

**CORRIB FIELD DEVELOPMENT PROJECT**

**Onshore Works – Construction of Tunnel**



**METHOD STATEMENT Rev 02  
Tunnelling Operations**

**Appendix B**

**Addendum**

**SUMMARY**

This document describes the activities involved in maintenance and inspection, intervention works associated with the Tunnel Boring Machine (TBM) cutter head, working in a compressed air environment.

**PURPOSE/  
BACKGROUND**

The TBM requires inspection and maintenance of the mechanical components of the TBM cutter head. To undertake inspections and maintenance on the TBM cutter head it is necessary to develop an Intervention Plan (IP) as work must be carried out at above atmospheric pressure. This pressure is adjusted and stabilised to ensure and safeguard the health and safety of the Operatives and maintain face stability within the excavation chamber. The IP is tailored to the anticipated ground conditions at each location and sets out the parameters and roles and responsibilities for the intervention. The IP is developed in accordance with standard industry practice for tunnelling and Health & Safety Authority guidelines.

**LOCATION**

Hyperbaric interventions are required for both routine inspections and maintenance, as well as to address potential unplanned operational issues (mechanical upgrades or faults) with the working of the TBM. The frequency of planned interventions varies per soil type, and are expected to be higher when tunnelling through rock than when tunnelling through sands and gravel. Indicatively rock interventions could be required every 100-200 meter, and sand intervention every 200 to 400 meter.

**TIMESCALE  
(NORMALLY)**

The duration of interventions will vary depending on the nature and extent of the works within the TBM. It would not be expected to extend beyond five working days per intervention.

**CONSTRUCTION  
METHODOLOGY**

There is always a potential for small scale air loss based on formation permeability, where large fissures or weaker spots in the ground conditions occur then this air loss may migrate to the surface. To minimise this air loss the tunnel face is sealed using bentonite.

The bentonite slurry is normally used to support the excavation face during tunnelling works. Prior to an intervention, the slurry level will be drawn down in the cutting head chamber. A fresh bentonite slurry will be added into the cutter head, as required, to provide an additional thickened covering to the excavation face. This new bentonite slurry will be added to the cutter head chamber and will be left for an acceptable period. The bentonite slurry, applied to the face, will help reduce the compressed air escaping. Face stability calculations have been developed and are used as a safety measure for the workers and to ensure face stability.

The face pressure will be monitored continuously by the TBM driver. The following is a summary of the face pressure air loss for safe guide ranges for the workers while in the compressed air:

- 0-10m<sup>3</sup>/min Normal working conditions (Green)
- 10 -16m<sup>3</sup>/min Caution prepare to evacuate chamber (Amber)
- >16m<sup>3</sup>/min Evacuate (Red)

The TBM driver will record the air losses in his driver log. For all air loss above 5m<sup>3</sup>/min the TBM driver will notify the Site Engineer whereby additional monitoring and/or corrective action will be taken. The following is a summary of the time recording for log keeping:

	<ul style="list-style-type: none"> <li>▪ 0 -4m<sup>3</sup>/min      Record air loss every 60 minutes</li> <li>▪ 4 - 8m<sup>3</sup>/min      Record air loss every 30 minutes</li> <li>▪ &gt; 8m<sup>3</sup>/min      Record every 15 minutes</li> </ul> <p>Throughout the compressed air interventions the surface will be continuously monitored with the use of CCTV (where possible) and visually at appropriate vantage points. Should excessive bubbles be visible on the water surface during high tides or should there be any unusual visible surface formations on the sea bed at low tide the Observer will immediately contact the Site Engineer and inform him of the observations.</p> <p>Additional staff will routinely monitor the bay through visual inspection and report any unusual sightings to the Site Engineer. Corrective actions are implemented in the event of air loss rising above 5m<sup>3</sup>/min or for visible distortion of the sea bed during low tide or excessive compressed air bubbles on the surface. This will involve the Site Engineer reviewing the process and increase the monitoring of the bay for unusual activities.</p> <ul style="list-style-type: none"> <li>▪ If deemed necessary, the Site Engineer will advise the compressed air intervention team to evacuate the TBM cutting head and commence decompression activities. This should take approximately two hours.</li> <li>▪ A fresh bentonite slurry may be added into the TBM cutting head chamber. The new bentonite slurry will remain flooded within the chamber for an agreed period. This will provide a refreshed layer of bentonite slurry on the excavation face.</li> <li>▪ Other options to be examined by the Site Engineer may include, re-examination of the Face Pressures applied, use of thickening additives, etc.</li> </ul>
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POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION
Release of air to environment	Prior to the commencement of the compressed air intervention, fresh bentonite slurry is used to ensure that the face pressure is maintained, this solidifies the face which minimises air migration to the surface. For the intervention itself the level of bentonite in the excavation chamber is drained down (safe working level) and transferred back to the sealed bentonite system on the TBM.

POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION
Physical Disturbance of sea bed sediment caused by air release.	<p>Any level of physical disturbance will vary with the volume of air loss, and the location and state of the tide during the event. For incidents between chainage 200 and 2250, a small depression would result through sediment re-suspension, particularly if released during high water periods. The natural sediments between chainage 2500 and 3750 are generally coarser and more free-draining resulting in a smaller physical impact at these sites. All other chainages are generally in the channel and sub-littoral (i.e. underwater) and would not be visible or accessible by land. As these are also within the faster flowing areas of the bay, the resulting depressions would be larger, but very quickly erased due to higher natural sediment mobility.</p> <p>For the most part any small surface depressions created by air escape are limited to a localised physical impact of the granular material. This would have a minimal ecological impact, but may present a small localised hazard to some surface users of the area (where relevant). The estuary is separated into three zones based on sediment type, and tidal exposure. Subject to the safe accessibility of the location in general (ie without physical disturbance caused by a hyperbaric intervention), additional corrective actions may be employed should similar incidents occur in the future to reduce any potential risk to the public and to accelerate the natural sediment repair process. These may be:</p> <ul style="list-style-type: none"><li>• Rake over disturbed sands and silt back into the depression, at the earliest safe opportunity to reduce the depth of the depression and longer term loss of material from the site.</li><li>• Use of localised vibro-compactor to reduce the thickness of unconsolidated sands in the larger depressions that may be accessible by the public.</li><li>• As a precautionary action, if required any residual impacts that remain after the above corrective actions the affected area maybe temporarily cordoned off until sediments have recovered commensurate to the surrounding sediments.</li></ul>

ENVIRONMENTAL MONITORING	
Visual Inspection	The surface at the above ground location of the position of the TBM will be inspected visually and also via CCTV (where possible).
Environmental Monitoring	The surface impact will be inspected at the earliest opportunity where safe to do so. A confirmation of the physical and environmental impacts will be undertaken and the recovery/reinstatement of the seabed followed over an agreed period commensurate with the level of impact.