mine stone roof to 102.5m mark (far rib line of belt hdgs) Flit miner to drive sequence 5	Relocate auxiliary fan in #50C/T & return through #50 C/T, slant roadway and A Hdg Install diagonal stopping at A49 intersection Install conveyor hanging bolts & chain Maintain survey control for duration of excavation Establish supply dump in A Hdg overdrive	72 HOURS 4 HOURS

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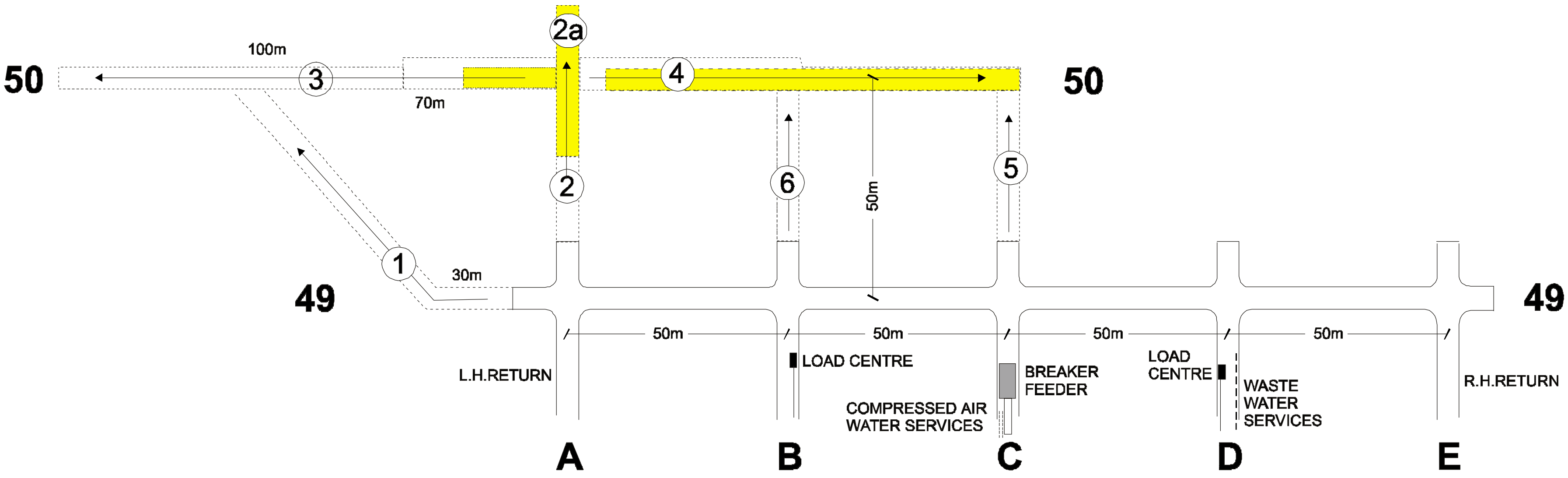
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Drive sequence 5 to hole #50 C/T Flit miner to drive sequence 6	Use brattice line ventilation through E Hdg Install stopping in D Hdg between #48 & 49 C/T's Excavate holing point at C50 intersection sufficient to establish a ventilation circuit Establish supply dump in #50 C/T Decommission auxiliary fan & establish ventilation circuit through #50 C/T & A Hdg	24 HOURS 2 HOURS
Drive sequence 6 to hole #50 C/T Flit miner to drive sequence 7	Use brattice line ventilation through A Hdg Isolate & tag out auxiliary fan Excavate holding point at B50 intersection sufficient to establish ventilation circuit Establish supply dump # 50 C/T Repower miner & shuttle cars from load centre in D Hdg Remove brattice & props from #49 to 50 C/T in B & C Hdgs	24 HOURS 4 HOURS

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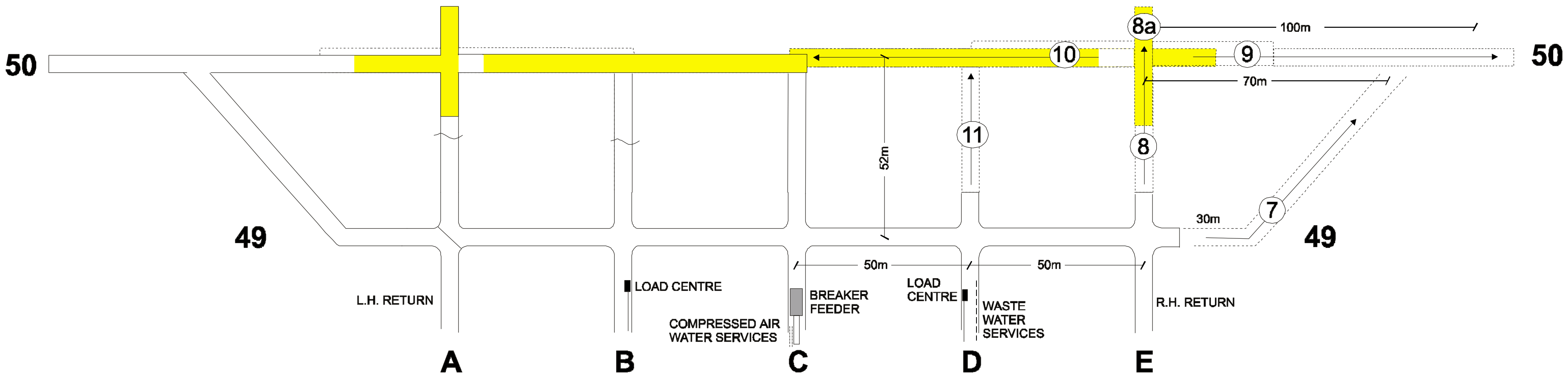
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Drive sequence 7 approx. 100m to align with near rib of #50 C/T Recover auxiliary fan from A50 intersection & ventilation ducting from A Hdg (49-50) & #50 C/T (A-C) Remove props & brattice from #49-50 C/T (B&C) & #49 homotropal hdg Flit to drive sequence 8	Use brattice line ventilation returning through E Hdg Establish supply dump in wing in E Hdg Provide survey control for slant roadway Wheel 2 shuttle cars through #49 C/T Install stopping in #49 C/T between A & B Hdgs Install auxiliary fan in #49 C/T & return through Sequence 7 to E Hdg	72 HOURS 4 HOURS
Drive sequence 8 to the 30m mark in coal – ramp up on coal to 4.5m level & mine stone to 60m mark Flit miner to drive Sequence 8b	Extend ventilation ducting to 60m in E Hdg & install R.H. "T" piece at 42m mark Control excavation height from German Creek upper seam benchmark Provide survey control for intersection E49	72 HOURS 1 HOUR
Mine bottom coal in sequence 8a and undermine lip of roof excavation for min. of 4m Flit miner to drive Sequence 9	Systematically lower the ventilation ducting to seam level as coal is removed Support exposed lip of excavation a minimum of 2m	8 HOURS 1 HOUR

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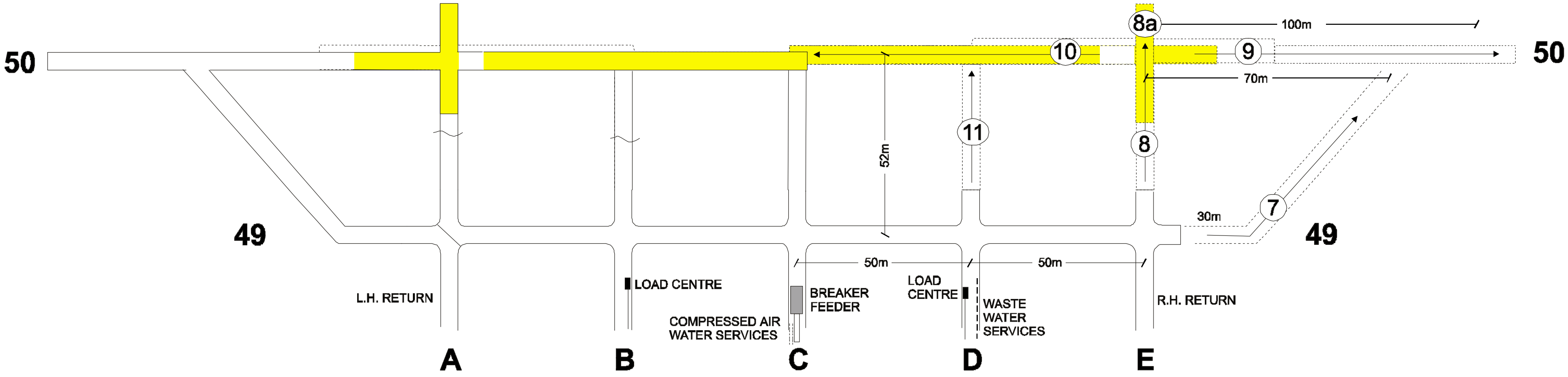
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Form R.H. breakaway & drive Sequence 9 to hole slant roadway at 70m & continue to 110m mark Flit miner to drive Sequence 10 & relocate auxiliary fan	Excavate roof to provide roadway height of 2.7m for initial 20m of drivage Check ventilation quality when slant roadway is intersected. Decommission auxiliary fan & ventilate #50 C/T overdrive (C Hdg 309 Panel)	48 HOURS 5 HOURS
Form L.H. breakaway & drive Sequence 10 to 8m mark in coal – ramp up on coal to 4m level & mine stone roof to 102.5m mark (far rib line of belt hdg) Flit miner to drive Sequence 11	Relocate auxiliary fan in #50 C/T & return through #50 C/T, slant roadway & E Hdg Install diagonal stopping at E49 intersection Install conveyor hanging bolts & chains Survey control of excavation height & width to be maintained for duration of drivage Establish supply dump in E Hdg overdrive Decommission auxiliary fan & ventilate #50 C/T through L.H. Return Install stoppings in A & B Hdgs between #49 & 50C/T's Barricade C Hdg holing point	72 HOURS 3 HOURS

