



**METRO NORTH  
ORAL HEARING**

**Proof of evidence  
Response to submissions  
relating to proposed  
modifications at Mater,  
Ballymun and Seatown.  
Rory O`Connor**



**Metro North Oral Hearing**

**Proof of Evidence**

**RPA Response to Submissions relating to proposed  
modifications at Mater, Seatown and Ballymun**

**Mr Rory O'Connor**

## **1.0 INTRODUCTION**

In November 2009, the Railway Procurement Agency (“RPA”) submitted details of proposed modifications to Mater, Seatown and Ballymun to An Bord Pleanála (“the Board”) at the Metro North Oral Hearing, in respect of the proposed Metro North Scheme, in response to stakeholders and local residents concerns. Full details of these proposed modifications were put on public display on 18th December 2009.

Three submissions were received by An Bord Pleanála by the closing date of 8th February 2010 and copies of these submissions were forwarded to RPA by the Board.

RPA has reviewed the submissions received which were from persons or bodies with whom RPA has been engaged on ongoing discussions throughout the course of the preparation of the Railway Order application and since the commencement of the oral hearing last April.

RPA will respond to these submissions, hereafter. RPA is satisfied that it has addressed the majority of concerns and issues raised by parties. This evidence summarises our response to the submissions.

## **2.0 DUBLIN COUNTY COUNCIL**

There has been close and continuous liaison between RPA and DCC throughout the design and EIA stages of this project. In its submission to the Board relating to the proposed modifications, DCC confirmed its support of the Metro North Scheme and of the proposed changes to the Mater Stop design stating that they have the potential to contribute significantly to the amenity of the area in terms of increasing the accessibility of the station and, by virtue of moving proposed ventilation structures, removing the need for demolition of dwellings on Leo Street and helping to address concerns of the Mater Private Hospital.

In their submission to the Board DCC request that RPA consult with the hospital development team in order to provide an integrated development. RPA has a close and continuous liaison with all the Mater Campus stakeholders, MCHD, MMUH, and NPHDB and we confirm that we will use all reasonable endeavours to work together by way of cooperation with a view to providing an integrated entrance development.

The new station entrance on Eccles Street shall be designed to be of a scale and character that is commensurate with the provision of a significant new piece of national transport infrastructure.

I can confirm that the proposed station entrance on Eccles Street can function in the event of an absence or delay of development of the proposed children’s hospital. Images of the entrance in isolation of the proposed children’s hospital were presented to this hearing on 7 December 2009 by Ms Anne Kiernan in her presentation on the revised design of the Mater Stop.

The impacts of the relocation of the southern ventilation structure to the rear of Leo Street have been assessed and detailed in the environmental report for the revised design of the Mater Stop previously submitted to the Board. The structure is no longer visible as part of the existing terrace and is no longer present in views at the southern end of Leo Street resulting in a positive visual impact. The impact of noise during routine ventilation system testing will be mitigated such that there are no residual impacts predicted. The emergency ventilation fans will be fitted with exhaust silencers. The fans will be attenuated to ensure that the noise levels in adjacent

buildings will not exceed noise criteria level NC 25dB and testing of fans will be limited to day time.

### **3.0 LEO STREET RESIDENTS ASSOCIATION**

In its submission to the Board of February 2010, Leo Street Residents Association raise a number of concerns relating to settlement, hours of tunnelling, the location of the ventilation structures, noise, numbers 25 and 26 Leo Street, access and liaison.

#### Settlement

Detailed evidence on settlement and property damage has been given to this hearing previously by Professor John Burland, Mr Paul Brown and by myself in RPA's response to submissions.

Over the past century the properties on Leo Street will have settled and additional settlement due to tunnelling is extremely unlikely to cause any significant damage. Any damage is likely to be limited to the type that can be corrected with minor decoration.

RPA's tunnel specialists have already carried out an assessment of the potential effects of ground movements on the properties on Leo Street, taking the age, character and condition of the buildings into account. This assessment demonstrates the properties will experience ground movement of a very small magnitude that is extremely unlikely to have a significant impact.

RPA excavated two trial holes at number 26 Leo Street in 2009. These excavations revealed no formal foundations beneath the walls at a depth of 1.2 metres. The assessment of the potential effects of ground movements on the properties on Leo Street has not changed following this work.

