HARD ROCK MINE VENTILATION 2012

20 - 21 March, 2012
Duxton Hotel, Perth, WA

Delivering a Safe Working Environment with Efficient Ventilation and Heat Control

www.mineventilation.com.au

Mining IQ
a division of IQPC

Workshop A: Simulating and Scenarios: Ventilation for Improved Expansions, New Mine Development, and Continued Excellence

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Workshop A: Simulating and Scenarios: Ventilation for Improved Expansions, New Mine Development, and Continued Excellence

Ventilation planning and simulation is an essential part of the ventilation officer and mine planner roles. This workshop will evaluate key concerns and points for consideration when undertaking expansions, new mine development, or simply re-coordination of airflow.

This workshop will evaluate how you can achieve these goals with the strategies and technologies available to your site.

- Simulation technologies and how they integrate with mine planning
- Assessing the needs and problem spots on your site
- Evaluating fan efficiency and air volume across the mine and integrating this knowledge with existing plans
- Developing new ventilation strategies for expansions and new sites
- Increasing power efficiency and air volume simultaneously
- Understanding the potential benefits of improved planning
- Bringing heat management into your ventilation plans

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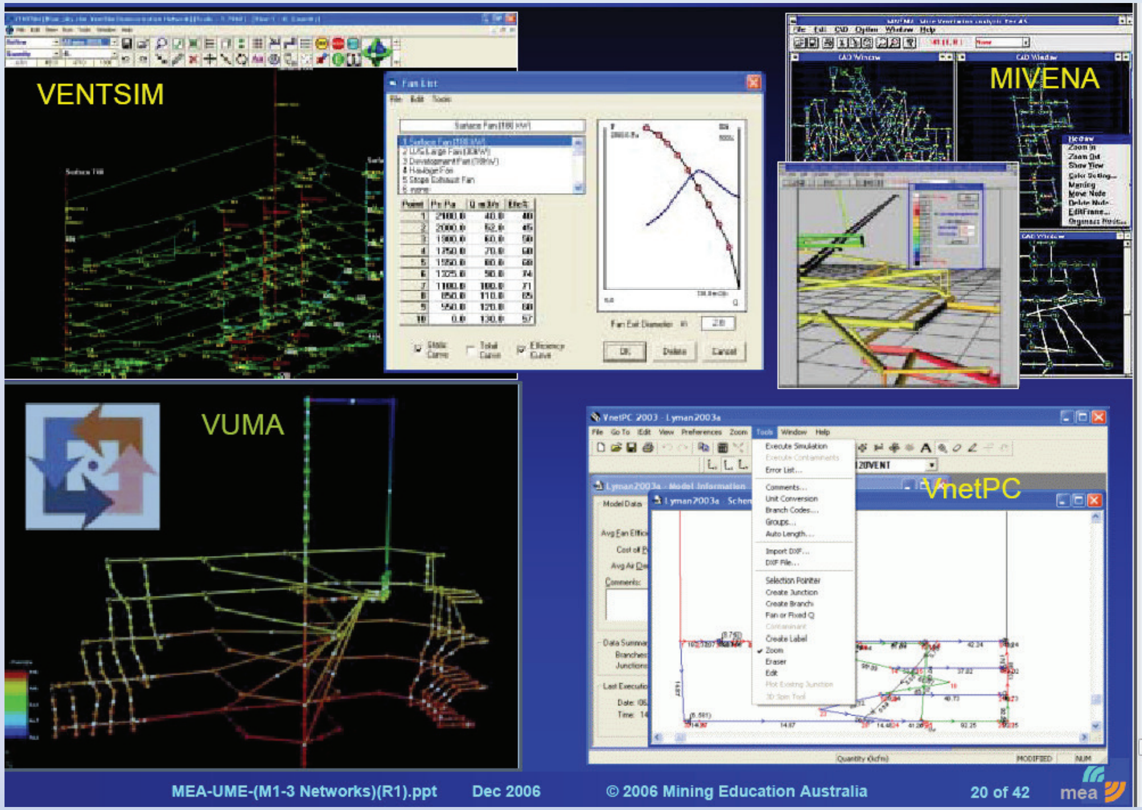
Simulation technologies and how they integrate with mine planning

- Model whole of mine
- Calibrate model with real survey data
- Monitoring of critical mine locations
- Test model especially against ventilation changes



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Assessing the needs and problem spots on your site

Overview

- Workshops
- Emergency situations
- Need to meet Australian Regulatory standards
- Risk assessment

http://google-new.tk/about/careerbuilder/electrical-engineering, retrieved 08 September 2011

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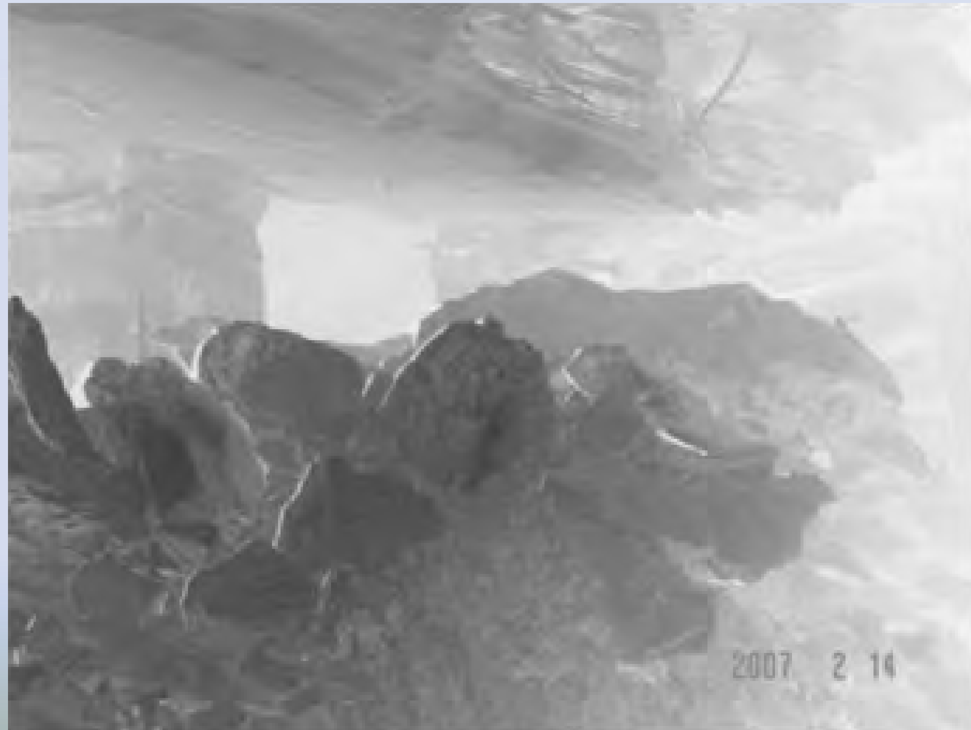
Evaluating fan efficiency and air volume across the mine and integrating this knowledge with existing plans