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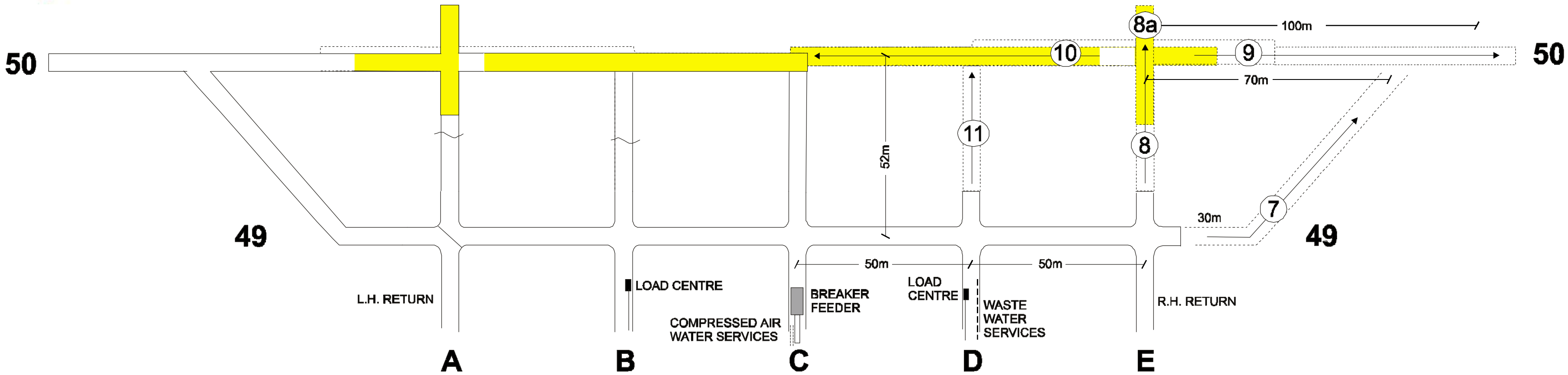
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Drive Sequence 11 to hole #50 C/T forming niche in R.H. rib at 30m mark Flit miner to C Hdg 50C/T	Use brattice line ventilation through #49 C/T & 2 Hdg Install stoppings in D & E Headings between #49 & 50C/T's	24 HOURS 1 HOUR
Complete mining bottom coal from C50 to A50 intersection Complete widening roadway to 7m by trimming R.H. rib between B Hdg & #1 C/T 209 Panel	Ventilate face operations through A Hdg return Remove ventilation ducting from C to E Hdg, #50 C/T Remove brattice & props from #49 to 50C/T in D Hdg Trim roadway in accordance with survey controls Systematically surface roadway to Manager's Rules	8 HOURS 16 HOURS
Cut floor profile for winch sub base at #1 C/T 209 Panel Flit miner to commence brushing for drivehead base	Install survey controls & provide plan	8 HOURS 1 HOUR
Cut floor profile for drivehead base & loop takeup module base Flit miner to C Hdg	Install survey controls & provide plan Advance load centre in B Hdg 50m	8 HOURS

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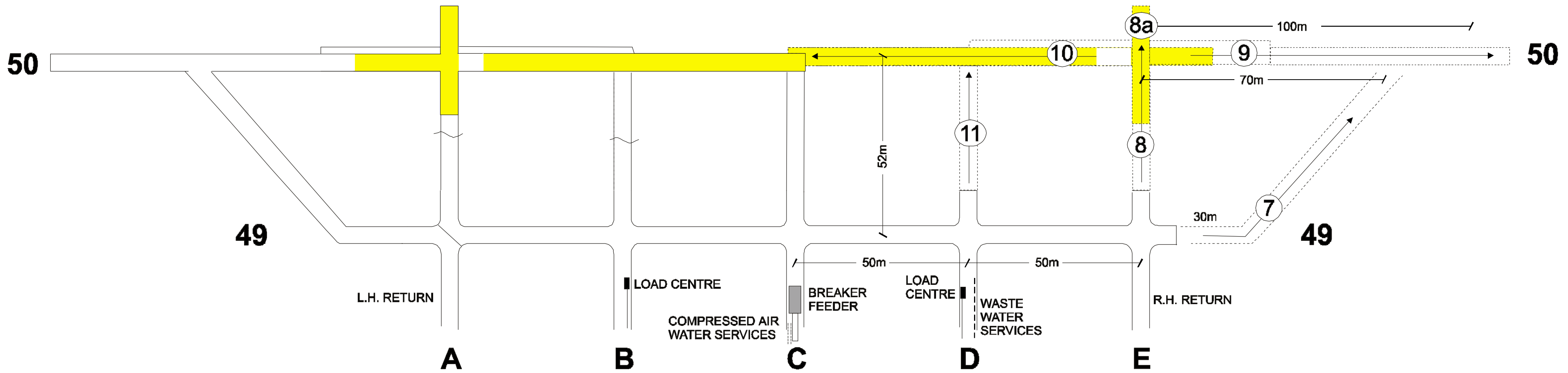
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Complete mining bottom coal from C50 to E50 intersections Complete widening roadway to 7m by trimming L.H. rib between D Hdg & #1 C/T 309 Panel	Check stoppings in D & E Hdgs Commence meshing #50 C/T from C to A Hdg Trim roadway in accordance with survey controls Systematically support roadway to Manager's Rules	8 HOURS 16 HOURS
Cut floor profile for winch sub base at #1 C/T 309 Panel Flit miner to commence brushing floor for drivehead base	Install survey controls & provide plan	8 HOURS
Cut floor profile for drive head base & loop takeup module base Flit miner to A Hdg & establish auxiliary fan ventilation	Install survey controls & provide plan Remove diagonal stopping at A49 Install semi permanent stopping between A & B Headings #49 C/T Commence meshing # 50C/T from C to E Hdgs	8 HOURS 8 HOURS
Advance conveyor belt & extend services 50m		24 HOURS

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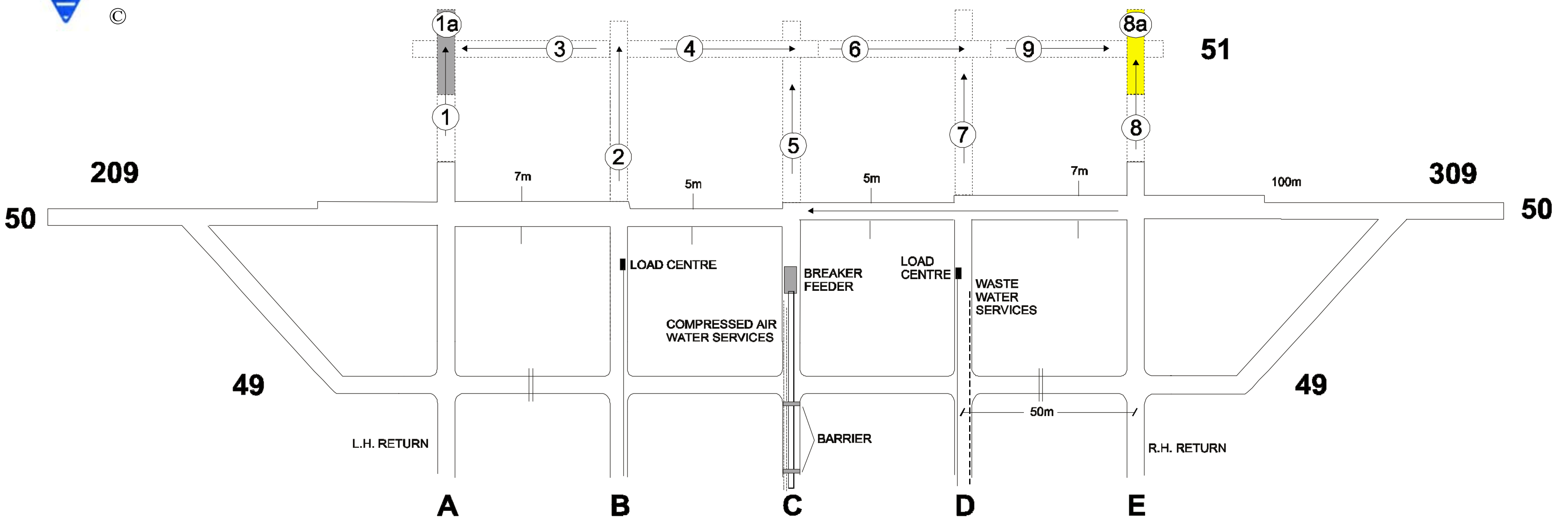
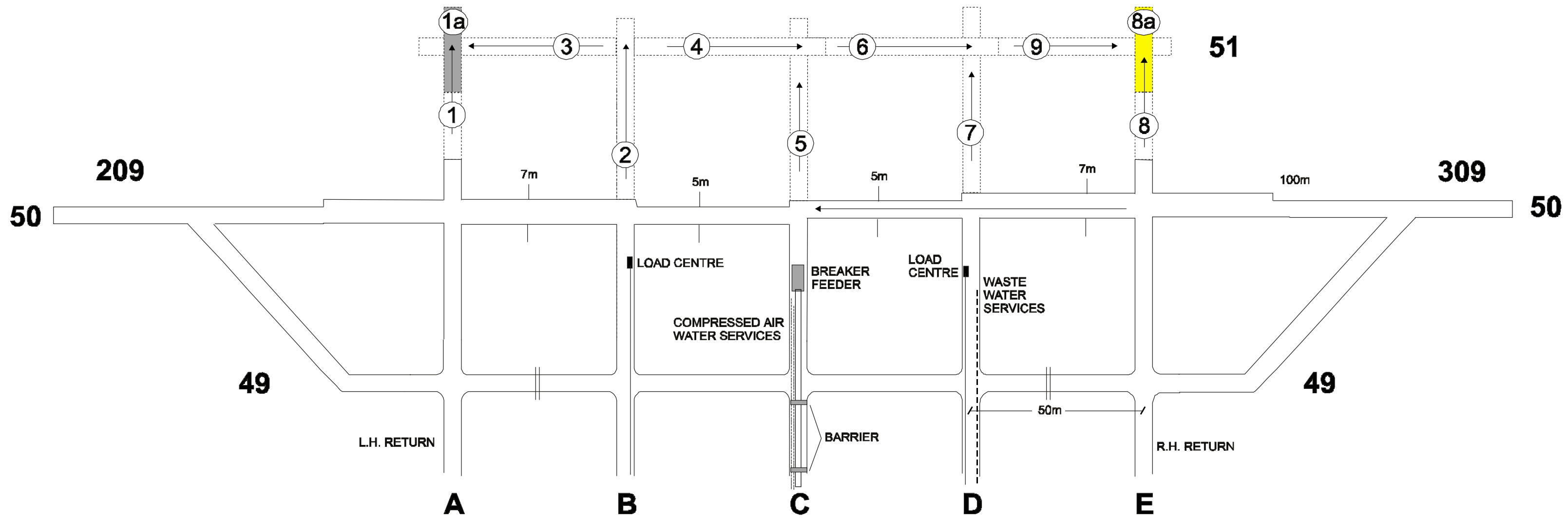
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