Residents on Leo Street have been invited to join the Property Owners Protection Scheme.

#### Working hours of tunnel boring machines

As most of the houses on Leo Street are located alongside the Mater Stop box, the tunnel boring machines will not be operated in the immediate vicinity of these houses. When the machines break into the northern end of the stop box, they will be dragged through the open stop box to starting tunnel boring again its southern end, which is located in the vicinity of number 23 Leo Street. RPA has predicted the vibration and groundborne noise levels that will arise during the tunnel boring machine excavations as the tunnel boring machines leave the Mater Stop box travelling south into the city centre. These noise levels may cause disturbance to local residents as well as to patients at the Mater Private Hospital.

As groundborne noise and vibration from tunnel boring machines cannot be mitigated at source, the only mitigation available to reduce the impacts relate to tunnelling hours. As outlined in my previous evidence RPA considered a number of alternatives in relation to tunnelling hours for this limited section of the alignment immediately south of the Mater Stop, and evaluated the relative impacts of each alternative.

The four options we considered have different levels of impact on the residents of Leo Street. Option 1, which is to operate the normal TBM working hours of 7.00 to 23.00 for six days per week, would result in disturbance to residents on Leo Street during these times. Option 2 is to work at nights only for six days per week. This would result in unacceptable levels of groundborne noise for local residents every night, Monday to Saturday. This would require the temporary relocation of residents

for six nights per week, and the closure of all the wards in the west wing and some in the main hospital. Option 3 is to work 24 hours per day to pass the residential area and the hospital campus as quickly as possible. In this case the residents of Leo Street would be disturbed, Monday to Saturday. This would require the temporary relocation of residents for six nights per week, albeit for a shorter duration than for Option 2.

The preferred option, Option 4, is to work extended hours over the weekends from 18h00 Friday to 0600 on Monday. The residents of Leo Street would be disturbed on the nights of Friday, Saturday and Sunday. This weekend working is expected to last for three or four weekends per tunnel drive but the effect on the Leo Street residents would be felt the most on the first weekend, will be far less significant the following weekend and not noticeable on the third. Again, relocation would be offered to residents for the period of disturbance. There would be no disturbance to residents whatsoever during the week and the offered temporary relocation would mean they are not impacted at all by groundborne noise and vibration.

As outlined in my previous evidence, Option 4 is by far the best option in terms of mitigating the effects of the tunnelling on the full range of sensitive receptors in this limited section of the alignment passing south from the Mater Stop box area. The impact on residents is limited to one or two weekends, and the impact will be further mitigated by offering relocation. The impact on patients in the hospital five-day wards is completely eliminated, as is the impact on hospital theatre operations. It is considered the very temporary effect on a limited number of residents in the area is much more appropriate than the suspension of clinical services and RPA would request that any Railway Order granted for Metro North would permit such tunnelling hours in this area.

RPA has had some discussions with local residents regarding relocation and has confirmed that the alternative accommodation would be of a suitably high standard and that appropriate arrangements would be put in place to ensure the security of people's properties while they are unoccupied.

There are no residual impacts in relation to vibration or groundborne noise predicted for residents or hospitals during the operational phase.

### Ventilation Structures

Residents raised concerns regarding the ventilation shafts and vents adjacent to the Mater Stop.

The northern emergency ventilation fans and escape core will be sited in the footprint of residences 398 and 400 North Circular Road. Its form has been agreed with the Planning Authority. The building is not overlooked by the houses on Leo Street and its scale is in keeping with the adjacent proposed hospital buildings.

As a result of the proposed modifications at the Mater Stop the southern ventilation structure will be located at the rear of 15-18 Leo Street. RPA has considered all feasible options for the relocation of the ventilation structure and the revised option proposed is the most suitable location. The vent structure will be located within the Mater Hospital grounds and will be no higher than the rear walls of the properties on Leo Street. The structure is no longer visible as part of the existing terrace and is no longer present in views at the southern end of Leo Street resulting in a positive visual impact. The scales of the two structures are different as at the northern end of the stop, the fans are mounted in a vertical orientation, and the vent structure is taller to accommodate these fans. At the southern structure, the fans are mounted horizontally inside the stop box and so the structure is simply a hollow structure accommodating the exhaust grilles.

