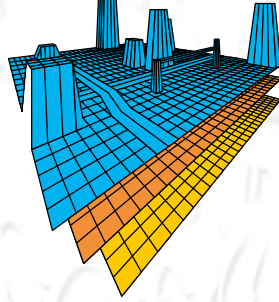


MINE SUBSIDENCE A COMMUNITY GUIDE

**MINE
SUBSIDENCE
BOARD**



PUTTING SERVICE AND THE NEEDS OF PEOPLE FIRST

MINE SUBSIDENCE – A COMMUNITY GUIDE

WHAT IS MINE SUBSIDENCE?

Mine subsidence may result from current or future mining, or from our heritage of 200 years of coal mining in NSW.

Subsidence can be described as the lowering or settling down of the land's surface. When underground mining takes place, the earth's forces are redistributed and there is a tendency for the void to close. Some of this effect may be transferred to the surface as mine subsidence. The extent to which subsidence occurs in a particular location depends upon the width and height of the coal extracted, its depth from the surface, and the rock types found in the overlying strata.

Not all mining results in subsidence nor does all subsidence cause damage to surface structures. Today's coal mines are required to provide detailed information regarding mining and its effects prior to extraction approval being granted. The amount of subsidence and type of structure will influence the extent of damage that may occur.

Since the early 1970s, a large data bank of subsidence information has been collected in NSW from field observations. Analysis of that data has led to the development of models to predict subsidence. The surface is monitored for mine subsidence whilst coal extraction is carried out.

Organisations such as the Department of Primary Industries - Mineral Resources and NSW Minerals Council can assist you by providing information on coal mining. The Department of Primary Industries - Mineral Resources is responsible for the issue of mining leases and approval to extract coal.

Experience both in Australia and overseas has shown that through controlled subsidence it is possible to successfully undermine significant and sensitive structures, eg, bridges, historical buildings, pipelines and railways.

UNDERGROUND COAL MINING METHODS

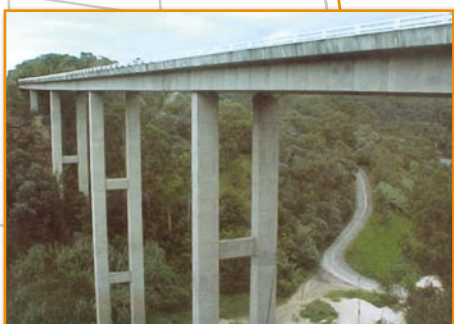
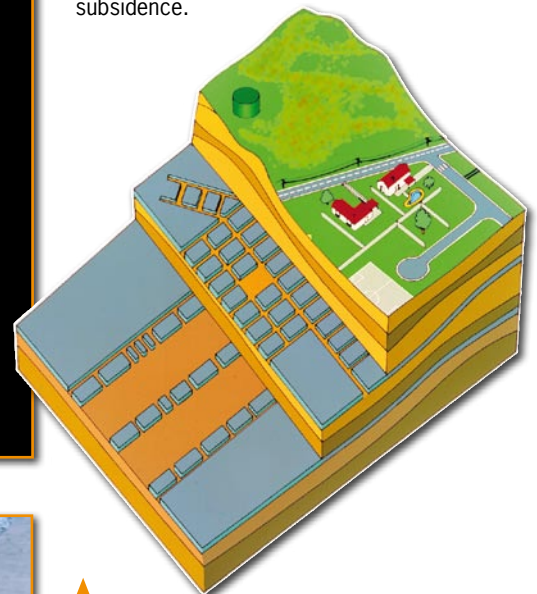
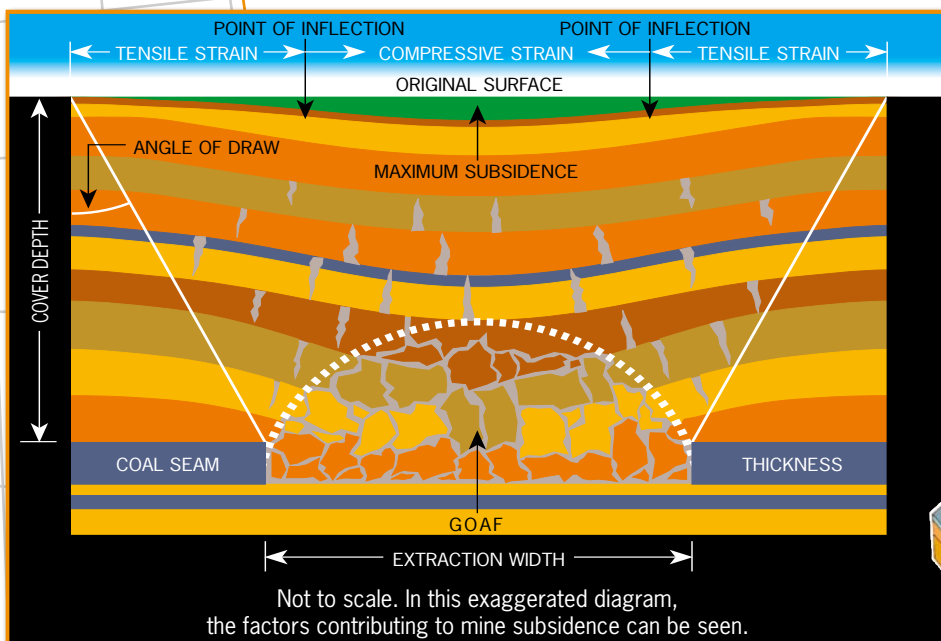
Bord and pillar and longwall mining are the two principal mechanical methods of underground coal recovery. Many variations based on these methods have been developed to suit particular geographical or mining conditions, however, all employ either continuous miners or longwall shearers to extract the coal.