TRIGGER:
- Roadway Development completed to 50 C/T line.
- Conveyor, compressed air, clean & waste water, electrical, ventilation & explosive barrier services extended.

PROCESS	CONTROLS	SCHEDULE
Drive sequence 1 to 30m mark in coal – ramp up on coal to 4.5m level & mine stone to 60m mark Flit miner to start of Sequence 1a	Install auxiliary fan in #50 C/T & return through 209 panel Extend ventilation ducting to 60m mark Control excavation height from German Creek Upper Seam benchmark	72 HOURS 1 HOUR
Mine bottom coal in Sequence 1a & undermine lip of roof excavation for a minimum 4m Flit miner to drive Sequence 2	Systematically lower ventilation ducting to seam level Support exposed excavation lip a minimum of 2m Isolate auxiliary fan & either "Bag Up" fan or install compressed air fan in ducting.	8 HOURS 1 HOUR
Drive Sequence 2 to 57m (5m overdrive) Flit miner to drive Sequence 3 Drive Sequence 3 to Hole A Hdg & overdrive C/T by 5m Flit miner to Drive Sequence 4	Use brattice line ventilation returning through A Hdg Use brattice line ventilation returning through A Hdg Use Brattice line ventilation returning through A Hdg using lip of roof excavation Remove auxiliary fan & ducting from A Hdg	24 HOURS 24 HOURS 1 HOUR



CONTINUED:

PROCESS	CONTROLS	SCHEDULE
Drive Sequence 4 to 60m (10m overdrive) Flit miner to drive Sequence 5	Set up brattice ventilation returning through #51 C/T & A Hdg Set up brattice wing from B to C Hdgs & return through B Hdg & #51 C/T	32 HOURS 1 HOUR
Drive Sequence 5 to hole 51 C/T & overdrive by 5m Flit miner to drive Sequence 6	Advance load centre in B Hdg	32 HJOURS
Drive Sequence 6 to 60m (10m overdrive) Flit miner to Drive Sequence 7	Ventilate through #51 C/T Establish auxiliary fan in #50 C/T & return through 309 Panel in preparation for Sequence 8	32 HOURS 1 HOUR
Drive Sequence 7 to Hole #51 C/T & overdrive by 5m Flit miner to drive Sequence 8	Use brattice line ventilation returning through E Hdg	32 HOURS 1 HOUR

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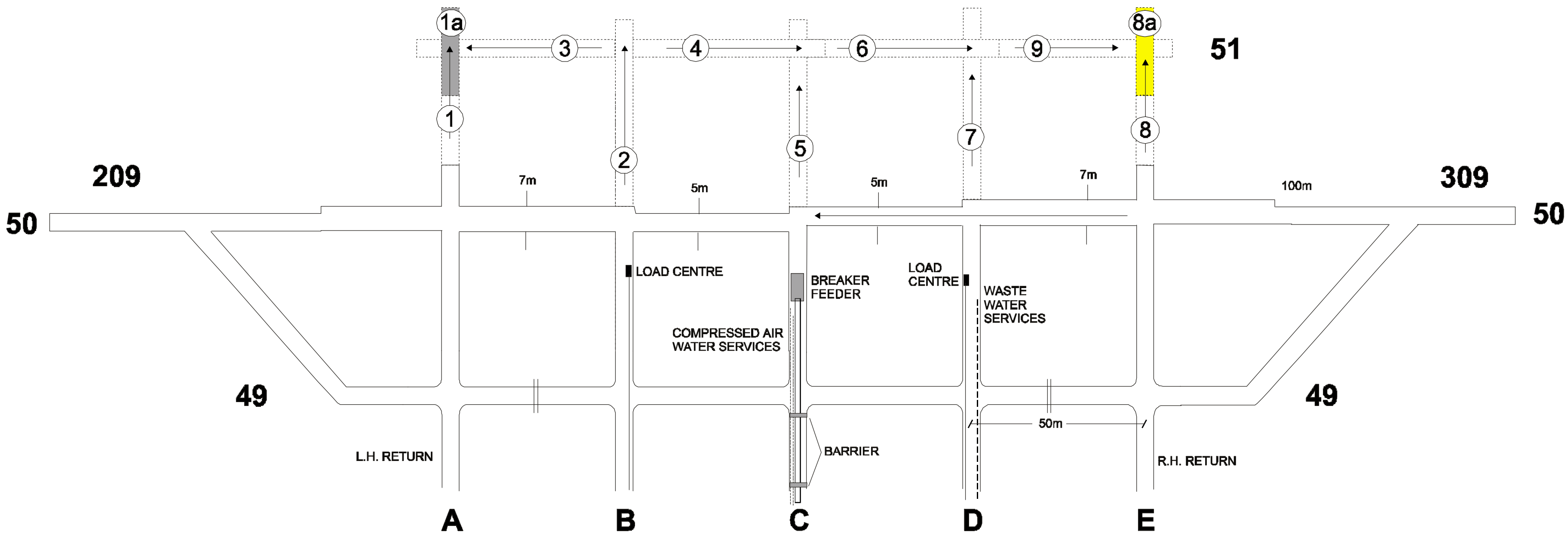

CONTINUED:

PROCESS	CONTROLS	SCHEDULE
Drive Sequence 8 to 30m mark in coal – ramp up on coal to 4.5m level & mine stone to 60m mark Flit miner to start of Sequence 8a	Commission auxiliary fan & extend ventilation ducting to 60m mark Control excavation height from German Creek Upper Seam benchmark	72 HOURS 1 HOUR
Mine bottom coal in Sequence 8a & overmine lip of roof excavation for a minimum of 4m Flit miner to drive Sequence 9	Ventilate 60m stub with auxiliary ventilation	8 HOURS 1 HOUR
Drive Sequence 9 to hole E Hdg & overdrive by 10m	Ventilate by brattice through #51 C/T Park miner & cars in #51 C/T between D & E Hdg Decommission fan when holing E Hdg	32 HOURS
Advance conveyor belt & extend services 50m	Remove auxiliary fan & ducting & store O/B	16 HOURS

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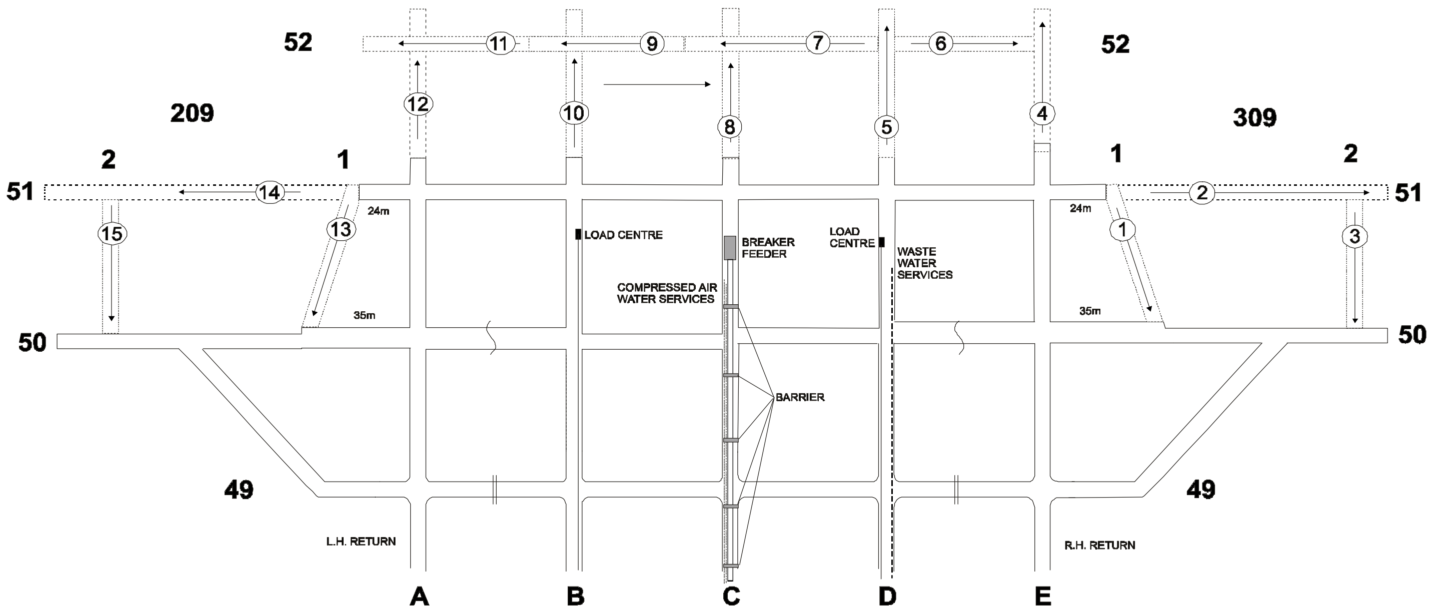
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