- Resistance
- Shock loss
- Reduction of stoppings
- Heat Management



Poor ground in a ventilation circuit, http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf, 11 March 2012

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Reusing Air

➢ Workshops – a case study

- ➢ Workshop - 24m3/s
- ➢ Total – 236m3/s
- ➢ Risk assess – historical data
- ➢ Monitoring required
- ➢ System developed – modelled
- ➢ Return regulator was closed
- ➢ Workshop access doors opened
- ➢ Battery charging was isolated and sent to return

Before (m3/s)	**After (m3/s)**
24 to return	5 to return
0 reused	19 reused
24 to workshop	38 to workshop

Became a parallel vent split and reduced resistance

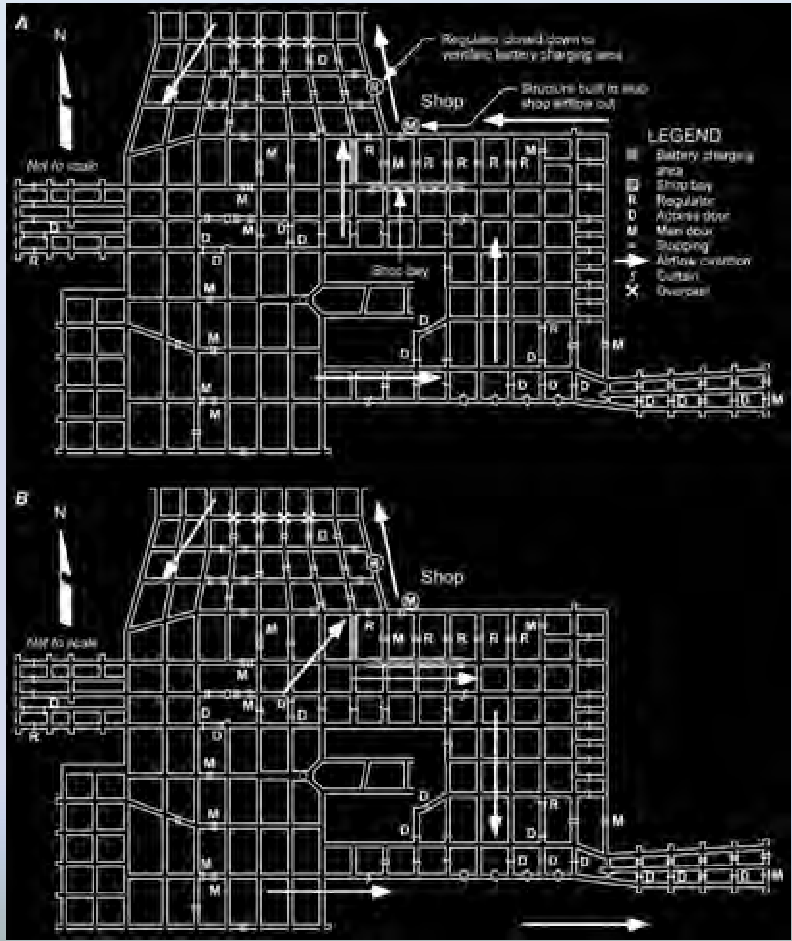

Figure1—Casestudy:reusingshopairformineventilation. A: original shop airflow. B: intake air flows through shop. http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf 11 March 2012

