



**METRO NORTH
ORAL HEARING**

**SD-2.6Aiii Geotechnical Instrumen-
tation Report Rev A 300309**

Mater Stop

Geotechnical Instrumentation Report

M000384/243231/SD-2.6Aiii/A



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Mater Stop

Geotechnical

Instrumentation Report

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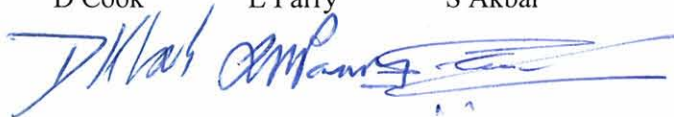
Mater Stop

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Executive Summary

It is proposed to construct the Mater Stop of the Dublin North Metro as an advance element of the project to enable integration with construction at the adjacent Mater Hospital. This is necessary because the proposed Mater Hospital works are at a more advanced stage of development than Metro North and require the stop box to be in place before they can be completed.

The proposed Stop will require the construction of a box measuring some 165m by 30m approximately 25m deep in close proximity to existing housing, infrastructure and the existing and proposed Mater Hospitals. Current proposals are to form the box within diaphragm walls extending slightly beyond the full depth of the excavation.

As part of the construction operation geotechnical monitoring will be required in order to determine:-

- Surface movements due to sub-surface effects of the construction operations on adjacent facilities.
- Deformation of diaphragm walls
- Ground movements adjacent to the Mater Stop site
- Water table levels within the ground

The report represents part of RPA deliverable SD-2.6A iii) – Geotechnical Instrumentation under the Contract and identifies the instrumentation which will be required, but does not set out to address specifically environmental monitoring such as contamination, noise and vibration.

The following instrumentation is recommended to fulfil the geotechnical monitoring requirements of the Mater Stop construction:

Existing Instrumentation:

- Precise Levelling Points and Prisms
- Standpipe Piezometers

New Instrumentation:

- Standpipe Piezometers – A number of new Piezometers are proposed in order to determine the groundwater profile due to the Mater Stop works. Three instrumentation profiles are proposed radiating from the station box in order to allow these groundwater profiles to be plotted.
- Inclinometers (Remote Data Capture) - Due to the proximity of Mater Private Hospital (MPH) and its associated sensitive equipment, at the south-east corner of the Master Stop box, it is proposed to install IPIs to 3 inclinometer tubes along that interface. These IPIs will be read remotely at a frequency which will need to be agreed with MPH.
- Inclinometers (Manual) – Elsewhere along the diaphragm wall it is proposed to take manual inclinometer readings at approximately 12 metre centres (in plan).
- Precise levelling Points – In addition to the RPA installed precise levelling points and prisms it is proposed to extend the precise levelling points out to the 1mm settlement contour, but at a reduced intensity. In addition it would be prudent to agree the installation of monitoring points to the ongoing MCHD works.

1 Introduction

1.1 Proposed Works

As part of the proposed Dublin Metro North scheme, linking Dublin city centre with the Airport to the north, a new metro stop is to be located on the site of the car park for the existing Mater Misericordiae Hospital. The local area is predominantly residential. Due to the advanced plans for a redeveloped Mater Hospital at the site location, Mater Stop is required to be constructed in advance of the main Dublin Metro North works.

Mater Stop will comprise a cut and cover box, which will contain the platforms and all required accommodation rooms. There will be three main surface penetrations, one for the entrance off North Circular Road, and two for ventilation shafts. The structure will be designed so that at a later date the TBM can transit through the box.

The Stop box will be constructed from diaphragm walls toed into the underlying bedrock, and tension piles will be required beneath the base slab to prevent uplift. At this stage it is envisaged that the box will be constructed using a top-down methodology.