TRIGGER: ϖ 5 Hdgs of 2 East Panel completed to 51 C/T.
ϖ Conveyor, compressed air, clean & waste water, electrical, ventilation & explosion barrier services extended.

PROCESS	CONTROLS	SCHEDULE
Drive Sequence 1 to form #1 C/T 309 Panel Flit to drive Sequence 2	Set up brattice ventilation returning through E Hdg	24 HOURS 1 HOUR
Drive Sequence 2 to distance of 115m with the final 10m widened on the R.H. rib by 1m to provide for preparation seal doors. Flit to drive Sequence 3	Ventilate by line brattice through as #1 C/T 309 Panel.	48 HOURS 1 HOUR
Drive Sequence 3 to form #2 C/T 309 Panel Flit to Drive Sequence 4	Ventilate by line brattice through #1 C/T 309 Panel	24 HOURS 2 HOURS
Drive Sequence 4 to 58m (5m overdrive) Flit miner to drive Sequence 5	Ventilate by line brattice through 309 Panel	24 HOURS 1 HOUR

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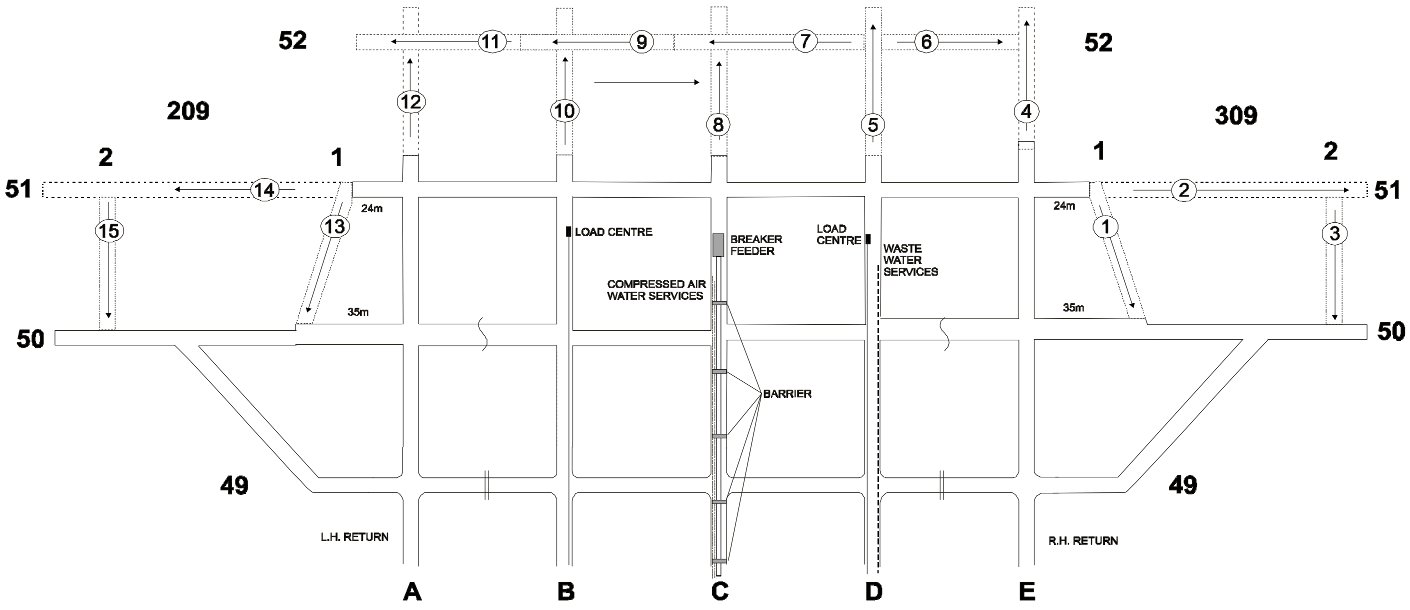
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Drive Sequence 5 to 58m Flit miner to drive Sequence 6	Ventilate by line brattice through #51 C/T	24 HOURS 1 HOUR
Drive sequence 6 to hole E Hdg Flit miner to drive Sequence 7	Ventilate by line brattice through #51 CT	24 HOURS 1 HOUR
Drive Sequence 7 to 58m (5m overdrive) Flit miner to drive Sequence 8	Ventilate by line brattice through #52 C/T & 309 Panel	32 HOURS 1 HOUR
Drive sequence 8 to Hole #52 C/T Flit miner to Drive Sequence 9	Ventilate by line brattice through #51 CT	24 HOURS 1 HOUR
Drive Sequence 9 to 58m (5m overdrive) Flit to Drive Sequence 10	Ventilate by line brattice through #52 C/T & 309 Panel	32 HOURS
Drive Sequence 10 to hole #52 C/T Flit miner to drive Sequence 11	Ventilate by line brattice through #51 C/T & 209 Panel	24 HOURS 1 HOUR
Drive Sequence 11 to 70m (20m stub for gas drill rig location) Flit miner to drive Sequence 12	Ventilate by line brattice through #52 C/T	40 HOURS 1 HOUR

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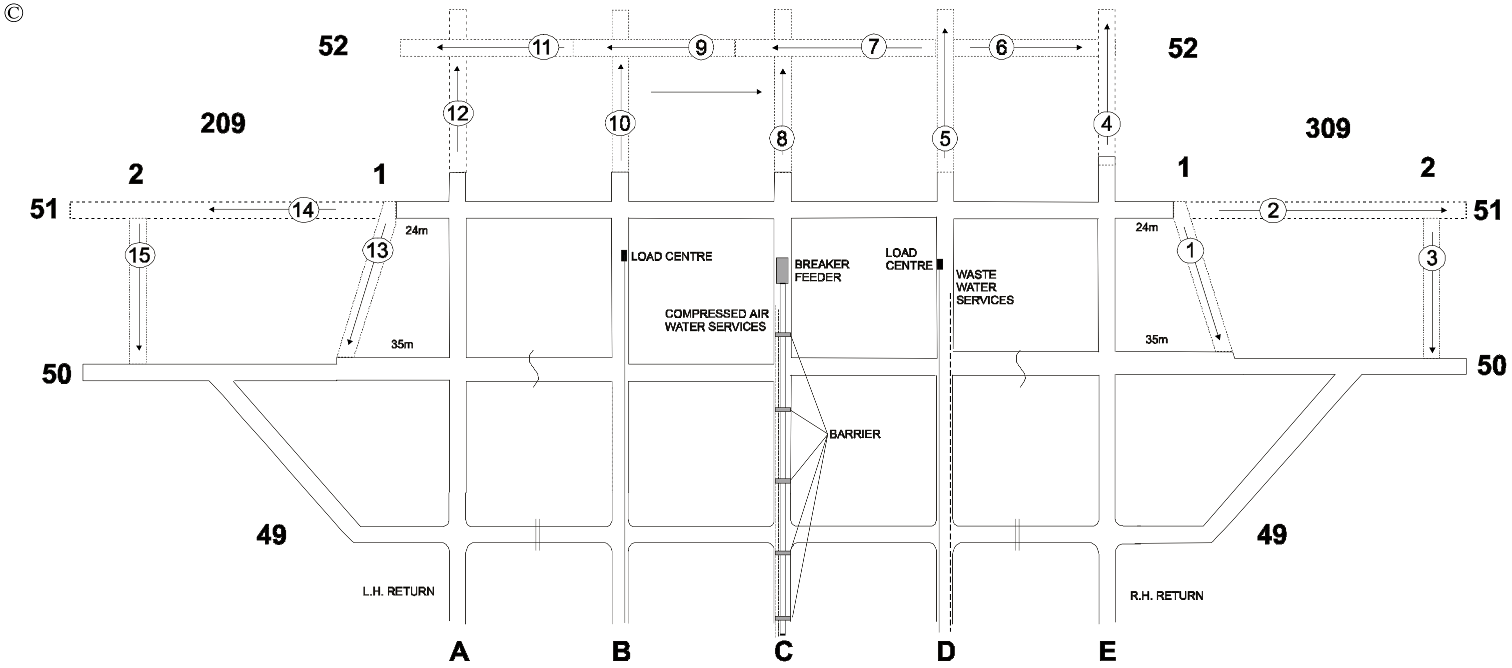
CENTRAL COLLIERY – PANEL EXTENSION PROCESS
49 C/T TO 52 C/T 2 EAST PANEL, 209 & 309 MAINGATE ENTRIES