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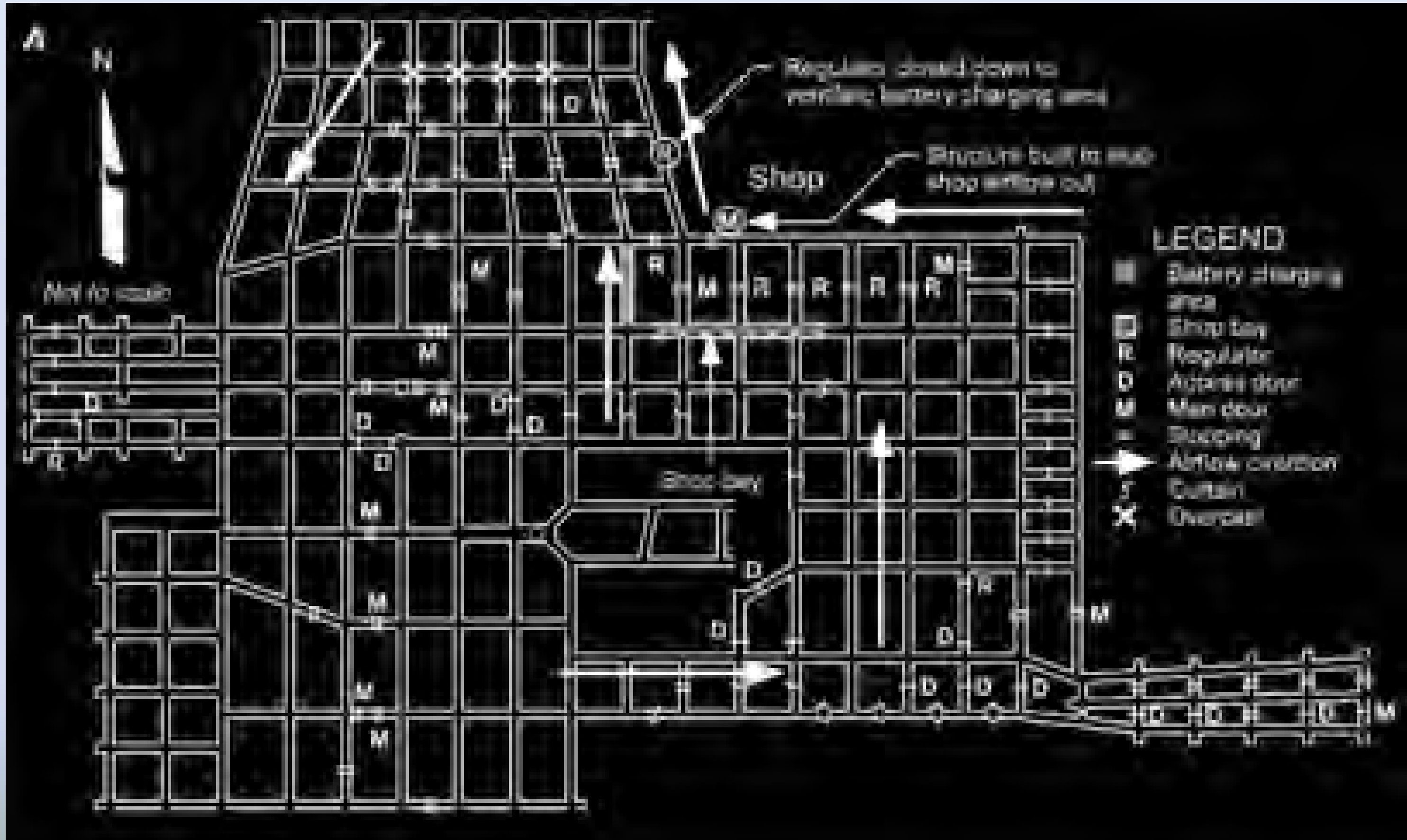

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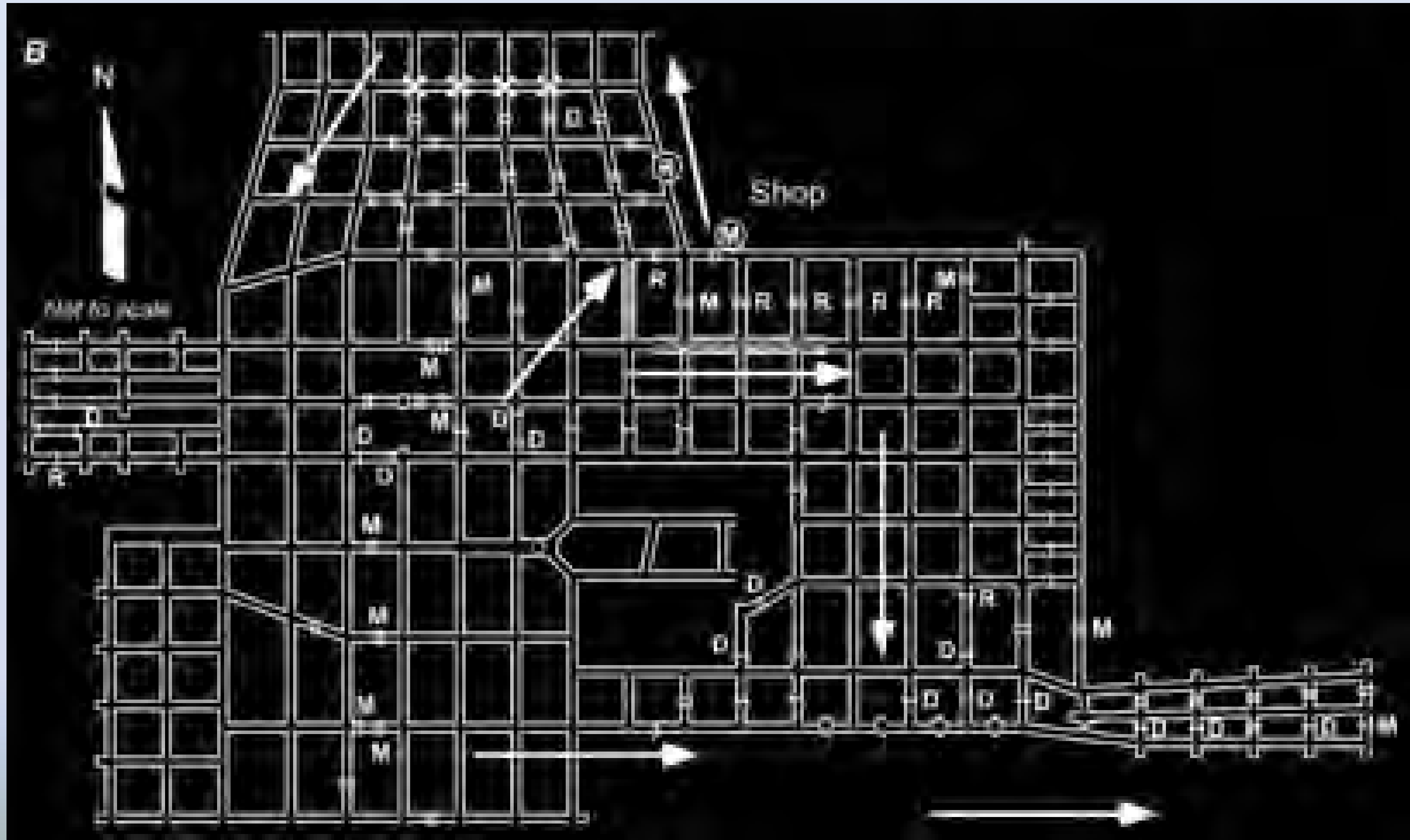