The sole purpose of the ventilation structure is to allow smoke exit the underground station in the extremely unlikely event of a fire. Smoke or fumes will not be exhausted during routine testing. Metro tunnel fires are extremely rare events. Based on London Underground statistics a fire in any metro stop is expected to occur less often than once in one hundred years. This is a significantly less frequent occurrence than a house fire. Because the materials used in modern metro stations and vehicles are subject to strict fire safety standards, there is little that can burn in the station and the overall fire load in the highly unlikely event of a fire would be not expected to be significantly different to the fire load from a house fire.

The impact of noise during routine ventilation system testing will be mitigated such that there are no residual impacts predicted. The emergency ventilation fans will be fitted with exhaust silencers. The fans will be attenuated to ensure that the noise levels in adjacent buildings will not exceed noise criteria level NC 25dB and testing of fans will be limited to day time.

The ventilation building will be secure and designed to deter people from climbing it and entering properties at the rear of Leo St.

#### Hoarding

Residents requested that hoarding will consist of acoustic panelling to minimise noise.

The contractor is required to comply with the requirements of the EIS in terms of noise limit values. The mitigation measures set out in the EIS for the Mater Stop include for the erection of a 4 metre high solid hoarding where practical and feasible.

#### No 25 and 26 Leo Street

Residents have stated that they are pleased that as a result of the proposed modifications nos 25 and 26 will not now be demolished.

They have requested that the new wall that has been erected at the rear of the houses in Leo Street should now be extended up to the rear of no 26 and also request that nos 25 and 26 be refurbished and sold back into private ownership. RPA will ensure that properties in its ownership will be properly maintained at all times. The disposals of such properties, or the erection of walls on such properties, are matters for RPA.

#### Access to Mater Stop from Leo Street

It is not proposed to have any access to the Mater Stop from Leo Street. RPA does not control access to the hospitals.

#### Liaison Committee

RPA are committed to maintaining good relationships with all residents along the route of the scheme. Residents will be given a free phone number for reporting complaints which will be manned at all times during construction. RPA will be putting a comprehensive communications strategy in place for the construction phase of the project. This will include regular progress updates on the construction works, liaison meetings with local residents, details of complaints procedures, information sources and contact point for queries.

## 4.0 MATER PRIVATE HOSPITAL

### 4.1 Introduction

Under cover of its letter dated 29 October 2008, Mater Private Hospital (MPH) made a submission to An Bord Pleanála (ABP) which MPH stated noted its concerns and views regarding the potential impact imposed through the construction and operation of Metro North. The letter added that the Board of MPH viewed the development of the scheme as highly beneficial development for the north city centre and for patients and staff and MPH added that it reiterated its support for an urban public rail transport in the area of MPH. MPH also stated that its concerns, risks and anxieties can and should be addressed by RPA and that site specific mitigation measures are required to ensure patient safety.

At the request of ABP for the submission of Further Information, specifically for an environmental assessment of the impacts associated with construction and operation of Metro North at the Mater Private Hospital, RPA did on 1 October 2009 submit a document entitled "*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*".

The Executive Summary to the Further Information stated that RPA fully recognises the importance of patient healthcare at MPH and that no residual significant effects that could compromise patient health care will be tolerated. RPA added that there were no residual significant negative effects at MPH for the construction and operational phase of Metro North.

Under cover of its letter dated 16 November 2009, MPH made a submission to ABP which MPH stated provided an assessment of the further information. The letter added that in the opinion of Mater Private the further information remained inadequate and rejected the RPA assessment that the construction and operation of the Metro North Scheme will have no residual impacts on the hospital or its patients. MPH added that consultations were ongoing between MPH and RPA to determine scheme design and mitigation measures.

During the re-convened oral hearing, RPA provided a summary response to the Inspector of its position regarding the MPH submission of 16 November 2009. The response provided a brief summary of the status of each issue that was raised by MPH in its submission and noted that RPA expected that further details will be presented during the hospital module of the hearing. RPA also noted that progress did continue to be made and expected that resolution of any outstanding issues would be substantively reached prior to the conclusion of the hearing.

RPA provided a revised design of the Mater Stop and the changes to the original design are as a direct response to the various requests made by Stakeholders including MPH. This revised design was presented in RPA's document entitled "*Metro North Environmental Report for the Revised Design of Mater Stop*" submitted to ABP during November 2010 and which was also put on public display at that time.