PROCESS	CONTROLS	SCHEDULE
Drive Sequence 12 to hole #52 C/T & overdrive by 5m Flit to drive Sequence 13	Ventilate by line brattice through A Hdg & 209 Panel	20 HOURS 1 HOUR
Drive Sequence 13 to form #1 C/T 209 Panel Flit to drive Sequence 14	Ventilate by line brattice through A Hdg	24 HOURS 1 HOUR
Drive Sequence 14 a distance of 115m with final 10m widened on L.H. rib by 1m to provide for preparation seal doors Flit miner to Sequence 15	Ventilate by line brattice through #1 C/T 209 Panel	48 HOURS 1 HOUR
Drive Sequence 15 to form #2 C/T 209 Panel Flit miner to face of A Hdg	Ventilate by line brattice through #1 C/T 209 Panel	24 HOURS 1 HOUR
Advance Conveyor Belt & extend panel services		24 HOURS
Clean roadways & stonedust in preparation of overcast & conveyor installation		24 HOURS

APPENDIX 5 – IMPLEMENTATION REPORT – NEWSTAN COLLIERY

Table A5.1 - Implementation Report of Newstan Colliery

No.	Recommendation	Agreement Status	Priority	Follow up Action	Responsibility
1	**Information**				
1.1	KPI's to be set for all development panels for the benefit of face crews. This should include: • pillar cycle times, • operating hours per week and average metres per operating hour, • metres per week.	Agreed	High	Newstan Management Team (NMT) to agree to specific KPI's and present them to Development crews.	Mike Alston
1.2	Specific recording of machine availabilities to be discontinued in favour of system availability. Analyses of data to be completed weekly, monthly and panel to date. From this analyses, pareto charts to drive action lists which include both process improvement initiatives and maintenance priorities. An important part of this change will be to incorporate the measurement of uptime rates as a measure of machine performance. This cannot be a measure of effort, but must be, and be seen to be, a way to improve a machine's performance, maintenance, ergonomics and/or to justify new equipment when necessary.	Agreed	High	Newstan to decide on person to conduct this analyses. John McNamara to include KPI and, downtime analyses and action lists in panel report Mick Kelly to ask Central for panel report format, Mark Harrigon to provide J. McNamara with proformas of analyses graphs	NMT John McNamara M. Kelly M.Harrigan

No.	Recommendation	Agreement Status	Priority	Follow up Action	Responsibility
1.3	With the process leaders and deputies, formally feedback this information to face crews, on a weekly, monthly and panel cycle basis. The weekly feedback could be done by deputies, the monthly by deputies and process leader and the periodic with all the crews together. These periodic meetings should occur at critical points in the panel cycle, ie start of panel set up, start of normal sequence(2-3 cut through), and prior to the end sequence. All meetings should be focused on process improvement, with the emphasis on exchange of information and followup.	Agreed	High	The starting point to be the commencement of 13MG. Crew meeting to be conducted on: • panel plan, with all disciplines to be incorporated, • introduction of process improvement and KPI's and • feedback from the crew	Mike Alston, John McNamara
2	**Maintenance**				
	A review of the maintenance system is required to enable the following to be achieved:				
2.1	Measurement system to give systems availabilities (not machine availabilities).	Agreed in principle	High	Mechanism to be decided on how this can be achieved	Geoff Pearson,
2.2	Introduction of engineering analyses of system availabilities to provide maintenance priorities and action lists.	Agreed	High	Resource to be decided to achieve this	NMT
2.3	Formal provision of feedback loops to persons identifying maintenance issues.	Agreed	High	Suggested to reinforce use of panel fitters work books in the panel for all work done in the panel	Geoff Pearson

No.	Recommendation	Agreement Status	Priority	Follow up Action	Responsibility
2.4	Improved engineering support to tradesmen including training in the Mincom system.	Agreed in principle	Medium	Implementation plan to be formulated and agreed	Geoff Pearson
2.5	Improved condition monitoring (especially of continuous miner, shuttle cars and bolter).	Agreed and already underway	High	Continue current implementation	Dominic Posavac
2.6	Regular communication sessions with individual crews to identify maintenance and engineering issues (to be included in action lists).	Agreed	High	To be incorporated in preferably weekly or minimum monthly shift-panel meetings (1.3)	Dominic Posavac
2.7	KPI's of maintenance performance to be introduced, especially system availabilities and % achieved planned maintenance	Agreed	High	To be included in outcomes from 1.2-1.3	Geoff Pearson, John McNamara
3	**Travel Road**				
3.1	As part of this project, Bob Miller is to undertake a project management approach to an issue that is not currently being approached with these techniques. This is an excellent activity for application of project management techniques and Bob could work directly with Bruce Calderwood on this. We saw this issue as one that had the most "bang for the buck" and should be given a high priority to overcome.	Agreed as a high priority, but ballast borehole and water control must precede extensive roadwork. This is best handled by the mine. Bob Miller to address panel extension optimisation	High	Complete ballast borehole Implement drainage plan Scheme for consistent application of resource to this task is required	Grant Watson Mike Alston? NMT

No.	Recommendation	Agreement Status	Priority	Follow up Action	Responsibility
4	**Face and Pillar Cycle Issues**				
4.1	Utilising a process improvement approach with the crews, introduce a 50 metre sequence as soon as possible. This process improvement approach should include a pillar cycle report to the crews on key KPI's and inviting comment and improvement suggestions. Include maintenance performance as part of this review. Change the water pipe to the centre road and review all other pillar cycle activities to try to include them in parallel to the face cycle. *Focus on metres per week and pillar cycle times and remove the focus from metres per shift and tonnes.*	Agreed to introduce this for 13M/G. Panel advance optimisation to be an activity on its own and utilise Bob Miller and project management techniques to achieve this.	High	Initial sequence to be finalised and presented to crews within the framework of the process improvement meeting at the start of 13M/G. Mick Kelly to contact Bob Miller to follow up to the Mine	Mike Alston Mick Kelly
4.2	Make the bolter a point of focus for improvement. Utilise any slack time in the cutting sequence to complete other pillar cycle activities	Agreed	High	This is already underway	Dominic Posavac, John McNamara
4.3	Review the performance of the HM7 and consider replacement with a higher capacity machine.	Agreed, Option to hire a 12cm12 should be considered initially	Medium	Inquiry to Shaft and Tunnel	John McNamara
5	**Other Panel and Mine Cycle Issues**				
5.1	Standardising the shift work pattern to 5 days, Monday to Friday, with the current four shifts per day arrangement. This will improve teamwork and shift coverage of essential activities.	Agreement in principle to minimise weekend roster groups to a five man crew per shift	Medium	Other ramifications to be considered before this is progressed	John McKendry

No.	Recommendation	Agreement Status	Priority	Follow up Action	Responsibility
	Introduction of more formal shift handovers to improve communication flow and feedback.	Agreed	High	Mike Alston to Initiate	Mike Alston, Geoff Pearson
	Introduction of a pit controller function to significantly improve communication, prioritisation of material flow and reaction to monitored critical areas (belts, ventilation, water levels etc.)	Was agreed to be beneficial, further discussion required	Medium	To be discussed further	NMT
	Increase the mining engineering resource to improve medium term planning and analyses and support of process improvement.	Agreed in principle	Medium	Existing resource to be found within the Powercoal group.	John Mckendry, Grant Watson
	Review the training priorities to improve the payback to the mine of this substantial investment.	Not agreed to.		No further action	

TIMING

Although many of these issues had a high priority, and most could be addressed in the remainder of the project (say to July), three initial actions are essential to commence. These are:

1. Someone needs to be allocated to collect the existing data and present it in a suitable format for process improvement. This will require someone who is familiar with Mincom and is able to do analyses of mining and machinery statistics and information. The person will also be able to do benchmarking and hands on process improvement work in tne pit and give technical advice and documentation to John McNamara. Essentially John McNamara needs to oversee these tasks.

   Timing Within the next two weeks.

2. At the start up of 13 maingate a meeting with the mining crews (preferably all four crews together) to layout the plan for the panel. This should include sequence, timing for the entire panel, start up issues of significance, maintenance issues and general mining issues such as pumping, roads etc. The main focus, however needs to be on introducing process improvement, the expectations of communication and emphasis on KPI's (especially metres per week, pillar cycle times and uptime rates).

   Timing: In two - three weeks time.

3. Commence the pillar cycle improvement work. Drive this through a specific activity to optimise the panel extension and secondly through a cribroom meeting at the end of each pillar cycle to review the previous cycle and take on board suggestions from the crews.

   Timing Bob Miller after two pillars have been completed.
   Pillar cycle meetings each pillar from the beginning of the panel.

APPENDIX 6 – NEWSTAN COLLIERY PROJECT MANAGEMENT

Implementation of Roadway Development Strategy
Interim Report on Site Visit
24-25 February, 1998

Introduction

An agreed industry strategic plan for the improvement of roadway development rates for underground coal mines has been the recommendation to adopt a systems approach in order to make measurable progress. A total of eight potential strategic initiatives designed to introduce a systems approach have been defined. These include:

- Information
- Technology Implementation
- Face Downtime/Uptime
- Project Management
- Parallel Operations
- Human Factors/Organisational Structure
- Automation
- Management Planning

It is not expected that one of these initiatives alone will create break through change but rather each initiative is interdependent with several others if the required level of improvement is to be achieved.