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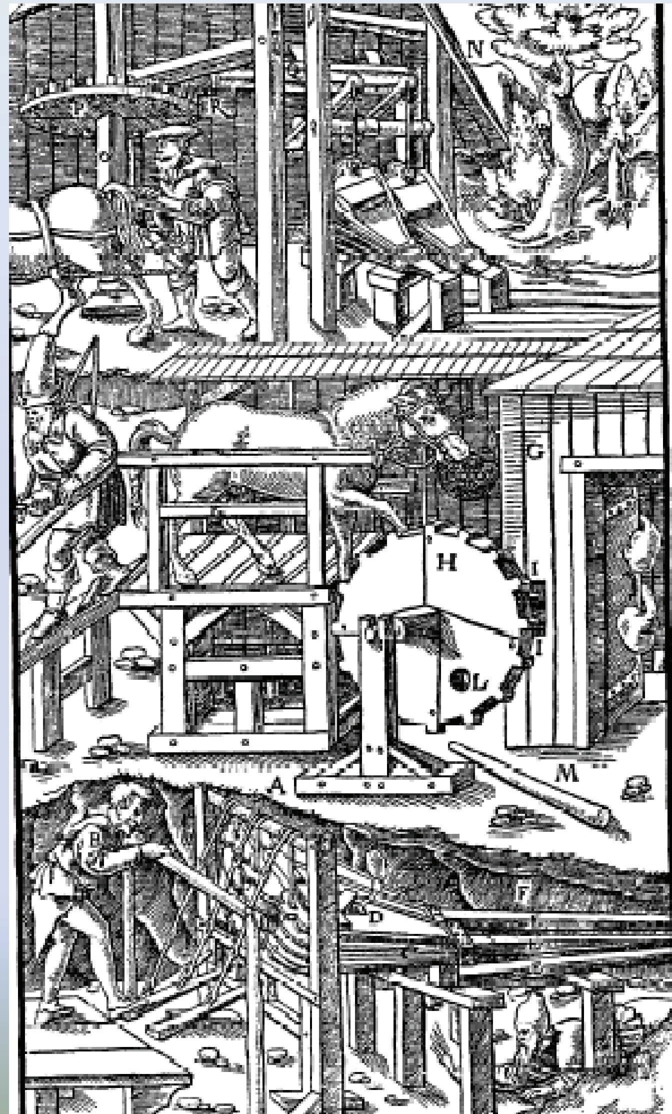
Reusing air

- Workshops – a case study
- Think outside the box
- Ventilation on Demand



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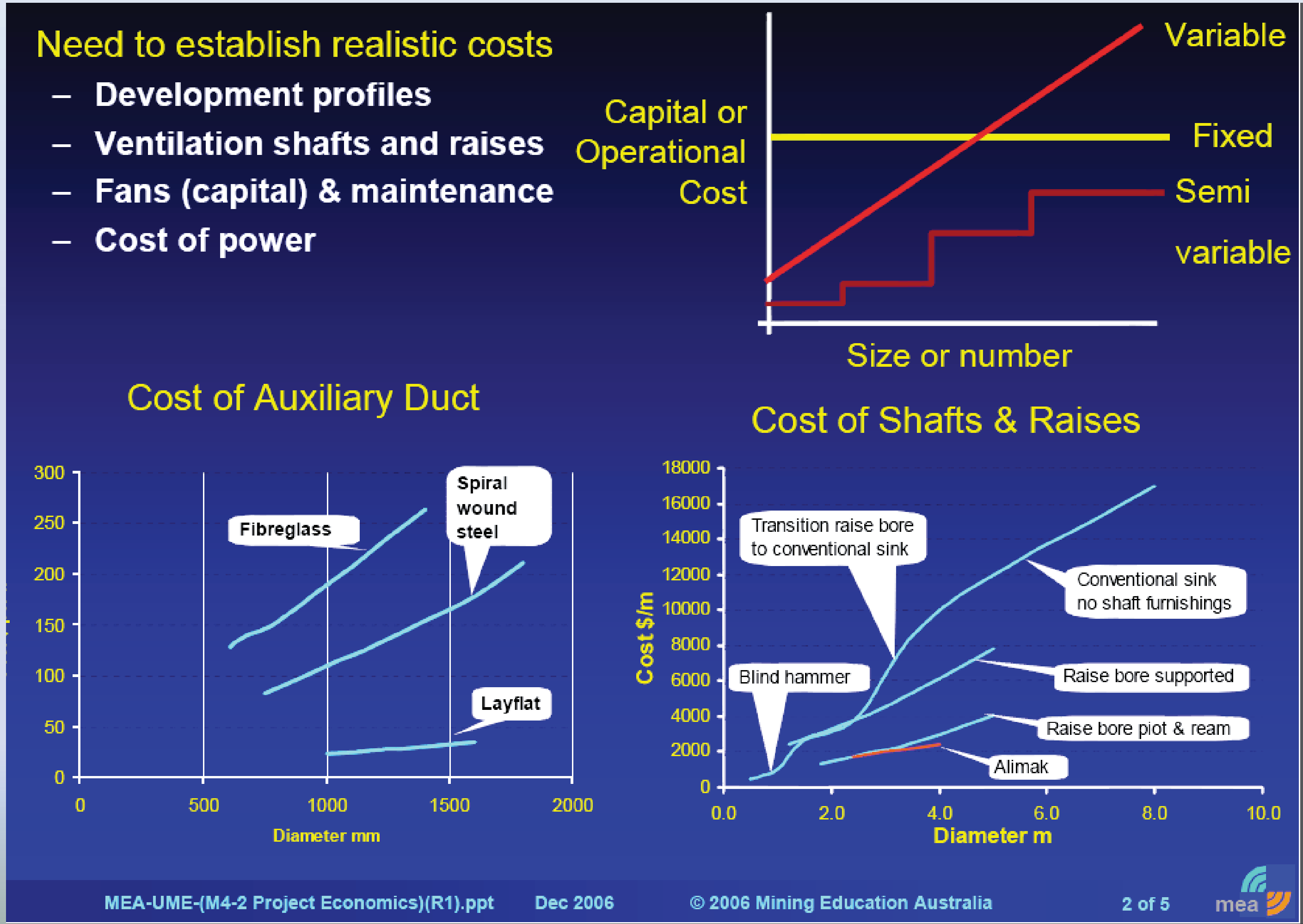
Developing new ventilation strategies for mine extensions and new sites