The changes to the original design were summarised as follows:

- The inclusion of a second entrance to the Stop within the proposed National Paediatric Hospital (NPH) and off from Eccles Street and incorporation within NPH of the southern emergency escape core.
- The relocation of the southern emergency ventilation structure (and substructure) further away from MPH.

- The shortening of the overall box length by moving the southern Stop diaphragm wall about 20m further away from MPH.

An environmental assessment of the construction and operation of the revised design at Mater was provided and it reflected the impacts of the revised design on the environment and concluded by comparing the impacts of the revised design with those arising from the original design.

The revised design substantially further mitigated impacts upon MPH.

MPH provided observations on the revised design in a response received by ABP on 8 February 2010. The observations again recorded that MPH was supportive of Metro North and that it had continued to engage with RPA to ensure that sufficient mitigation measures were put into place to protect the hospital from any adverse impacts. MPH added that the concerns were set out in its previous submissions.

MPH added that it welcomed the new measures contained in the revised design.

Prior to and since the submission of the observations on 8 February 2010, RPA has continued to meet with MPH as a continuance of the Environmental Impact Assessment process and further progress has been made in agreeing mitigation measures with MPH. This evidence responds in summary form to all the issues raised by MPH and notes the agreements reached between RPA and MPH in terms of mitigation of the environmental effects.

It should be noted that agreements very specific to MPH have been reached to recognise the very special circumstance of an operating hospital in very close proximity to the construction works and the mitigations proposed would not necessarily be appropriate to other parts of the scheme. In reaching these agreements it has been necessary to consider the effect on other stakeholders in the area and the mitigations proposed represent the best solution in consideration of all stakeholder concerns.

## **4.2 Scope of Evidence**

In its submissions of 29 October 2008, 16 November 2009 and 8 February 2010, MPH set out its concerns under a number of headings (occasionally differently titled between the three submissions) and as such in this evidence, RPA has addressed all of the key concerns under the following headings:

- Ground movement.
- Traffic impacts.
- Human health.
- Airborne noise.
- Vibration (and associated groundborne noise).
- Electromagnetic interference.
- Utilities.
- Construction nuisance (dust and mud).
- Monitoring and liaison.

Each of the above is addressed in turn in the following.

### 4.3 Ground Movement

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of structural damage from construction of the Metro works. The submission focused on the following issues:

- Settlement caused by ground loss during tunnelling operations.
- Differential settlement due to tunnelling in close proximity to piled foundations.
- The degree of lateral loading to be exerted upon the piles due to tunneling.
- The effect of dewatering and possible settlement of the MPH foundations.
- Vibration emanating from rock breaking with explosives.
- MPH consideration that the projected damage category would lead to an event causing MPH to be uninhabitable.
- MPH view that the tunnel should be re-aligned.
- MPH view that alternative construction methods should be proposed.

In its submission of 16 November 2009, MPH responded to RPA “*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*” and MPH set out its concerns regarding the effect of ground settlement and structural stability from construction of the Metro works. The submission focused on the following issues within item 6 of the MPH submission:

- The predicted ground movements and the effect on joints between the west wing and the main building of the hospital.
- The predicted floor slope at sensitive equipment and the view that the impact will require repairs as well as re-commissioning of high tech medical equipment.
- The concern that there would be a high volume of minor cracks that may require extensive repairs and the possibility of compromising lead lined walls.
- Rock breaking with explosives.
- The appropriateness of the tunnel volume loss factor used within RPA’s analysis.
- The damage category derived in the EIS.
- The analysis of stresses induced in piles due to tunneling.
- The analysis of settlement in terms of clinical equipment for which RPA has determined that there is “no effect”.
- The requirements for detailed monitoring and contingency planning.
- RPA proposal to provide an adjustable foundation for the linear accelerator.
- Predictions of ground settlements associated with the Stop box excavation.
- MPH proposal that pre-loading of temporary struts be a contractual requirement.
- The impact on the hospital of construction induced ground water lowering.
- MPH request for further borehole information.

- MPH commentary on RPA risk assessments.