The Project Management strategy recognises that the application of project management techniques will improve the execution of many underground activities with the desired outcome of wider industry experience and application of those techniques to mining systems.

Whilst it is recognised that project management is applied in varying degrees by a number of operations in the industry to date, the application is not focussed on a systems approach to improving roadway development rates. The implementation mechanism is to introduce the systems approach into 3 selected mines initially concentrating on the strategies of information, uptime/downtime and project management. This report is an outcome of a 2 day workshop conducted at Newstan Colliery where project management techniques were applied to a 2 heading longwall gate road development with particular emphasis on the extension of services within the individual roadways. The workshop team comprising a process leader, production and maintenance supervisors, operators and tradesmen was facilitated by Bob Miller with technical support provided by Dan Bailey.

Project Objective

The objective of the Project is to develop a set of recommendations for the application of a consistent industry wide framework for the use of project management techniques as part of a systems approach to continuous improvement of longwall roadway development rates in coal mines. Particular emphasis is placed upon the extension of services for each pillar advance.

Background

The purpose of the workshop was to identify opportunities to reduce the time taken to complete each pillar of longwall gate road development at Newstan Colliery. In order that a comprehensive and realistic outcome could be achieved, the composite knowledge and experience of a selected team was applied within an analytical and systematic framework based upon Project Management principles.

The agreed objective of the project was to define a structured programme for the development, documentation, communication, implementation and auditing of the processes involved in the development of roadways and the associated extension of services in Maingate 13 Panel to an agreed schedule and standard.

The report includes recommendations considered appropriate to support the effective application of Project Management techniques to Maingate 13 Panel Development. Newstan has to date gained experience in the development of longwall gate roads utilising the mining system termed "place changing". The roadway development rates achieved under this system when applied to a 3 heading development in Maingate 12 Panel, although an improvement on the performance of the "cut and support" systems at the mine, are still considered insufficient to maintain longwall continuity in the medium to long term.

Consequently, given the increased complexity of applying the "place changer" system to 2 heading development, project management techniques have been considered the appropriate tool to assist the project team in achieving the required performance improvement. Some of the claimed pitfalls the of previous gate road development using the "place changer" system include:

- Excessive work loads for some individuals
- Staffing conflicts with other projects or assignments
- Cost overruns
- Team members lacking appropriate skills
- Considerable rework or duplication of work
- Insufficient resources
- Missed deadlines

Project Management

Managing projects is not new, simply because managing a project as a means to an end has been around since man's early history. Projects have been managed, for better or for worse, depending to a large extent on all of the skill, intuition, and luck that the manager could muster at the time. However, in recent years there has been growing recognition, that management and particularly project management is a special skill that can be codified and learned. Project Management skill is quite different from the technical skills that are so often associated with most projects. If the projects objectives are to be met with optimum economy of resources and maximum satisfaction to the "customer" the non technical areas are to be managed with every bit as much care, ability and concern.

A project can be defined as any undertaking with an established starting point and defined objectives the achievement of which clearly signifies the conclusion of the project. In practice most projects are constrained by limits placed upon the resources available to achieve the required objectives. Project Management supplies project teams with a process that helps them co-ordinate their efforts so that they create the right product at the right time within the resource limits established by the organisation.

The basic Project Management functions include:

Scope Management is the function of controlling a project in terms of its goals and objectives through the processes of conceptual development, full definition or scope statement, execution and termination.

Cost Management is the function required to maintain appropriate allocation of time to the overall conduct of the project through the successive stages of its natural life-cycle, (i.e. concept, development, execution and finishing) by means of the processes of time planing, time estimating, time scheduling, and schedule control.

Quality Management Quality itself is the composite of material attributes (including performance features and characteristics) of the product or service which are required to satisfy the need for which the project is launched.

Human Resource Management is the function of directing and coordinating human resources throughout the life of the project by applying the art and science of behavioural and administrative knowledge to achieve the predetermined project objectives of scope, cost, time, quality and participant satisfaction.

Communications Management is the proper organisation and control of information transmitted by whatever means to satisfy the needs of the project. It includes the processes of transmitting, filtering, receiving, and interpreting or understanding information using appropriate skills according to the application in the project environment.

Risk Management is the art and science of identifying, analysing and responding to risk factors throughout the life of a project and in the best interests of its objectives.

Approach

Agreement upon the scope and boundaries of the project was made within the workshop team. The project objectives, deliverables and customers and the customers' expectations were defined as well as the starting and end points of the team's involvement in creating the end product.

A list of the activities performed, the equipment available, the resources consumed and the desired quality standard of the end product was developed by the team.
The recommendations included in a report prepared by Mick Kelly, C.S.I.R.O. were considered by the team in designing the panel layout, roadway development sequences and the assessing productivity potential of the production panel.

The team attempted to assign a limit for the maximum degree of risk connected to the project scope, that the mine is willing to accept. That is, the uncertainty of not being able to physically produce the required outcome according to the customer (the longwall) through not having the ability, the skill or the technology to create the final deliverable. Consideration was given to the development of counter measures to bring the risks down to levels that are acceptable to the organisation. These are detailed in the recommendations contained within this report.

A Gantt chart was selected to display the major activities of the project and their duration with the resources allocated to each task. The Gantt chart is supported by a process map which defines the roadway advance sequences, the service extension activities for each roadway and the location of plant and equipment. The assignment of accountability for overseeing the completion of each supporting the chart and process maps are shown as attachments in this report. Activity was considered by the team as a prerequisite to the effective execution of the project.

Implementation

A key factor in the effectiveness of a project is the availability of relevant information and expertise. Group workshops recruit the knowledge and experience of persons who are familiar with a particular system or process. Utilising the Project Management approach often provides a positive team building environment, engenders ownership of the output and generally results in a better overall understanding of the process under review. The implementation strategy is Process Focussed Management rather than the traditional shift based supervision. Its success relies on the following factors:

- Processes are clearly defined and documented and standard work procedures exist
- Proper analysis occurs before changes are made
- Appropriate measures exist and are a mechanism for both analysis
  and ongoing performance monitoring exists.
- Effective process team meetings occur to structure agendas to cause involvement, ownership and improvement
- Process improvements are properly reflected in process documentation and are effectively communicated
- Process requirements drive an effective mine training plan and standard work procedures
- Audit mechanisms exist against the defined processes to ensure what we think is happening is actually happening
- Appropriate inter-process management and information mechanisms exist to ensure overall mine priorities are met and to minimise inter-process conflict.

Recommended Actions

A number of recommended actions to support the implementation of the Project Management of Maingate 13 Panel Development have been developed. The recommended actions were reviewed by the workshop team and ranked in order of priority and responsibilities assigned for the timely and effective implementation of the project. These recommendations are included in an attachment to this report.

Timing

Given the “high” priority status placed upon the majority of recommended actions it was considered that the implementation of the following 3 action plans would bring about an early return to the project:

1. Carrying out an assessment of the productivity potential of the Panel with the support of crews is to follow a presentation to the workforce of the proposal to commence performance measurement of the development process.

   TIMING: By end of March,1998

2. Selecting project team members to represent crews operating in Maingate 13 Panel to assist the project leader in the implementation of the process controls required to achieve the schedule and standards required for effective “place changer” operations.

   TIMING: By end March,1998

3. The development of protocol for and the implementation of formal shift handovers is essential to capture meaningful and timely information under the revised “bank to bank” shift arrangements.

   TIMING: End of week three March, 1998

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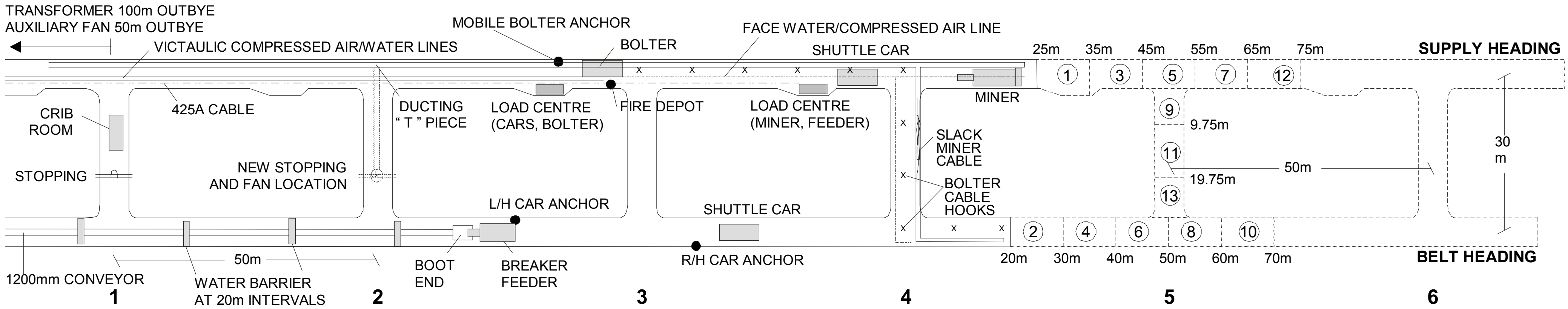

