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DEVELOPMENT OF A WEB-BASED UNDERGROUND COAL MINING INFORMATION MANAGEMENT SYSTEM

Ian Porter, Ernest Baafi and R Stace

Abstract: The development of the Australian Coal Association Research Program (ACARP) funded “one stop shop” information management system for the coal mining industry is described. The site www.undergroundcoal.com.au went live on 28 August 2009 with various sub-modules including an introduction to underground coal mining practices and a handbook of roadway development practice. The site also includes presentations from ACARP six-monthly workshops on current roadway development practice. These workshops provide an invaluable opportunity to share state of the art knowledge in roadway development practice, to learn of emerging Research and Development (Rand D) programs and development of equipment and technology by Original Equipment Manufacturers (OEMs).

INTRODUCTION

A review of current roadway development practice (Gibson, 2005) found that there was little information transfer across underground coal mines, even for mines within the same company, and that mines were unaware of developments in roadway practice, equipment and technology. The review recommended that the coal industry develop “a body of knowledge” as a means of capturing current roadway development practice and sharing it across the industry. This provided the impetus for the establishment of a professional website with the domain name www.undergroundcoal.com.au. The website was developed and is maintained by the Faculty of Engineering’s Mining Unit in collaboration with the Centre for Academic Systems and Resources (CASR) at the University of Wollongong (UoW). Located on a single domain website, this visually interactive learning environment provides appropriate material for undergraduate mining engineering students through to highly experienced practicing mining engineers. The three basic elements of the website are:

(i) Information delivery

- Links to OEMs, Government organisations and mine sites;
- Video/audio content of presentations from experts;
- Knowledge of coal mining through practicing engineers;
- Industry calendar of events.

(ii) Web – Interaction (Internet forum)

- This is a message board feature where users can engage in an online discussion in the form of posted messages.

(iii) Research support

- Conference and journal articles;
- Proceedings of industry workshops such as Roadway Development Operators’ Workshops. These workshops had been conducted six monthly since 2006 and provide an invaluable opportunity to share knowledge and improvements in roadway development practice, to learn of emerging R&D programs and development of equipment and technology by OEMs, and to network across the industry.

DOMAIN ARCHITECTURE

The domain’s homepage and a simplified sitemap are shown in Figures 1 and 2, respectively.

