Transport for NSW

Fact sheet – ground movement, vibration and ground-borne noise

Western Harbour Tunnel

February 2025

We acknowledge the Traditional Custodians of the Country on which Western Harbour Tunnel is being constructed, including the Gadigal, Cammeraygal, and Wangal peoples, as well as the Aboriginal peoples of Emu Plains, and we pay respect to Elders past and present.

This fact sheet provides information about ground movement and vibration including what causes it, how we manage it, and the property damage claim process.

Ground movement

Ground movement can be caused by many different factors, such as seasonal climate variations, vegetation and a natural process known as shrink-swell. Construction-related ground movement or settlement can also occur along the Western Harbour Tunnel project alignment where tunnelling is carried out.

On occasion ground movement can be caused by groundwater drawdown after tunnelling, where clay soils dry out and shrink. A certain amount of ground movement is allowed, with limits set by the Department of Planning, Housing and Infrastructure (DPHI). This is outlined in Condition E104 of the Western Harbour Tunnel project's (the Project) Conditions of Approval.

Prior to starting construction, ACCIONA prepared an assessment of the expected ground movement within the local area where our construction activities will take place. Our work is not expected to cause any structural damage to properties.

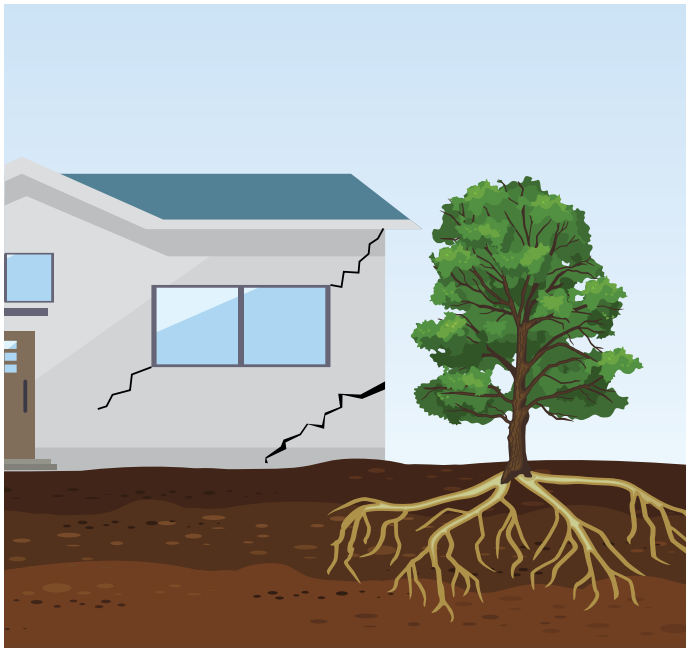
Tunnelling activities at Cammeray

What is shrink-swell?

Shrink-swell refers to the way clay soils move downwards, upwards and horizontally, depending on the reactivity of clay soil beneath and around a property. Other factors such as the depth and distribution of clay, and changes in moisture content, can also contribute to seasonal shrink-swell.

Moisture changes are the result of a combination of factors, and may include:

- seasonal and long-term climate variations including dry summers, extended wet seasons, floods and droughts
- the influence of buildings, garden coverage, drainage and trees which may contribute to drying out of the underlying soils
- the long-term effects of urban infrastructure including paving and drainage
- the prevailing moisture conditions of the ground, or any recent disturbance such as demolition, renovation of an existing house or removal of large trees/vegetation.



Tree roots can cause damage to property

Monitoring ground movement

ACCIONA has an extensive ground monitoring program in the local area where our construction activities will take place. The ground monitoring program measures both surface and sub-surface ground movement. It provides important information to ACCIONA and regulatory authorities on how the ground behaved before, during and after all construction activities. It includes monitoring points along the tunnel alignment such as:

- Precision survey targets, which are often attached to roads, footpaths, and the facades of buildings.
- In-ground geotechnical instruments.
- Groundwater monitoring wells.
- Below-ground instruments, which provide ACCIONA with baseline information about the seasonal (natural) behaviour of the ground.
- InSAR satellite settlement monitoring that provides historic baseline data as well as ongoing settlement data across the project during construction.

These monitoring devices measure minute changes in ground levels that cannot be seen on the surface. Data is also gathered from locations remote to the Western Harbour Tunnel works to form a baseline model.

All monitoring data from these devices is used to ensure that the amount of ground movement remains consistent with our predictions and within the permitted movement levels.

ACCIONA has a dedicated monitoring team that includes geotechnical engineers and surveyors, responsible for continually measuring ground movement. Data is gathered, assessed and monitored in daily meetings between the construction, geotechnical and surveying teams to identify any notable ground movement within the local area.

This process is overseen by Transport for NSW and the Independent Certifier for the Project.

An underground monitor in a basement

Survey targets on the facade of a building

Vibration and ground-borne noise

Vibration

During tunnelling some residents and businesses along the project alignment may experience vibration when we are using equipment such as roadheaders and tunnel boring machines (TBMs).

The level of vibration is dependent on the area's geology, the intensity and frequency of vibration, the distance from the source and the construction type of a building.

There are two types of vibration:

1. Vibration that people are able to 'feel' which is called Human Comfort,
2. Vibration that can cause structural or cosmetic damage to buildings.

People are able to 'feel' vibration at levels far lower than those required to cause even superficial damage to the most susceptible of buildings. An individual's perception of motion or response to vibration depends very strongly on their previous experience and expectations. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

The Project's Conditions of Approval require equipment and work methods that mitigate against vibration levels which are likely to cause cosmetic or structural damage to properties and human comfort level for vibration.

The human comfort level for vibration is much lower than the vibration level for cosmetic and structural damage which means that while you may notice vibrations, they are highly unlikely to cause damage to your property.