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Increasing power efficiency and air volume simultaneously

- Frequency controlled speed fans with an on demand system – a case study – Kristinberg (a Boliden Mine)
- Total Volume 16m3/s
- Mie depth 1,110 metres
- Could Kristenerg have continued to mine without automated VOD?
- 30% reduction in power costs
- On demand to remove dust from breaking rooms and blast fumes
- New vent shaft

ABB 800xA automation system fitted to 2 mine fans and auxiliary fans, http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf,, http://www05.abb.com/global/scot/scot296.nsf/veritydisplay/ffc3aa055156da50c12577df0017ac39/$file/3bse061496_en_system_800xa_ventilation_governed_by_needs_reduced_costs_by_30_percent_at_boliden.pdf 11 March 2012

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Increasing power efficiency and air volume simultaneously

- Fans operate only when activity in progress
- Vehicles transmit identity to fans, where they ramp p to equipment pre programmed needs
- Fan operates for 14 minutes after activity ceases – remove exhaust
- Fans not in use is ¼ speed

- Grapenberg using the same system reduced power needs by 40%
- Fans now operating at higher speeds and thus higher flows
- Reduce the need for infrastructure upgrades
- Payback 3 years

System 800xA is discrete but an effective "brain" in the Kristineberg mine ventilation system. Project report System 800xA – Ventilation governed by needs reduced costs by 30% at Boliden, http://www05.abb.com/global/scot/scot296.nsf/veritydisplay/ffc3aa055156da50c12577df0017ac39/$file/3bse061496_en_system_800xa_ventilation_governed_by_needs_reduced_costs_by_30_percent_at_boliden.pdf, 11 March 2012

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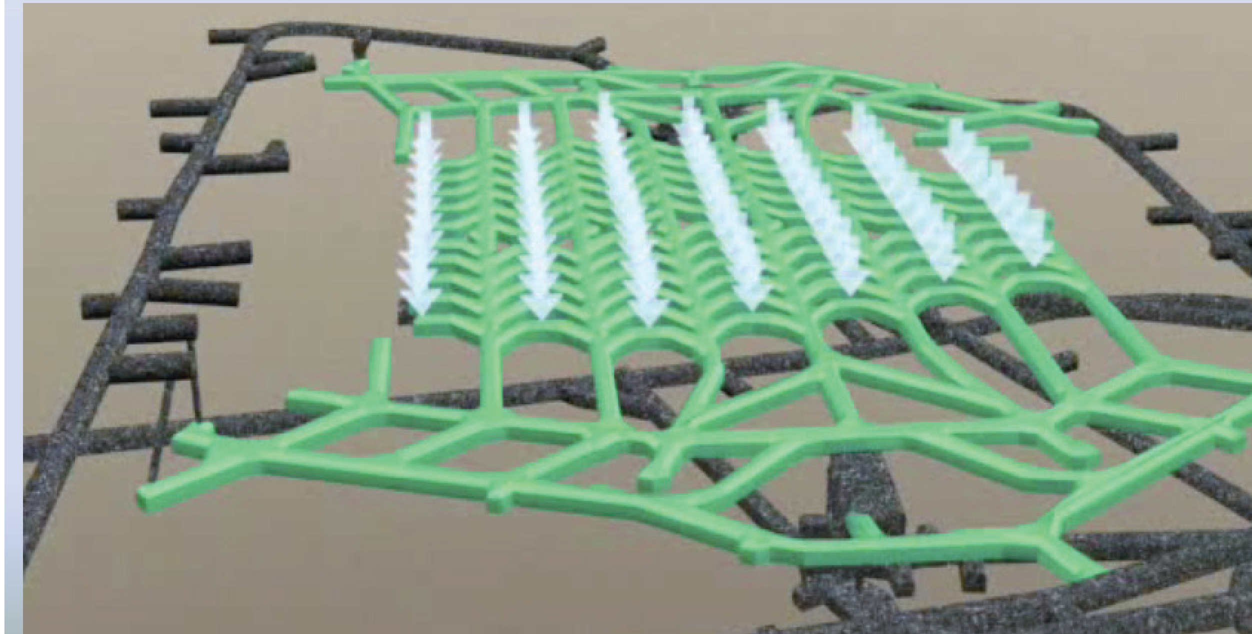
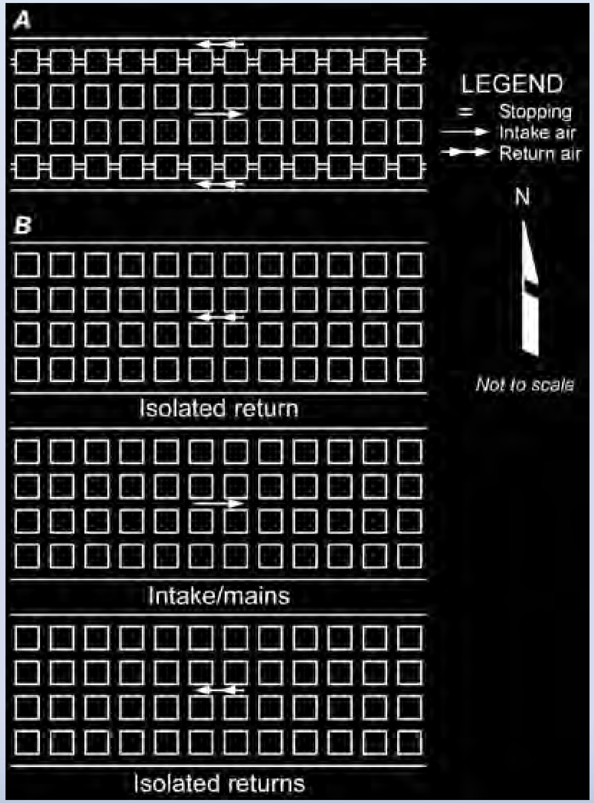
Increasing power efficiency and air volume simultaneously