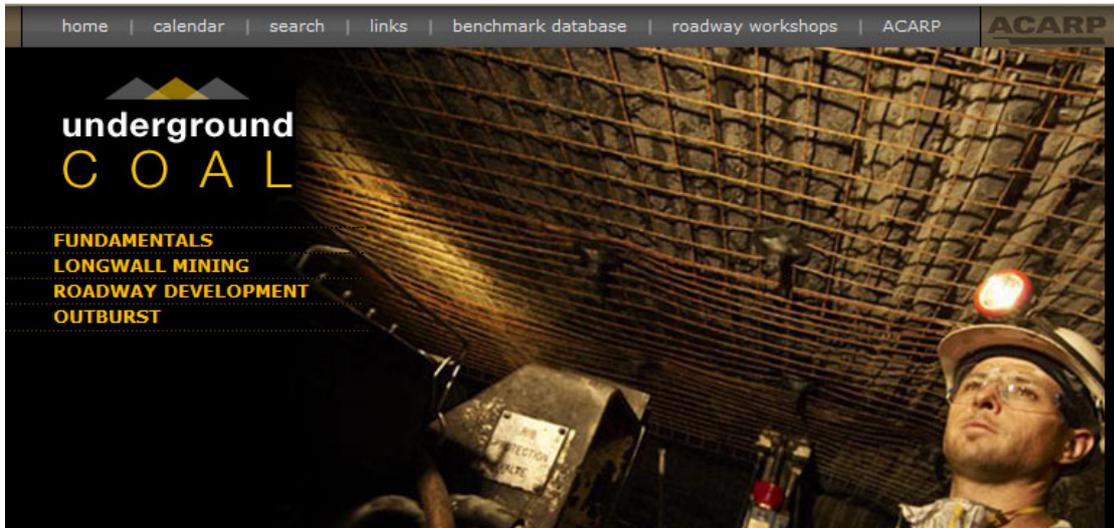


Figure 1 - Homepage of www.undergroundcoal.com.au

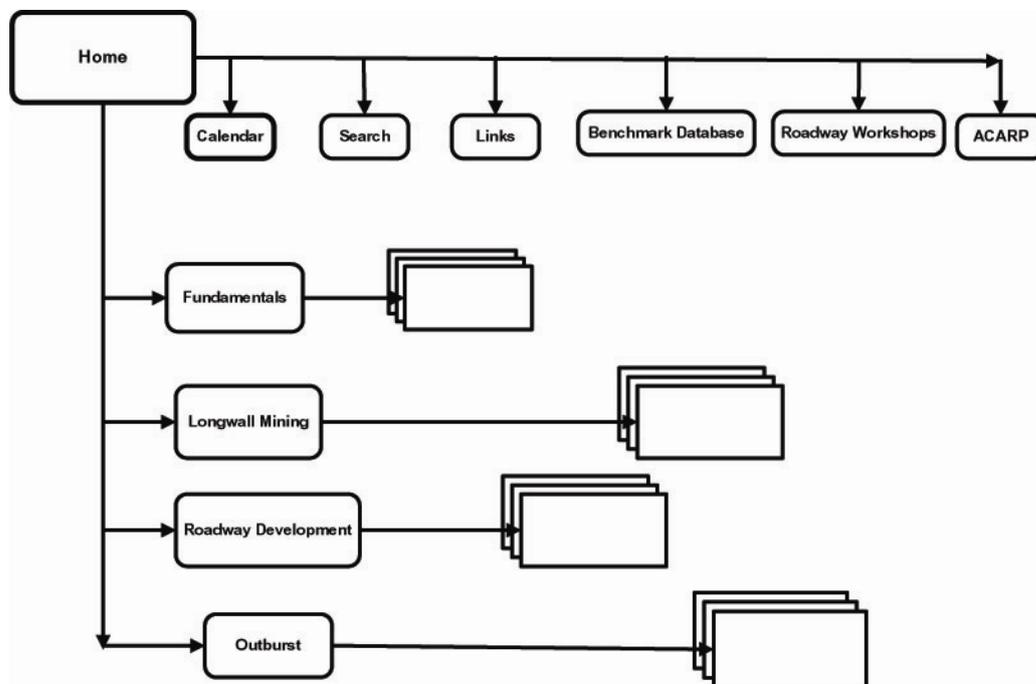


Figure 2 - A simplified sitemap of www.undergroundcoal.com.au

Main/Tier 1 navigation

The following six links are available from the Main or Tier 1 Navigation section of the homepage:

- 1) Calendar - Keeps the dates, venues of future coal events including conferences and workshops.
- 2) Search - Accesses the site's Mini Google to search for documents from www.undergroundcoal.com.au.
- 3) Links - Hyperlink to a database of contact details of coal mining consultants and other service providers.
- 4) Benchmark Database - In responding to why some longwall roadway development rates are different among mines, ACARP's Roadway Development Task Group (RTDG) initiated a benchmarking study to survey each longwall mine to determine the correlation between roadway development practices and roadway development performances (Baafi and Gibson, 2010). This sub-module of the site is a web-based relational database system which was developed purposely to survey Australian longwall roadway development performance. Participating longwall

operators are invited annually to supply information online via this sub-module on the following topics:

- (i) Mine parameters;
- (ii) Development parameters;
- (iii) Gas and ventilation;
- (iv) Shifts and personnel;
- (v) Management of development performance, and
- (vi) Development performance.

5) Roadway Workshops - This is a hyperlink to the presentations of the Roadway Development Operators' Workshops which were initiated in September 2006 as part of ACARP's overall roadway development improvement project. The primary objective of the workshops is to provide all personnel involved in roadway development a forum to:

- (i) learn of emerging best practice and roadway development initiatives;
- (ii) learn of developments in equipment and technology;
- (iii) network with peers and share their experience and learnings, and
- (iv) identify areas for targeted research.

The workshops are held in the three major coal mining regions each six months, Pokolbin (Newcastle/Hunter Valley region NSW), Penrith (Southern/Western NSW) and Mackay (Central Queensland), so that mine based roadway development personnel have the opportunity to attend a workshop in their region without losing time to attend an interstate venue and incurring the associated travel and accommodation expenses.

6) ACARP - Hyperlink to ACARP website: www.acarp.com.au.

Local navigation

The following four sub-modules are also accessible from the Local Navigation of the site:

1. *Fundamentals*- the www.undergroundcoal.com.au website is to be of use to all levels of expertise from people with no or, at most, a very limited knowledge of mining through to practicing mining engineers seeking specific information on some aspect. The sub-module is not intended to re-write information which is already available in the public domain but to provide references and where possible web links so that the website can be used as a rapid means of sourcing required information. As a result, most of the text provided in this section of the website covers very basic descriptions of aspects of underground coal mining while the more technical details are available through the links or references. The following topics are presented in this sub-module:

- (i) Basic mining terminology;
- (ii) Exploration;
- (iii) Access to seam from surface;
- (iv) Mine development;
- (v) Pillar extraction using continuous miners;
- (vi) Longwall mining;
- (vii) Ventilation;
- (viii) Gas drainage/outburst;
- (ix) Spontaneous combustion;
- (x) Coal haulage;
- (xi) Personnel and material transport;
- (xii) Subsidence;
- (xiii) Gas utilisation;
- (xiv) Strata control, and
- (xv) Mine services.