ACCIONA carry out on-site vibration monitoring regularly to ensure that vibration levels stay within the thresholds specified.

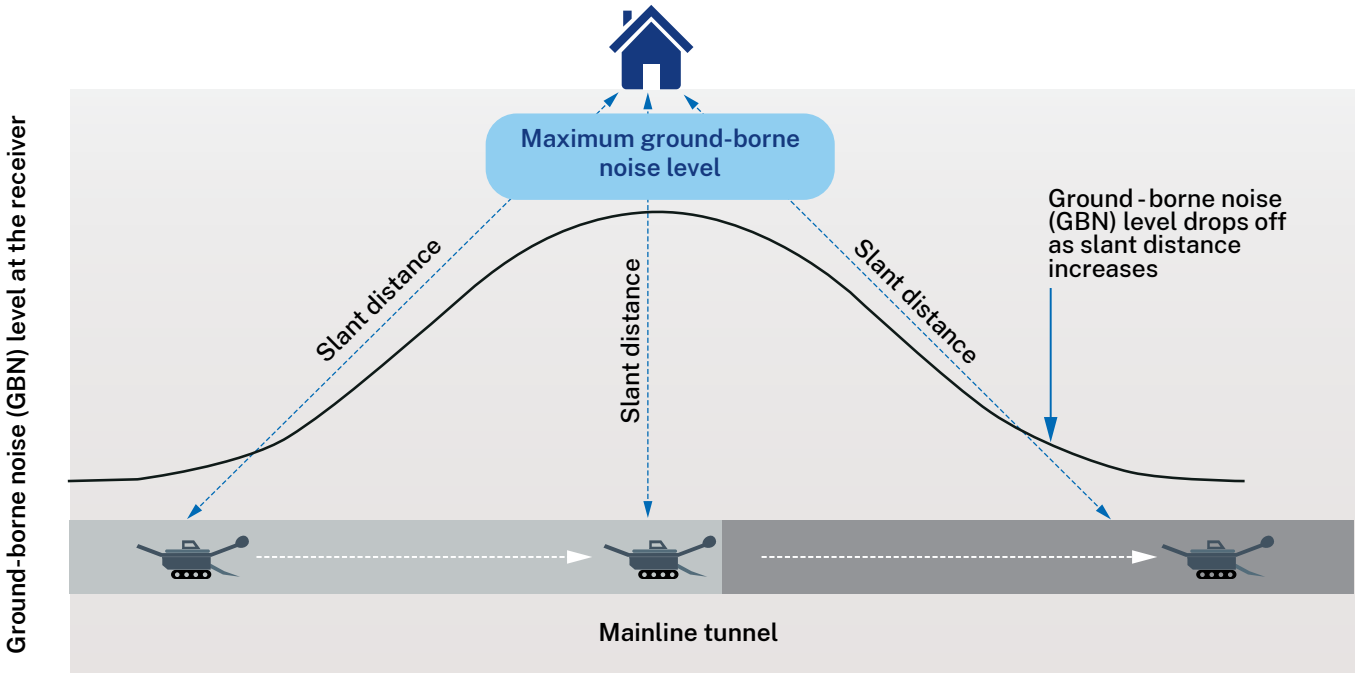
Ground-borne noise

Noise from tunnelling is called ground-borne noise, which passes through the ground and into a built structure, resulting in audible noise levels.

Ground-borne noise from tunnelling activities results from vibration being transmitted through the ground and 'regenerated' as noise into a building. It typically has a low frequency 'rumbling' sound due to the frequency of the vibrations. Like vibration, ground-borne noise is more noticeable when we are closest to a property, increasing on approach and reducing as we move away.

The Project's Conditions of Approval (Condition E71) require mitigation measures where ground-borne noise levels are predicted to exceed 35 decibels (dB) during the night time (10pm–7am). As the majority of our tunnelling on Stage 2 is more than 40 metres deep, the project is not expected to exceed this noise limit in the areas where we are working.

Roadheader excavation



Property condition surveys

Properties within 50 metres of our alignment will be offered a free property condition survey (PCS). Even though it is highly unlikely for any property damage to occur from our tunnelling, we encourage anyone eligible for a PCS to take up this offer.

We will send a letter to the owners of eligible properties about how to accept a PCS offer before we start tunnelling nearby.

What gets assessed in a damage claim?

ACCIONA follows a detailed assessment process when investigating any damage claimed. This process is shown in the flow chart.

Each property damage claim is treated uniquely and typically involves consideration of the following:

- information provided by the property owner
- information gathered during a site-specific visit
- the type of work being undertaken near the property
- the property's location in relation to the project
- the tunnel excavation progress
- previous development applications associated with the property
- the pre-existing state of the property captured in the property condition survey
- geotechnical conditions under the property
- ground movement and monitoring data
- shrink-swell and weather patterns
- materials used when constructing the property
- changes to the property, such as trees being removed or renovations
- the property's age.

If you suspect the Western Harbour Tunnel project has contributed to any damage of your property, we recommend you contact us to start the damage claim process as soon as possible. Do not wait until construction is completed in the area.

A project team member will maintain contact with the property owner throughout the assessment process.

1. The property owner contacts ACCIONA using the contact details on this page
2. ACCIONA provides the property owner with a claim form to complete
3. The property owner completes the claim form, providing as much supporting evidence and detail as possible
4. ACCIONA visits the property to inspect the damage
5. ACCIONA considers all available data and assesses whether the Western Harbour Tunnel Stage 2 works have contributed to the claimed damage
6. ACCIONA provides the property owner with an outcome to their claim.

Contact us

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Visit our website at nswroads.work/whtportal

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