The facilities, affected by the Mater Stop works, which will require geotechnical related monitoring include:-

- Mater Private Hospital (MPH)
- The current construction works for Mater Campus Hospital Development (MCHD)
- Leo Street Houses
- Potentially other structures within the 1mm settlement contour

1.2 Objectives

The Geotechnical Instrumentation Report for the proposed Mater Stop has been prepared to meet deliverable SD-2.6A iii). The geotechnical instrumentation is proposed to monitor;

- Movements due to sub-surface effects of the construction operations on adjacent facilities.
- Deformation of diaphragm walls
- Ground movements adjacent to the Mater Stop site
- Water table levels within the ground

Monitoring shall continue throughout the life of the Contract with the objective of checking during operation that the behaviour of the structural elements and ground conditions comply with the design predictions, to ensure safety factors are maintained and to minimise potential spurious claims.

Monitoring is not an end in itself but should be undertaken in support of the construction operation, therefore a number of objectives have been identified in Table 1.1.

Objective	Method
Construction Process Control	Provision of data, which informs decisions made as an integral part of construction activities
Design Verification	Provision of data to validate assumptions or predictions made during design and verify that the design is appropriate
Risk and liability allocation	Provide evidence which may be used to determine which works caused which effect and thereby determine which party may be accountable for the consequences of the measured effect.
Asset protection	Provision of data, which may be used in connection with contingency plans to protect existing assets or their operation.
Legislative Compliance	Provide evidence in support of a safe system of work for the work force and third parties (Health and Safety). To meet designer's requirements or to provide information needed for future management of the structures or systems affected (Construction Design & Management)
Risk Management	Provision of data which may be used to trigger pre-planned contingency actions to control risks associated with the effect of the works.

Table 1.1: Objectives of proposed monitoring programme.

In order to produce this document and drawing D MN 7091 GI 6010 "Construction Monitoring and Instrumentation Requirements" consideration has been given to:-

- Extent of the area to be monitored
- Likely frequency of monitoring
- Accuracy
- Density of monitored points
- Range of measurements to be undertaken
- System robustness
- Whom the monitoring is intended to inform
- How the monitoring data may be expected to be used.

1.3 Programme and Monitoring Stages

The geotechnical monitoring will need to be installed prior to the main construction works and sufficient allowance for background readings made.

1.3.1 Background Monitoring

Background monitoring is required to:-

- Establish the stability of monitoring systems prior to the works
- Determine any existing movements which would otherwise be attributed to the works

A longer background monitoring period will increase confidence but must be balanced against other factors such as risk of delay to the works. Sufficient time will need to be allowed for in the project programme for that confidence to be developed.

A minimum period of three months of data collection prior to construction work predicted to cause movements should be allowed for in order to establish base readings, but that will not provide sufficient information to quantify the effects of potential annual cycles.

1.3.2 Construction Monitoring

During construction monitoring will be required to control the construction process and maintain the confidence of the potentially affected third parties.

1.3.3 Close-out Monitoring

After construction ceases ground movements will continue and it will be necessary to continue monitoring until they have demonstrably ceased.

1.3.4 Monitoring during tunnelling

The programme for tunnelling is yet to be confirmed. Whilst falling outside the remit of this report, much of the instrumentation proposed will also have a relevance to tunnel construction, both into and out of the Mater Stop, by the PPPCo.

1.4 Definitions

Remote Data Capture [RDC]	Data which is collected and transmitted back to a location to be examined without manual intervention.
Manual Data Capture [MDC]	Data which is collected and transmitted back to a location to be examined by manual methods.

1.5 Monitoring Frequency

Monitoring frequencies will need to be determined once the contractors programme has been established but for remote data capture (RDC) this is likely to be on an hourly basis.

2 Instrumentation

2.1 Existing Instrumentation

2.1.1 Precise Levelling Points and Prisms

RPA are installing a number of precise levelling points and prisms. It is proposed that these installations should be incorporated within the geotechnical monitoring for the Mater Stop Box. The buildings affected are: the Mater Private Hospital, and properties in Leo Street, Leo Avenue and North Circular Road.

The details of these monitoring points are indicated on the following drawings;

- B MN 703 TU 6133 B01 Baseline Building Monitoring – Mater Stop Sheet 1 of 4
- B MN 703 TU 6132 B01 Baseline Building Monitoring – Mater Stop Sheet 2 of 4
- B MN 703 TU 6133 B01 Baseline Building Monitoring – Mater Stop Sheet 3 of 4

2.1.2 Piezometers - Standpipe

A number of piezometers have been installed during previous works on site and at the time of writing are still available. It is proposed that these be incorporated within the Mater Stop geotechnical monitoring.