With bord and pillar mining, a series of parallel headings connected by cut-throughs are developed to the furthestmost limit of the panel. Once these first workings are completed, the standing pillars and surrounding coal are systematically extracted, working back towards the main access roadways. This part of the operation is called second workings or pillar extraction.

It is possible to limit the surface subsidence by leaving a proportion of the pillars in place to support the overlying strata. This is known as partial extraction.

With longwall mining, two sets of parallel headings are developed between 100-300 metres apart and linked by a connecting roadway at the end furthest from the main access roadway. This becomes the site for installing the longwall equipment, which systematically removes the large block of coal between the headings or gate roads.

In both types of mining, it is the second workings or pillar extraction, that results in mine subsidence.



▲ Achieving compatibility between coal mining and residential development requires an awareness of the needs of both. Bord and pillar workings are shown in the upper seam and longwall mining in the lower.

▶ Mitigatory work by the Mine Subsidence Board allowed this bridge to remain operational whilst undermined by longwall methods.

COMMUNITY GUIDE

SURFACE EFFECTS OF COAL MINING

When a seam of coal is extracted over a wide area, the strata will sag to rest on the fallen material ("goaf"). As a result, surface movements occur in both the vertical and horizontal planes. Damage can include fine cracks to brickwork and concrete, opening of joints in internal linings and tilting of structures.

The main components of surface subsidence are:

(a) Vertical Subsidence - is most significant where the elevation of a surface feature is important, such as in low lying areas.

(b) Tilt - differential vertical subsidence between two points changes the slope of the surface and consequently that of any surface features. Features which may be particularly affected include tall structures and gravity-dependent structures, such as gutters, drains, sewers, water and sewerage works.

(c) Strain - different horizontal movements between two points cause a change in the length of the surface. If the length of this surface increases, a tensile strain is induced. If the length reduces, a compressive strain is created. The effects of strain on a surface feature depend very much on its design and the materials selected. For example, weak masonry has a low tolerance to tensile strain, whereas steel has a very high tolerance. Rocks and masonry have much higher resistance to compressive strain than timber.

Structures, such as pipelines and buildings, can be engineered so that they have an increased tolerance to strain. Foundations can be designed to limit the amount of ground strain that is transmitted into the building.

In most cases, the majority of mine subsidence is completed within two years of total extraction occurring. Small levels of residual subsidence can continue for a longer period of time.



▲ Subsidence has caused internal cracking.

▼ The effect of tensile strains from subsidence is clearly shown on this road surface.



DESIGNING FOR MINE SUBSIDENCE

Special design and detailing techniques are adopted to allow structures to withstand anticipated movements from earthquakes and unstable foundation material. That includes all types of buildings, roads, railways, drains, services, etc.

Mine subsidence is just another form of ground movement that can be designed for. Design principles and techniques that allow structures to accommodate ground movement resulting from mine subsidence have been adopted extensively in England and Europe since the 1920s and in Australia since the late 1960s.