- Think in 3 D
- Use drainage drives





Repurposing drivage for ventilation, http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf, 11 March 2012

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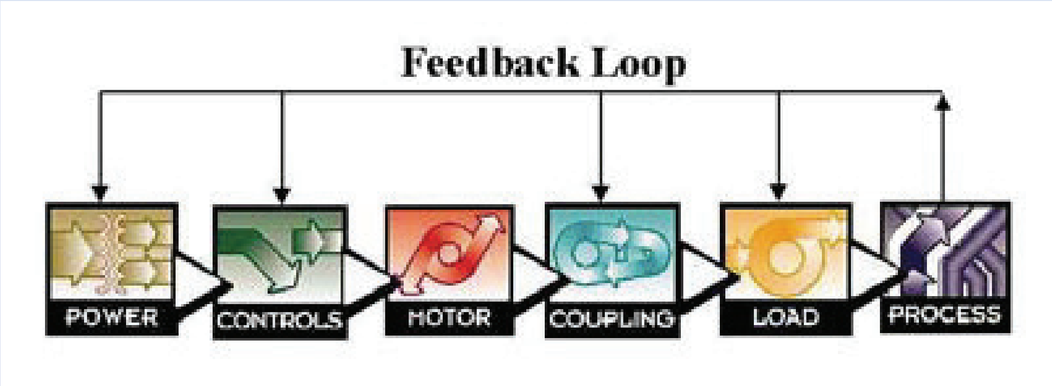
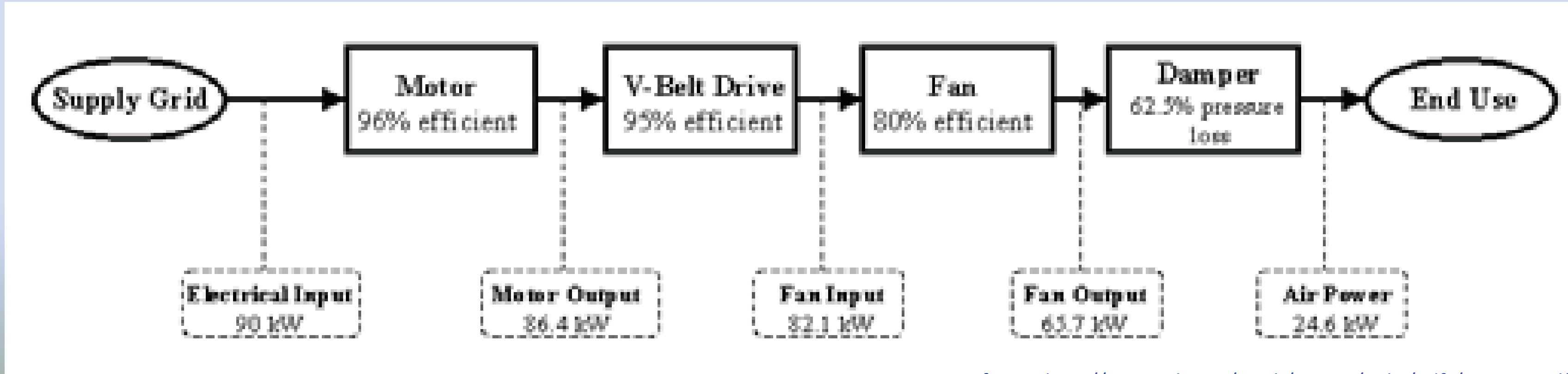
Increasing power efficiency and air volume simultaneously

- Case study -





Wire to Air factor, http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf, 11 March 2012

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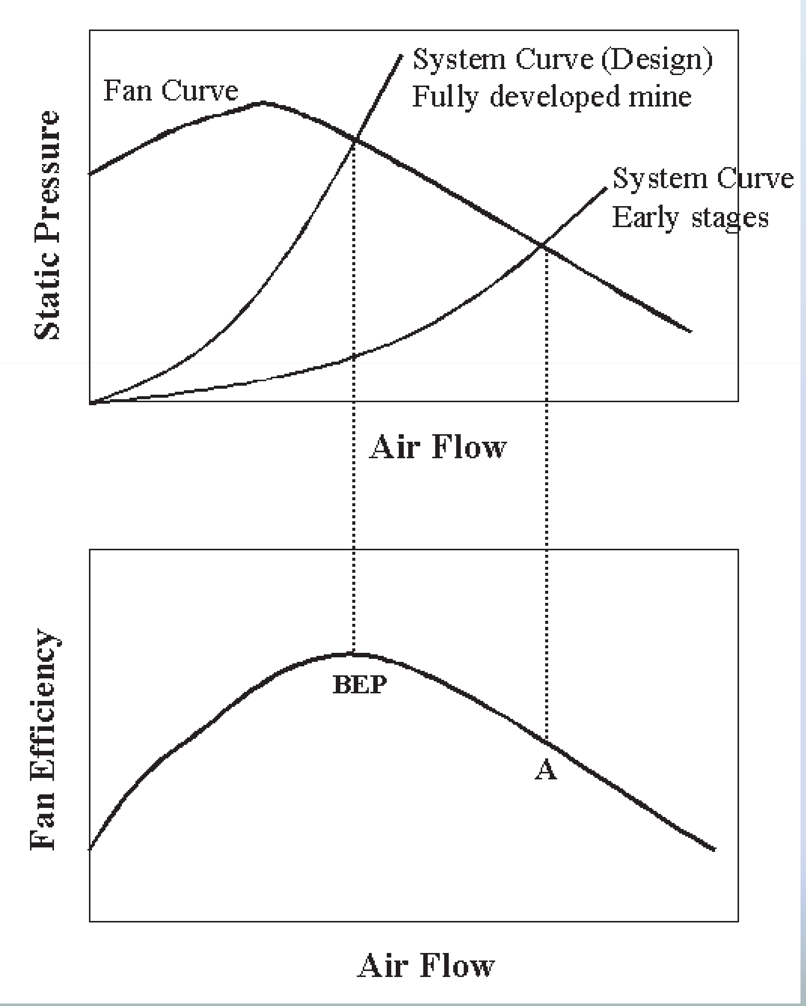
Increasing power efficiency and air volume simultaneously