In its submission of 8 February 2010, MPH set out its concerns regarding the effect of ground settlement and structural stability from construction of the Metro works. The submission focused on the following issues within item 2 of the MPH submission:

- The introduction of an excavation for the second entrance has introduced a new adverse impact as no excavation previously existed along the western flank of the hospital.
- The shortening of the main box is likely to reduce the settlement impact on the Linac but MPH requires confirmation that the improvement is sufficient to fully mitigate the settlement impact on both Linac machines.
- That additional work is required on mitigating the effects of ground movement on medical pipes and utilities.
- That updated ground movement predictions and settlement contour drawings be provided.
- That monitoring proposals be provided.
- That ground treatment proposals be provided.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects of ground movement have been appropriately mitigated.

The current status of each of the key issue is set out in the following.

#### Effect of Ground Movement on Clinical Equipment

In the response to Further Information request Item 1 Part 3, RPA detailed the predicted floor slope at each item of clinical equipment as well as the effect on that equipment and whether any mitigation was necessary. RPA has now updated the predictions to recognise the effect caused by the excavation of the second entrance and there is no significant change

On the basis of the predictions and based on information provided by MPH in regard to the sensitivity of the equipment to ground movement it has been agreed that only for the following equipment will a form up mitigation be necessary. These items of equipment are:

- The Varian linear accelerator; this item will continue to function until tunnelling works commence at which time operations will cease. On completion of the tunnel induced excavations the equipment will be re-levelled and commissioned.
- the Siemens linear accelerator which is moving towards the end of its usable life; this item will be de-commissioned, an adjustable floor slab will be provided and a new linear accelerator will be installed and commissioned. The floor will be adjusted as ground movements take place to ensure the continued safe operation of the equipment.
- The CT Simulator (which is to be installed within the next few months); discussions are in hand to ensure that the base frame of the equipment is adjustable.
- The eye laser; MPH has not yet been able to confirm whether the predicted slopes would have any effect or not, if mitigation is proven to be necessary then suitable measures will be agreed.

### Effect of Ground Movement on Medical Gases and Building Services

In its observations submitted to ABP on 8 February 2010, MPH noted the following:

*“There is additional work required for mitigating the effects of ground movements on the medical pipes and utilities at the Hospital” and*

*“Work to characterise these joints structurally was jointly commissioned by the Hospital and RPA”.*

Discussions are continuing between RPA and MPH to finalise the required mitigation measures to ensure, in particular, that medical gas pipes that cross between the west wing and the main building are not compromised. In its previous evaluations RPA was of the view that the movements to be experienced were such that the increase in strain induced in the pipework was well within the material property range, concluding that there was no risk to the pipes. This is still generally the view of RPA but given that the structural configuration of MPH is complex and given the RPA position, like that of MPH, that patient safety cannot be compromised it has been agreed that extremely conservative and robust mitigation measures will be provided. MPH has agreed to determine the mitigations that it considers to be necessary.

### Effect of Ground Movement on Building Structure

With the exception of work agreed to be necessary for the safeguarding of medical gas pipework and building services pipework, RPA has stated variously the following:

*“The calculated damage category forms the basis for determining the need for ground movement mitigation measures for each of the buildings assessed. It is generally accepted practice that where the degree of damage predicted is “negligible” (category of damage 0), “very slight” (category of damage 1) or “slight” (category of damage 2) that these categories fall under the aesthetic damage category and that protective measures are not required.”*

*“Mater Private Hospital, Predicted Damage Category - 0 (negligible)”*

MPH has agreed with this assessment.

## **4.4 Traffic Impacts**

In its submissions of 29 October 2008 and 16 November 2009 MPH set out a detailed commentary on both the overarching traffic management plan for Metro North and in terms of the local impacts that the Mater Stop construction traffic may have.

MPH has confirmed that it now has no comments in terms of the Metro North Scheme Traffic Management Plan (the overarching plan) and withdraws all its assertions in that regard as may be found in its various submissions.

MPH, further, has noted that the routing of construction traffic is such that heavy goods vehicles are precluded from using Eccles Street between Dorset Street Lower and the Mater Stop site entrance off Eccles Street and this has satisfied MPH concerns in terms of access to its hospital drop off point.

MPH has sought that the entrance to the Mater Stop compound be accessed from the North Circular Road. MPH now agrees that, on the provision that the construction traffic route down the western façade of MPH is within a tunnel type construction; this condition is no longer sought. Exit from the compound will be onto the North Circular Road as has always been the intention.