Monitoring over many years of structures affected by subsidence has enabled the effects to be better understood. Better prediction of the behaviour of structures has led to improved structural design.

Generally, it is the strains and curvatures that damage structural elements of buildings. Although tilt does not normally cause structural damage, in severe cases it may affect the usage of a building.

At the design stage, it is possible to select a type of structure that, with appropriate detailing, will allow the building to accommodate these subsidence effects. We require designers to ensure that any damage is non-structural and the building remains:

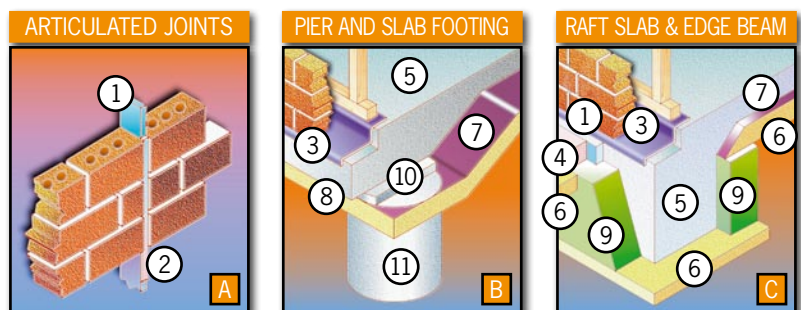
(a) Safe - no danger to users

(b) Serviceable - available for its intended use

(c) Repairable - damaged components repaired economically

In areas where shallow mine workings exist, design can overcome the risk of pothole subsidence.

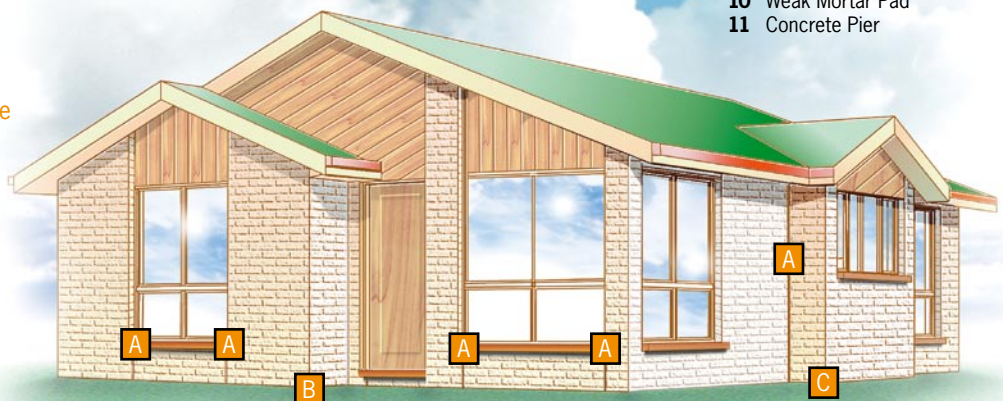
In general, mine subsidence damage is minimised by limiting the size of the structure, careful choice of the building materials used and incorporating design details such as flexible joints, slip layers, elimination of brickwork over openings and the requirements of the Building Code of Australia. Buildings can be designed to facilitate ready repairs should mine subsidence damage occur and, in some cases, are designed to be relevelled to overcome tilting.



STRUCTURAL FEATURES DESIGNED TO ACCOMMODATE GROUND MOVEMENT WINDOWS AND DOORS

Brickwork above openings replaced with in-fill panels (timber, glass, etc)

- 1 Compressible Joint Filler
- 2 Sealant
- 3 Damp Course
- 4 Paving
- 5 Concrete Slab
- 6 Sand
- 7 Waterproof Membrane
- 8 Sand (Sliding Layer)
- 9 Compressible Filling (eg. Vermiculite)
- 10 Weak Mortar Pad
- 11 Concrete Pier



MINE SUBSIDENCE

DEVELOPMENT GUIDELINES

Engineering and architectural considerations can significantly minimise the risk of mine subsidence damage. To assist the community in this matter, we provide surface development guidelines relating to structures and subdivisions within Mine Subsidence Districts. We can also provide advice outside Mine Subsidence Districts. Our development guidelines are designed to ensure that structures will tolerate the expected levels of subsidence so that safety is not compromised, buildings can remain in use and, in the event of mine subsidence damage occurring, any inconvenience to owners and users is limited while repairs are made.