- Base case vs fully developed mine

- Components of the Mine Ventilation System:
  - Power Supply
  - Motor
  - Coupling
  - Fan
  - Flow Control Devices
  - Ducts, Passageways & other System Hardware



Fan curves, http://www.cdc.gov/niosh/mining/pubs/pdfs/mtieom.pdf, 11 March 2012

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Increasing power efficiency and air volume simultaneously

- Flow control devices
- Cost Implications and Benefits:
  - Life Cycle Costing best solution
  - Payback is not appropriate
  - Set up costs only small part of over all costs
  - Improved power factors
  - Reduced Greenhouse Gas Emissions
  - Reduced maintenance
  - Increased reliability and productivity

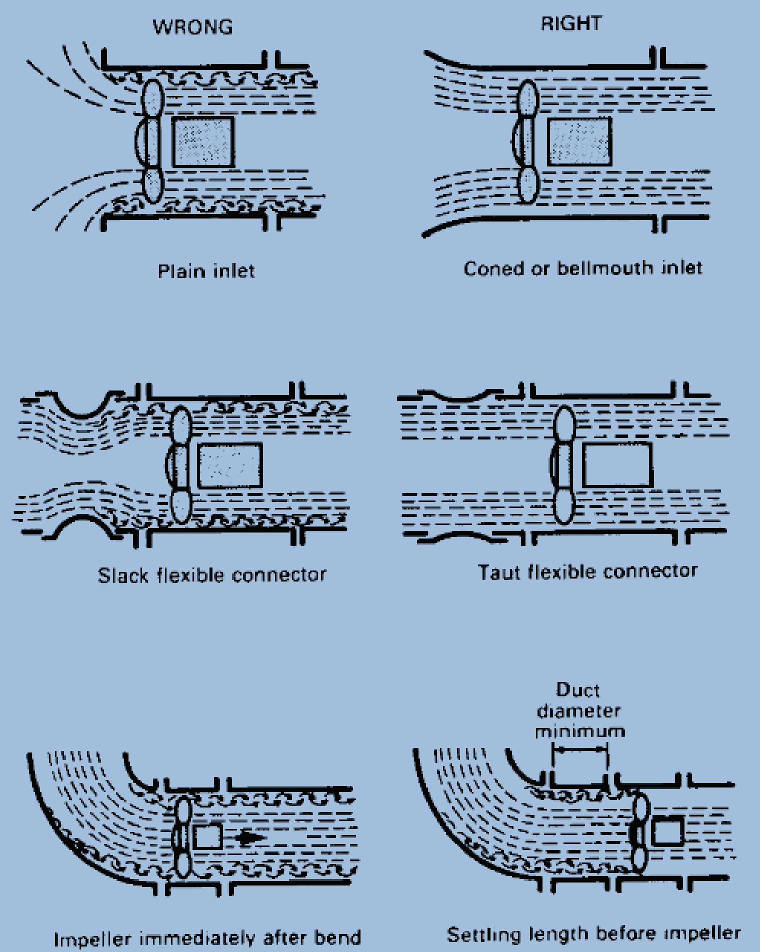

Fig. 10.2 Examples of noise generating installations.

Woods Practical Guide to fan engineering, GEC 1995, BB Daily

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Increasing power efficiency and air volume simultaneously