TRIGGERS: ϖ Conveyor, Compressed Air, Water & Electrical Services Extended

PRODUCTION	SERVICE EXTENSION	
Mining Extended 10m cuts using 2 shuttle cars wheeling the pillar	Supply Heading	Belt Heading
Sequence 1 ◊ Sequence 4	Install plasterboard stopping in cut-through outbye boot end (provide for fan) Extend auxiliary fan supply cable 100m to cut-through outbye boot end Advance auxiliary fan & locate against stopping in cut-through outbye boot end & connect to ventilation ducting Advance stonedust supply dump to fan location	Install 100m belt roll at conveyor head jib in preparation for extension
Sequence 5 ◊ Sequence 6	Extend 425A reticulation cable to niche in RHS rib	
Sequence 7 ◊ Sequence 9	Extend victaulic compressed air & water lines to 10m inbye load centre Extend survey control centre & sight lines	Extend survey control for roadway centre & sight lines, conveyor hanging bolts & boot location
Sequence 10 ◊ Sequence 12		Clean floor of belt road & around feeder Install barrier tub frames & hang conveyor structure support chains
Sequence 13	Flit miner to face	Flit 2 shuttle cars to face

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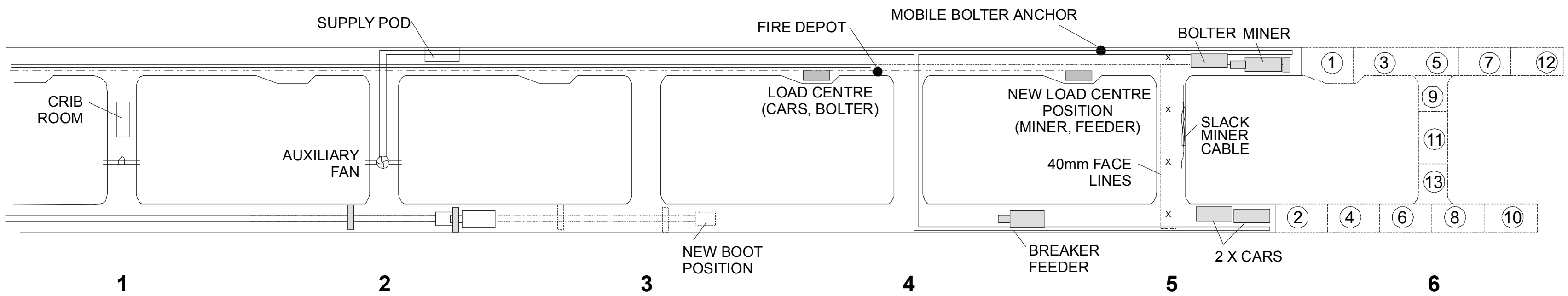
NEWSTAN COLLIERY
MAINGATE 13 – PANEL EXTENSION PROCESS



TRIGGERS:
- 50m Pillar Extension Completed, Compressed Air, Water Services Extended
- 425A Reticulation Cable Extended & Belt Roadway Cleaned
- Continuous Miner Parked at Face of Supply Heading & Shuttle Cars Parked at Face of Belt Heading
- Auxiliary Fan Advanced 100m

PRODUCTION	SERVICE EXTENSION	
Mobile bolter supporting sequence 13 holing point & installing 4 x 6m long flexibolts & extensometer	Supply Heading	Belt Heading
	Recover miner cable from outbye load centre & store in inbye cut-through & extend plug to new load centre position Park mobile bolter behind miner De-energise transformer & advance outbye load centre to inbye niche & connect 425A cable Power up miner & bolter, anchor bolter Commence preventative maintenance on miner Recover & extend 40mm compressed air & water hose through last cut-through to faces & miner Recover shuttle car cables, anchor & power up from outbye load centre Commence preventative maintenance on cars Flit bolter to supply pod & restock Test run miner & shuttle car wheeling routes	Recover car cables & store in cars Advance feeder breaker & park in centre of last pillar Run belt clip into place at conveyor head, isolate energy & connect 100m roll belt Lay out conveyor structure in roadway Fit QDS to Eimco, connect to boot & release boot anchor Advance boot 50m inserting structure pulling belt off roll, aligning & leveling structure Pin boot & insert tubs in water barrier frames Connect end of 100m roll of belt, tension belt & test run Re-route feeder cable to inbye load centre & flit feeder to boot end Test run coal clearance system

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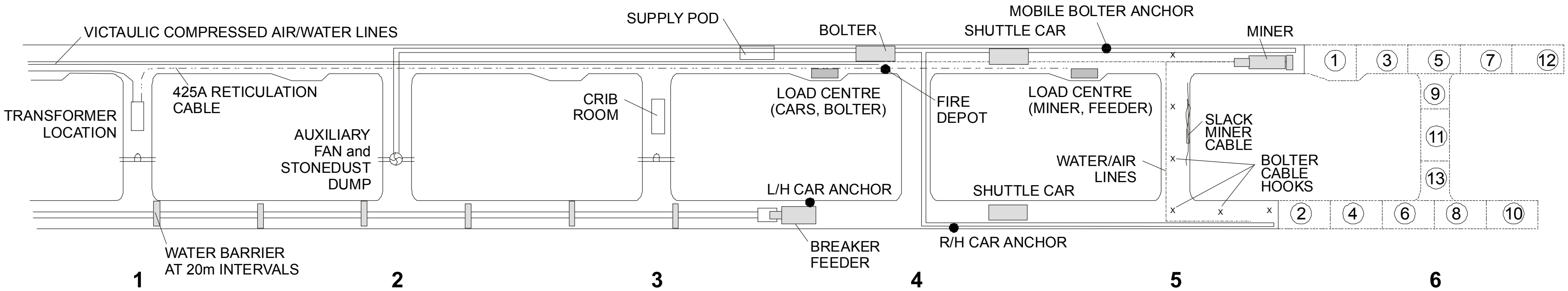
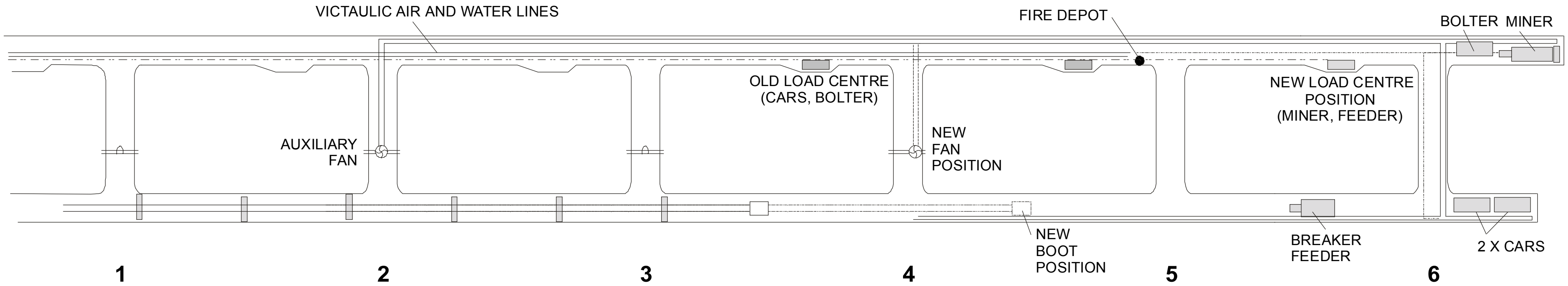
NEWSTAN COLLIERY
MAINGATE 13 – PANEL EXTENSION PROCESS



TRIGGERS:
- ϖ Conveyor Extended, Load Centre Advanced, Maintenance Completed on Miner & Shuttle Cars
- ϖ 40mm Face Compressed Air & Water Lines Installed
- ϖ Supply Pods & Spares Dump Advanced

PRODUCTION	SERVICE EXTENSION	
	Supply Heading	Belt Heading
Sequence 1 ◊ Sequence 4	Install plasterboard stopping in cut-through outbye boot end Advance crib room & hygiene facilities 100m Advance spares & supply pods	Install 100m belt roll at conveyor head jib in preparation for extension
Sequence 5 ◊ Sequence 6	Extend 425A reticulation cable to niche	
Sequence 7 ◊ Sequence 9	Extend victaulic compressed air & water lines to 10m inbye load centre Extend survey control centre & sight lines	Extend survey control for roadway centre & sight lines, conveyor hanging bolts & boot location
Sequence 10 ◊ Sequence 12		Clean floor of belt road & around face Install barrier tub frames & hang conveyor structure support chains Flit 2 shuttle cars to face
SEQUENCE 13 Mobile Bolter supporting holing point & installing flexibolts	Flit miner to face Recover miner cable from outbye load centre & store in inbye cut-through Park mobile bolter behind miner	Flit 2 shuttle cars to face Recover car cables & store in cars Advance breaker feeder & park in centre of last pillar

NEWSTAN COLLIERY
MAINGATE 13 – PANEL EXTENSION PROCESS



TRIGGERS:
- ϖ Pillar Extension Completed, Compressed Air & Water Services Extended
- ϖ 425A Cable Extended & Belt Roadway Cleaned
- ϖ Continuous Miner Parked at Face of Supply Heading & Cars at Face of Belt Heading.