The guidelines cover both the nature and class of improvements and include the height of a building, the type of building materials used and the construction methods. Solid or cavity brick construction is not flexible and can be damaged by low levels of subsidence. In some areas, even brick veneer construction is unsuitable, particularly should high levels of subsidence be anticipated.

Some structures are not specifically designed for mine subsidence, for example, those outside a Mine Subsidence District or those built prior to proclamation of a District. They are however eligible for the full range of our services, including any appropriate work to prevent or mitigate damage from mine subsidence.

We encourage the development of building techniques to allow the widest possible range of designs and material to be available to the building public.

Our staff would be pleased to discuss our surface development guidelines with you.



WHAT CAN BE THE CAUSE?

Damage to homes can arise from many causes. While it is often thought that mine subsidence is the cause if the property is in a Mine Subsidence District, this is not always the case. Our staff will consider many factors when inspecting a damaged home and discussing a claim with an understandably concerned owner.

Records kept at our District offices will show if the property is undermined and what the likelihood is of subsidence having occurred. Survey marks, if available, will also be checked. However, other factors need to be investigated as damage to surface structures may have many causes.

A problem often experienced is the failure of footings or concrete slabs due to incorrect reinforcement or inadequate compaction of the underlying materials. In some cases, homes may have been subject to unusual loadings, such as earthquakes, or the structural design may be inadequate. (For example, bearers and floor joists may be incorrectly spaced or of inadequate size.)

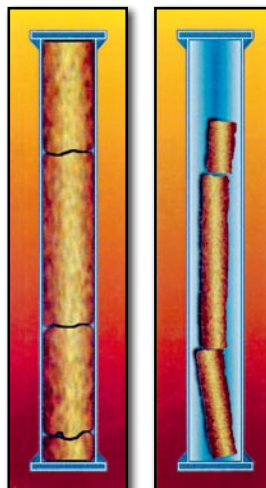
Changes in drainage patterns or moisture content will lead to ground movement should reactive soils be present. (The reactivity of soils can be determined by having the site classified by a geotechnical engineer.) Homes can be designed and built for reactive sites so that the ground movement will not normally cause any structural damage, although some minor cracking of slabs, brickwork and interior fittings may occur. Australian Standard 2870 classifies wall cracks of less than 1 mm as fine cracks which do not need repair.

Whilst older homes may be subject to the ravages of time, particularly if they have not been properly maintained, it should be recognised that new homes often experience settlement or frame/concrete shrinkage.

We can provide you with more detail on any of these issues on other causes of damage to homes.

◀ Type of dwelling approved under the Board's guidelines.

◀ Research and development leads to less damage by using better materials and constructions methods.



Inadequate footings ▲



No expansion joint in pavers ▲



No reinforcement ▲



Inadequate footings ▲

◀ Reactive soil testing - Soils can expand or contract as moisture content changes, often resulting in significant cracks in buildings.

A COMMUNITY GUIDE

THE MINE SUBSIDENCE BOARD'S ROLE IN THE COMMUNITY

The Mine Subsidence Board is a service organisation operating for the community in coal mining areas of NSW and is responsible for administering the Mine Subsidence Compensation Act. The Act provides for compensation or repair services where improvements are damaged by mine subsidence resulting from the extraction of coal.

The Act also gives us the responsibility of reducing the risk of mine subsidence damage to properties by assessing and controlling the types of buildings and improvements which can be erected in Mine Subsidence Districts. A Mine Subsidence District is used to recognise areas where our expertise and service are likely to be in higher demand due to existing or future coal mining.

Other important roles are the elimination of public and private danger caused by mine subsidence and the provision of a comprehensive and accessible advisory and technical service.

We maintain an active role in liaising with the community, industry and other government departments.

We can assist you if you have any enquiries regarding mine subsidence or if your property has incurred damage as a consequence of mine subsidence.



◆ Repairs in progress.



▲ Potholes from old abandoned mining are repaired by the Board where they ▼ present a public or private danger.



▼ Pre-mining inspections record any pre-existing damage.



THE BOARD'S CUSTOMER SERVICES

Our staff can provide you with a range of brochures and other information on mine subsidence as described in this publication.

You will require our approval to subdivide land or to erect or alter improvements within a proclaimed Mine Subsidence District. However, where a council does not require a building application, we will deem approval for those improvements.