Existing piezometers installed within the footprint of the Mater Stop box are unlikely to remain available and have been discounted.

2.2 New Instrumentation

2.2.1 Piezometers - Standpipe

A number of new piezometers are proposed in order to determine the groundwater profile due to the Mater Stop works. Three instrumentation profiles have been arranged (approximately) radially from the station box in order to allow these groundwater profiles to be plotted. Some are installed to below the rock head and others to within the glacial till (to monitor perched water tables).

2.2.2 Inclinerometers

Based on the current diaphragm wall panel length of 3m it is proposed that a void former be installed to every other panel and an inclinometer tube be installed to every other former thereby allowing an element of redundancy. In order to provide a confident base the installed inclinometer tubes are to extend 3m below the underside of the Mater Stop Base Slab or 3m into the rock, whichever is the greater. The tops of all the inclinometer tubes will need to be surveyed (both E & N) prior to first use.

(i) In-Place Inclinometers – (IPI) - [Real-time Data Capture (RDC)]

Due to the proximity of MPH at the south-east corner of the Mater Stop box it is proposed to install IPIs to 3 inclinometer tubes along that interface. These IPIs will be read remotely at a frequency which will need to be agreed with MPH.

(ii) Manual Inclinometers [Manual Data Capture (MDC)]

Elsewhere through the box it is proposed to take manual inclinometer readings at frequencies appropriate to the construction programme.

2.2.3 Precise Levelling Points

The RPA installed precise levelling points and prisms are limited in extent, and apart from the extremities of MPH are mainly adjacent to the Mater Stop Box. It is proposed to extend the precise levelling points to other buildings and above the major services to the 1mm settlement contour, but at a reduced intensity.

In addition it is proposed to install precise levelling points to the ongoing MCHD works at the interface.

2.3 Other forms of monitoring

Other forms of monitoring may need to be considered, (other than noise, vibration and contamination) following completion of condition surveys to the Mater Private Hospital and the Leo Street houses. It is likely that some form of crack monitoring will be required.

3 Conclusions and Recommendations

Additional monitoring, beyond that indicated as being installed by RPA, is proposed. This consists of:-

- Standpipe Piezometers

A number of new piezometers are proposed in order to determine the groundwater profile due to the Mater Stop works. Three instrumentation profiles are proposed radiating from the station box in order to allow these groundwater profiles to be plotted.

- Inclinometers (Remote Data Capture)

Due to the proximity of MPH at the south-east corner of the Master Stop box it is proposed to install IPIs to 3 inclinometer tubes along that interface. These IPIs will be read remotely at a frequency which will need to be agreed with MPH.

- Inclinometers (Manual)

Elsewhere along the diaphragm wall box it is proposed to take manual inclinometer readings at approximately 12 metre centres (in plan).

- Precise levelling Points

In addition to the RPA installed precise levelling points and prisms it is proposed to extend the precise levelling points out to the 1mm settlement contour, but at a reduced intensity. In addition it would be prudent to agree the installation of monitoring points to the ongoing MCHD works.

A strategy for collecting, reporting, reviewing, and acting upon the monitoring results will need to be developed in advance of the above monitoring points being installed at Mater Stop.

4 References

Drawings

D MN 7091 GI 6010 Construction Monitoring and Instrumentation Requirements

B MN 703 TU 6133 B01 Baseline Building Monitoring – Mater Stop Sheet 1 of 4

B MN 703 TU 6132 B01 Baseline Building Monitoring – Mater Stop Sheet 2 of 4

B MN 703 TU 6133 B01 Baseline Building Monitoring – Mater Stop Sheet 3 of 4

Documents

MN_703 Baseline Building Monitoring Works (Parnell and Mater Stops) – Employer’s Brief

B0307000-010/STB.360/001 Technical Note 25, Instrumentation & Monitoring . Example Specification

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