Howden Australia Brochure Industries Mining Australia

Area	Check	Possible improvements
Application	Is the system doing useful work?	Significant energy savings can be achieved by stopping the fan when the ventilation is not required.
Design	Has the fan been sited to reduce system resistance?	Poor design can mean the ductwork has unnecessary bends and fittings, or even that the length of ductwork is excessive. Careful consideration of the fan location at the design stage can lead to significant energy savings.
Performance	Can a control method be used to match the fan speed to demand?	Many control systems are available. By monitoring the demand, the airflow rate can be adjusted to meet the demand, e.g. using a variable speed drive (VSD). For larger axial fans, adjusting the pitch of the blades is a common method of adjusting the airflow. Savings can be as high as 30%. Note. Where there is no need to adjust the airflow rate, installing a VSD could increase energy consumption by 5%.
Fan	If it is a centrifugal fan, is it running in wrong direction or is a wrong-handed impeller fitted?	Change the fan direction or replace the impeller.
	If it is a centrifugal fan, is it handling an incorrect volume of air?	Change the impeller to reduce energy consumption
	Is a complete change of fan justified to obtain a significant improvement in fan and system efficiency?	Significant savings can by achieved by selecting efficient fans that are sized as accurately as possible to work at the correct flow near their point of most efficient operation.
	Is the swirl at the inlet the opposite direction to the fan rotation?	Straighten out the flow in the inlet with fixed vanes.
	Are turning vanes fitted where there is a duct bend close to the inlet?	Install vanes if not fitted.
	Is a transition piece fitted where the duct size reduces?	Install a transition piece if not fitted
	Are flexible connections fitted correctly with no offset or slack?	Carry out a visual inspection to ensure correct connection.
Fan outlet	If there are bends in the ductwork close to the outlet, are these radius bends with splitters?	It is generally good practice not to have bends close to the outlet
	If the fans are an axial or propeller type, are guide vanes fitted to provide energy recovery?	Guide vanes should be considered when the pressure is above 750 pascals.
	Is the swirl at the inlet in the opposite direction to the fan rotation?	Motor overload is possible. Consider installing upstream straightening vanes
Motor	Is the motor oversized?	Losses are often caused by too large a safety margin being introduced during the design and installation stages, resulting in the specification of too large a motor. Modern motors give good performance from 50-100% of rated load, making selection a little easier; however, selection of the right motor remains important.
	Is a three-phase motor operating on all three phases?	Check for faulty wiring and fuses.
	Is an AC motor running below its normal speed due to a winding or starting fault?	Check the connection diagram with the motor.
	Can the drive mechanism be improved?	Changing from a vee-belt to a direct drive or flat belt drive can save energy.
	Is a higher efficiency motor (HEM) being used?	Apart from very low duty applications, it is always worth fitting HEMs that are classified as Eff 1 or that appear on the Energy Technology List (see www.eca.gov.uk).
Ducting	Is the ducting tubular with a large cross-sectional area?	If so, this should be kept to a minimum. Installing tubular ducting instead of standard rectangular ducting and ensuring that the cross-sectional area is as large as possible will produce a low velocity system with a low pressure drop, thus maximising efficiency.
	Has the pressure drop achieved using dampers during balancing been minimised?	Good design should ensure that all legs have equal pressure losses. After installation, a ventilation system must be balanced to ensure that all areas receive the ventilation required. Care should be taken when selecting dampers for balancing to minimise the pressure drop.
Site performance	Have checks been carried out throughout the site on airflow rate, pressure and absorbed power?	Possible actions identified by a site test are change of fan speed, new fan drive change of fan motor (e.g. to a higher efficiency type or a different power rating) change of fan size and capacity control to meet varying load demand.

Mine planning

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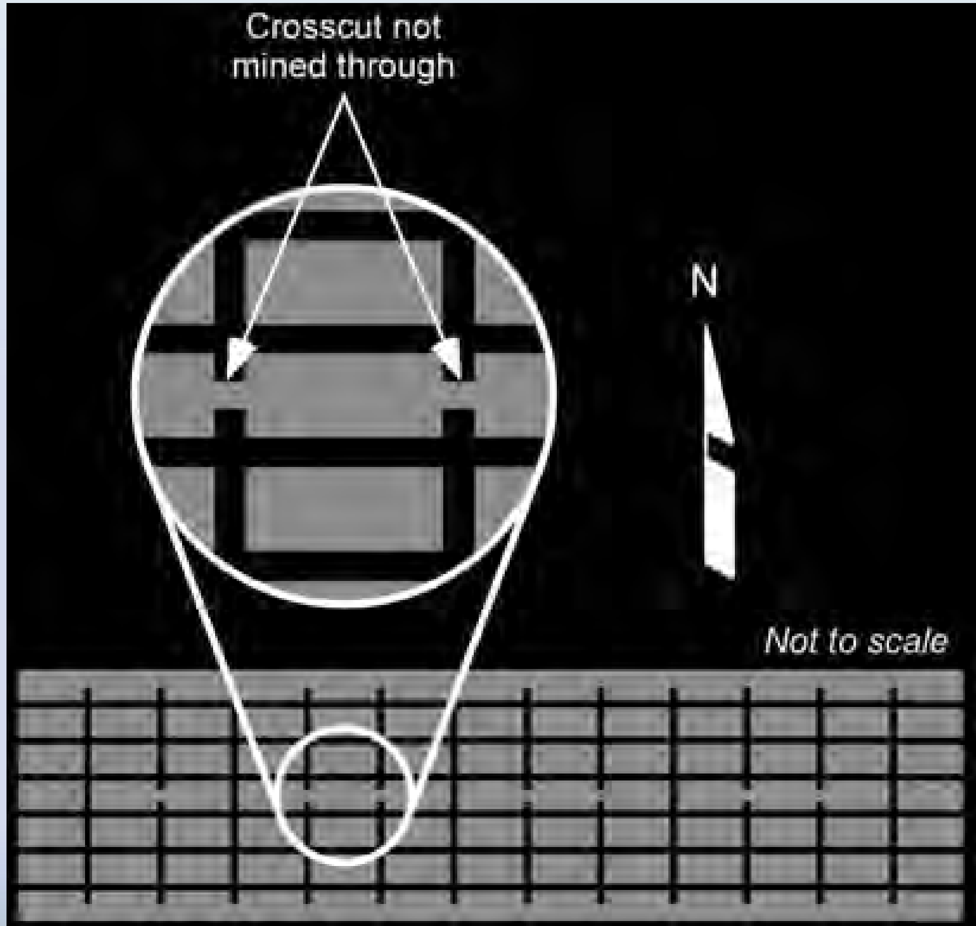
- Plan with large enough cross sectional area to support vent needs
- Assess changes between intake and return to optimise – dust, flow, resistance
- Considerations to improve vent:
  - Remove rubbish
  - Set pipes into walls
  - Engineer equipment for low shock loss
  - Design mine for low shock loss
  - Design for laminar flow
  - Reduce resistance
  - Blasting requirements



Increasing Energy Efficiency of Mine Ventilation Systems – Papar, Szady,et al, http://industrial-energy.lbl.gov/files/industrial-energy/active/0/LBNL-43885.pdf, 11 March 2012

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Thank you.
Any Questions?