Buildings built outside of and prior to the proclamation of a Mine Subsidence District are automatically covered for compensation. However, homes and other structures built in contravention of, or without, our approval, in a Mine Subsidence District, are not eligible for compensation in the event of damage due to mine subsidence.

Homeowners who believe that their improvements have suffered mine subsidence damage should contact our nearest office without delay and request a claim form. Care should be taken to include all information required. On receipt of your claim, one of our technical officers will contact you promptly to begin investigation.

As a guarantee of service, we will offer to carry out pre-mining inspections of residential areas, where subsidence is likely to cause damage. A pre-mining inspection is designed to establish the pre-mining condition of surface improvements which may be damaged by mine subsidence. Pre-mining inspections may range from a visual examination to survey levels and detailed photographs.

A Section 149 Certificate issued by councils and which must be attached to a Contract of Sale when a property is put on the market, gives notice as to whether a property is within a Mine Subsidence District. If it is, most financial institutions will require you to obtain a Section 15B Certificate from us prior to advancing money to purchase a home. This certificate is an assurance that the improvements are eligible for compensation if mine subsidence damage occurs.

On occasions, particularly over old shallow workings, mine subsidence may crack the ground or cause potholes. Should you know of any possible openings to old mine workings, please contact us or call our 24 hour emergency number to enable us to eliminate any danger.

WHERE CAN I GET MORE INFORMATION?

Our expert staff are there to assist you with further enquiries. In addition to our Head Office at Newcastle, we also have five District Offices strategically located in coal mining areas of NSW.

A range of brochures and fact sheets on mine subsidence is available free of charge. These include details on buying and building in a Mine Subsidence District and how to claim for mine subsidence damage. Surface development guidelines can be obtained upon request. Our staff also provide technical information on items such as designing for mine subsidence.

We provide interpreter services free of charge through the Community Relations Commission for people from non-English speaking backgrounds.

A 24 hour emergency service is provided in all districts.

WE APPRECIATE YOUR FEEDBACK

As part of our service commitment, we are dedicated to continuous improvement in providing the highest standard of customer service.

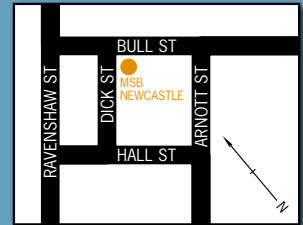
Our staff adheres to a professional Code of Conduct and our Guarantee of Service ensures that we meet the needs of our customers.

Your comments provide valuable information to assist us in keeping our service relevant to your needs.

- Constructive complaints help us identify areas where our service can be improved.
- Compliments reinforce what is well accepted and ensures these areas are maintained.

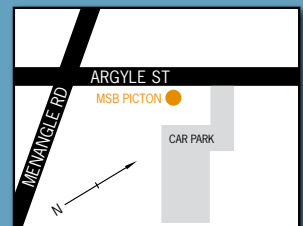
NEWCASTLE

Ground Floor
NSW Government Offices
117 Bull Street, Newcastle 2300
Telephone: (02) 4908 4300
Facsimile: (02) 4929 1032



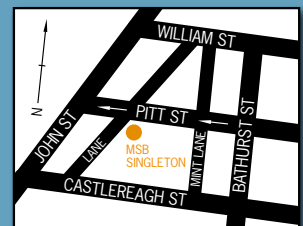
PICTON

100 Argyle Street, Picton 2571
Telephone: (02) 4677 1967
Facsimile: (02) 4677 2040



SINGLETON

The Central Business Centre
Unit 6, 1 Pitt Street, Singleton 2330
Telephone: (02) 6572 4344
Facsimile: (02) 6572 4504



WYONG

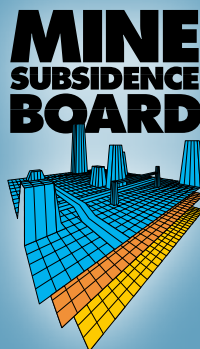
Suite 3 Feldwin Court
30 Hely Street, Wyong 2259
Telephone: (02) 4352 1646
Facsimile: (02) 4352 1757



24 HOUR EMERGENCY SERVICE

Free Call 1800 248 083

Email: mail@minesub.nsw.gov.au
Web: www.minesub.nsw.gov.au



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