PRODUCTION	SERVICE EXTENSION	
	Supply Heading	Belt Heading
sequence 13 Completed	De-energise transformer & advance outbye load centre to inbye niche & connect 425A cable Power up miner & bolter, anchor bolter Commence preventative maintenance on miner & bolter Recover & extend 40mm compressed air & water hose Recover shuttle car cables, anchor & power up from outbye load centre Commence preventative maintenance on cars Flit bolter to supply pod & commence restocking Test run miner & shuttle car wheeling routes	Run belt clip into place at conveyor head, isolate energy & connect 100m roll of belt Lay out conveyor structure in roadway Fit QDS to Eimco, connect to boot & release boot anchor Advance boot 30m inserting structure, pulling belt off roll, aligning & leveling structure Pin boot & insert tubs in water barrier frames Connect end of 100m roll of belt, tension belt & test run Re-route feeder cable to inbye load centre & flit feeder to bootend Test run coal clearance system Install 100m belt roll at conveyor head jib in preparation for extension
Sequence 1 ◊ Sequence 4	Install plasterboard stopping in cut-through outbye boot end Extend fan supply cable to cut-through advance auxiliary fan, locate against stopping & connect to ducting advance stonedust dump to fan location	

Table A6.1 - Newstan Colliery Project Management

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
1	**PERFORMANCE MONITORING /PROCESS CONTROL**				
1.1	An assessment of the productivity potential of the M.G 13 Panel is to made using measurement taken of exising equipment performance operating within the proposed panel design. Miner cutting and loading rates, car wheeling and dump times, mobile bolter support and restock times, and machine flitting times will be measured and analysed to determine performance potential and the extent of mismatched capacities	Agreed	High	* Present proposal to employees and employee representatives: - outline details of productivity study - method of system measurement - define method and timing of feedback on outcomes - develop proforma for recording system performance	Mike Alston John MacNamara M.G. 13 Panel Deputies Bob Miller John MacNamara
1.2	A selection of project team members with the best blend of skills, influence and knowledge and capable leadership is essential in making the project achieve its objectives. Members should be representatives of each the shifts and those involved in service and support functions attached to the panel. The team needs to establish protocol for conducting meetings and determining membership of the project team and agree on proceedings for capturing and evaluating ideas and providing feedback to respective crews	Agreed	High	* Select representatives from each shift and maintenance support - outline team membership accountabilities - detail working relationship required between deputies and process leader	Mike Alston John McNamara M.G. 13 Deputies Dominic Posavac

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
1.3	To ensure that the project is moving forward as planned a program of regular review to provide timely warning of variances is required to allow the team to solve problems early and avoid costly changes later on. The supervisors shift control schedule miss reporting, the daily operational review meeting and the project team issues meeting will provide the appropriate information and analysis of actual against planned performance	Agreed	High	* Develop and implement appropriate reporting systems to capture shift, daily and weekly performance against pre - determined targets * Determine performance criteria for deputies steward-ship in applying corrective action to maintain the schedule	John McNamara Mike Alston Bob Miller John McNamara
1.4	An essential step in any effective problem solving process is data collection and analysis. The tools and techniques for the collection of data is the panel control schedule (actual versus plan) and for the analysis which identifies processes variation and trends, the control chart will be used. A run chart is to be used to represent both gate and road development and longwall performance and highlight lead time requirements to maintain longwall continuity. Analysis of data is to be completed weekly monthly and panel to date. Training and coaching for supervisors in the effective use of control schedule by outlining the shift plan and defining the term "downtime" and "uptime" will be a prerequisite for the collection of meaningful and realistic data.	Agree	High	* Newstan Management to decide on person to conduct analysis of data: - update pareto and run charts - prepare report for feedback to crews - coach supervisors on reporting standards * Process Leader to develop proformas of analysis graphs	John McNamara Dominic Posavac John McNamara

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
1.5	Key performance indicators (K.P.I.) to be set for the panel for the benefit of crews. These should include: - pillar cycle times - operating hours per week and average metres per operating hour - metres advanced per week Additional productivity/performance measures include: - manshifts required to complete service Extensions - manshifts required to complete planned Maintenance - system availability - percentage achieved planned maintenance	Agreed	High	* Newstan management team to agree to specific K.P.I.'s for M.G.13 Panel * Process Leader to present K.P.I's to development crews in M.G. 13 panel * Process Leader to present K.P.I's for M.G. 13 panel to service and support personnel and Newstan Management team * Process Leader to develop panel report format	Mike Alston John McNamara John Alston John McNamara John McNamara Dominic Posavac
2	**PLANNING AND SCHEDULING RESOURCES**				
2.1	To ensure the effective utilisation of resources in the tasks of scheduling, production, maintenance and service extension, a weekly (or pillar cycle) planner is to be issued to supervisors. The planner defines the numbers and skills of person (fit for duty) to be assigned to the panel of each shift, the equipment and the materials requirement for each step in the pillar development cycle and the contingency plan for work to be completed during system break downs.	Agreed	Medium	* The process leader and M.G. 13 panel deputies are to develop a resource planner for each pillar cycle to include: - labour and skills - mobile equipment - supplies * The process leader is to develop a reporting mechanism for updating the program for service extension on a shift to shift basis.	John McNamara M.G. 13 panel deputies John McNamara
2.2	The introduction of formal process hand-overs involving production and maintenance supervisors (and oncoming crew menbers)	Agreed	High	* Process Leader to determine location and format of formal shift handover	John McNamara

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
	provides a status report on current pillar cycle upon which resources and targets can be established for the next shift. An updated plan with results from the previous 24 hours is to be provided to each crew member and should include: * safety performance * hazards and mining conditions * sequence and targets * conditions with potential to affect targets and contingency plan for break down * actual versus plannned performance on pillar cycle. * status on mining equipment condition * allocation of labour resources and mobile Equipment				
2.3	The categories of maintenance work require definition to determine the skills which will be assigned to particular tasks. Categories include: * Routine "in progress" servicing * Planned work * Emergency "breakdown" work The general principles of maintenance management are to include:	Agreed	High	* Process Leader and maintenance supervisor to define categories of mainten-ance work and communicate same to M.G. 13 panel crews to include: - servicing tasks and "safe to operate" checks assigned to operators	John McNamara Dominic Posavac
2.4	* All work should be planned through a job request/work order system * For work to proceed it must have the customer's and the provider's agreement and be scheduled when resources and			- task assignment for service extensions to define operators and tradesmen * Process Leader and maintenance support to	John McNamara Dominic Posavac

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
	facilities are available * Maintenance perfomance is measured and feedback is provided to stakeholders in M.G. 13 Panel * The agreed levels of service provided by maintenance and production personnel will take the form of a Quality Contract * Regular audits will be used to identify customer complaints and non conformances.			develop minimum standards for production and mainten-ance "handovers": - communicate standards to operators and tradesmen	M.G. 13 Panel deputies
3	**COMMUNICATION AND INFORMATION**				
3.1	Both system and personnel performance tracking is essential in determining the root cause of unacceptable performance. (Personal performance may include absenteeism and compliance with safety standards). The Process Leader is to gather this infor-matuion and supported by the panel deputies formally feedback this to crews at periodic meetings based upon critical point in the pillar cycle time. A monthly meeting combining all crews to be chaired by the process leader will focus on panel performance and status of the implementation of agreed standards and process improvement suggestions. Feedback will be recorded and action plans developed for agreed changes.	Agreed	Medium	* Process Leader and deputies need to agree to format, content and timetable for weekly and monthly crew and team meetings * Newstan Management and process leader need to agree to starting date for crew * Meetings to outline: - the panel plan and resource allocation - process improvement strategy - the essentials of standardis-ation and teamwork - learning to work to a schedule	John McNamara M.G. 13 panel deputies
3.2	Project team meetings will be held monthly to analyse panel performance and to	Agreed	Medium	* Newstan Management team and Process Leader to	Mike Alston John McNamara

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
	develop corrective action plans and assign responsibility for production and maintenance performance shortfalls. The outcome of the meeting is a documented action plan with responsibilities and timeframe for completion assigned to individual team member for the resolution of problems in this area. Problem solving is carried out at the meeting only when the issue requires input from all shifts and parties			establish project team and define its operating parametres	
4	**STANDARDS AND PROCEDURES**				
4.1	Formalise a mechanism for loss control by employing the following steps: * Identify what environment and procedures can injure people or cause damage to property * Set standards of conformance and measurement (roadway support, stone-dusting, materials storage) * Assign accountability for ensuring standards are met (isolation procedures,safety briefs * Measure performance against the standard Eg. personal protective equipment inspection and audit * Evaluate the compliance with the standard to assess the effectiveness of the controls (report outcomes and provide feedback) * Correct the deficiencies and non conformances and document outcomes.	Agreed	High	* Process Leader maintenance support and deputies to develop a list of auditing standards from a list of elements provided by Bob Miller * Procedure to be developed by process leader to capture "hazardous" tasks and assess the level of risk of the activity by: - halop studies - risk assessment - development of standard work procedures	Bob Miller John McNamara John McNamara Safety specialists

No	Recommendation	Agreement Status	Priority	Follow up action	Responsibility
4.2	Develop an audit (check) form for the compliance with standards the completion of service extensions and installations			* Process Leader and team (3 crews) to develop minimum standards for: - housekeeping - mechanical, electrical and persoanl safeguarding - fire protection and prevention	John McNamara
4.3	Develop an audit form for compliance with agreed work procedures for service Extensions			* Process Leader and team to develop standard work procdeures and document	John McNamara
4.4	Develop and document a set of operating procedures for development of 2 heading longwall gate road using a "place changer" mining system. Minimum standards to be developed, documented and then implemented include those for: * roadway support * ventilation * extension and installation of services * panel layout and housekeeping * operation of remote control equipment * sequence of operations * remote isolation (zero energy) * auxiliary fan operation • evacuation procedures	Agreed Partially completed in M.G. 13 Panel standards and procedures manual	High	* Communicate standards and working procedures with crews prior to commissioning of panel. * Provide documentation (in manual) of standards and procedures at deputies station	John McNamara M.G. 13 deputies John McNamara
5	**ROLES AND RESPONSIBILITIES**				
5.1	In accordance with the "process focussed management" approach the roles and assigned responsibilities of the process leader, deputies, team members and support	Agreed	High	* Communicate strategy to team and the leaders of other processes at Newstan	Mike Alston John McNamara