2. *Longwall Mining* - This section discusses the elements of longwall mining methods, including mine planning, equipment selection, automation and cutting methods as well as how to avoid and correct practical longwall related problems.

3. *Roadway Development* - This sub-module is devoted to roadway development practices. The following topics are presented:

- (i) Improving roadway development performances;
- (ii) Roadway development research updates;
- (iii) Roadway development benchmark database, and
- (iv) Presentations of ACARP Roadway Development Operators' Workshops.

4. *Outburst* - This sub-module of the website is a modified version of the original outburst website of ACARP Project C14015 (Aziz, *et al.*, 2007). The original website has been reviewed and modified with the content now being within www.undergroundcoal.com.au. All the figures have been enhanced by professional graphic designers and incorporated into the website using javascript library enhanced modal dialog windows. The site uses "prettyPhoto" a jQuery driven lightbox clone (jQuery, 2010). This results in thumbnail images of the figures being enlarged in a stylish, cross-browser compatible, animated popup display when clicked by the user. By using such a plugin for the jQuery javascript library a broad, robust and maintainable range of browser compatibility is ensured. The original outburst site can still be accessed at <http://www.uow.edu.au/eng/outburst/>, and is also available via <http://research.uow.edu.au/coal>.

THE DOMAIN HARDWARE AND SECURITY

The server

This domain is hosted on a dedicated web server installed in the University of Wollongong Information Technology Services (ITS) data centre. The details of the domain's hardware are:

- Dell(TM) PowerEdge (TM) R710 Rack Mount Server - 3.5-Inch (8.89 cm) Chassis;
- Processors: 2 X Intel(R) Quad Core E5506 Xeon(R) CPU, 2.13GHz, 4M Cache, 4.86 GT/s QPI;
- Memory: 4GB Memory (2x2GB), 1333MHz Dual Ranked RDIM;
- OS drive 146GB - 2 x 146GB SAS - Raid 1;
- Data drive 1.5TB - 4 x 500GB SATA - Raid 5.

This drive configuration allows the operating system to be on one drive and data on the other. Both logical drives are made up of hot swappable drives allowing continuous server operation and data protection in case of a single physical drive failure.

The software used to develop and maintain the site are:

- Windows Server 2008 Enterprise;
- Internet Information Services (IIS) version 7;
- Net Framework versions 2 and 3.0;

The search engine

A mini search engine has been incorporated into the website to allow a rapid and easy search with the inclusion of Google search functionality at a local level. This is achieved by incorporating into the site Google Mini (Google, 2010), an integrated hardware and software solution designed to make the most of digital resources. The Mini achieves this by delivering the power and productivity of Google by searching across all documents within the website quickly and easily. The Mini includes support for multiple document collections, search across file servers and reporting functions. It works with over 220 different file formats and is accessed by a search box on www.undergroundcoal.com.au.

Security access

The server of www.undergroundcoal.com.au is hosted in the University of Wollongong Information Technology Services (ITS) machine room and physical access to the server is restricted to authorised ITS personnel. UoW information technology infrastructure incorporates the provision of computer, network and communication services to the campus community for academic teaching and research and for general administrative functions. The server conforms to the UoW server security process and guidelines. This implies the website is behind the UoW firewall and public access is only allowed to the web content through the UoW hypertext transfer protocol (http) through port 80. Windows file sharing is, however, allowed from a number of nominated machines in UoW CASR for content update and management. Location of the machine within ITS allows automatic backup and recovery of all site content in the event of a system or hardware malfunction.

CONCLUSIONS

The ACARP funded website www.undergroundcoal.com.au provides easy access to current information on underground coal mining, especially roadway development technology and systems for Australian longwall operators, OEMs, researchers and developers. The site provides a 'one stop shop' for information on Australian coal mining practices, and has become an invaluable tool - for mining engineering students and practitioners worldwide. The website www.undergroundcoal.com.au also serves as devolution of outcomes from ACARP's RDTG. Its current content includes:

- Fundamentals of coal mining practice sub-module;
- Outburst module;
- Online forum sub-module to engage web-based discussions in real time;
- Roadway development benchmarking online survey;
- Handbook of Roadway Development Practice – Improving Roadway Development sub-module;
- A directory of active consultants serving the industry;
- Presentations of Roadway Development Operators' Workshops since 2006;
- Calendar of future events;
- Research updates and useful information, and
- Industry links.

An editorial panel comprising experienced mining professionals and UoW mining academics has been charged with the responsibility for not only developing the basic structure of the site but also reviewing and updating the content.

ACKNOWLEDGEMENTS

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