In addition to the “traffic tunnel” the site entrance road will be subject to the following as agreed with MPH:

- A speed restriction of 10kph.
- A recognised maintenance standard for temporary access roads.

#### 4.5 Human Health

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of *aspergillus* and *leptospirosis*. The submission focused on the following issues:

- MPH noted that, owing to the scale of the proposed development, proactive improvement works were in the process of implementation to augment the HEPA filter areas and that it anticipated agreement with RPA for compensation for this work.
- That the HEPA filter banks take up to one day to replace during which air conditioning could be compromised.
- That rodent control measures should be put in place.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects of *aspergillus* and *leptospirosis* have been appropriately mitigated.

In its submission of 16 November 2009, MPH responded to RPA “*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*” and MPH simply noted that RPA had provided an undertaking to provide an *aspergillus* prevention plan.

In its submission of 8 February 2010, MPH had no comment in relation to *aspergillus*.

4.5.1.1.1.1.1.1 Discussions have concluded with MPH and the following has been agreed:

- Mitigation measures for the prevention of *aspergillus* will be provided as set out in the RPA response to the request for Further Information, Item 1 Part 3, Clause 13.2.3.
- Contractors will be required to implement an effective rodent control plan.
- The appropriate sections of the contractors’ environmental plans that deal with the prevention of *aspergillus* and *leptospirosis* will be provided to MPH for comment.

#### 4.6 Airborne Noise

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of airborne noise. The submission focused on the following issues:

- Assessment of the cumulative predicted noise levels.
- Specific noise mitigation measures for MPH.

In its submission of 16 November 2009, MPH responded to RPA “*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*” and MPH set out its concerns regarding the effect of airborne noise from construction of the Metro works. The submission focused on the following issue within item 8 of the MPH submission:

- The appropriate airborne noise limits that should be adhered to.

In its submission of 8 February 2010, MPH set out its concerns regarding the effect of airborne noise from construction of the Metro works. The submission focused on the following issues within item 4.2.3 of the MPH submission:

- Specific noise mitigation measures for MPH.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects of airborne noise have been appropriately mitigated.

Discussions on the subject of airborne noise have been concluded with MPH and the following agreement has been reached:

#### Internal Airborne Noise Limits within Wards in MPH

The criteria for noise intrusion to be met inside all wards from external sources is 45 dBL<sub>Aeq,1hr</sub> daytime where daytime is defined as 07h00 to 19h00 Mondays to Fridays and 07h00 to 16h30 on Saturdays. Outside of those hours the criteria to be met shall be 35 dBL<sub>Aeq,1hr</sub> or 45 dBL<sub>Amax,F</sub>. These limits have been agreed on the basis of Health Technical Memorandum 08-01, Table 1 that is quite specific to noise levels in a hospital environment.

These limits will include for the cumulative effects if any of construction for the new Mater Adult Hospital.

#### Mitigation Measures to be employed

Mitigation measures that may be utilised by the contractor(s) may include any of the following but the final determination of the measures to be used to ensure that the specified limits are achieved will be determined by the contractor(s):

- Provision of a 4 metre high hoarding to the southern perimeter of the Stop box construction compound.
- Enclosing the power pack of the hydrofraise milling machine.
- Limiting other plant to 76dB at 10 metres.

In addition, recognising the proximity of construction haul traffic passing close to the west wing of the hospital in which patient wards are located, it has been agreed to enclose the road adjacent to the western façade in a tunnel type construction (roof and eastern side clad only).

#### **4.7 Vibration (and associated groundborne noise)**

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of vibration and associated groundborne noise. The submission focused on the following issues:

- Assessment of the cumulative predicted vibration and groundborne noise levels.
- Specification of appropriate vibration and groundborne noise levels that should be set to recognise the use of the hospital.
- Specific mitigation measures for MPH from tunnel and stop box construction.
- Details of monitoring systems to be put into place.
- Compliance with design standards.
- Provision of an alarm system such that works may be stopped in the event that trigger levels are reached.
- The control of construction activities.

- The establishment of direct lines of communication between MPH and the construction manager for the Mater Stop works and a dedicated construction liaison officer.

In its submission of 16 November 2009, MPH responded to RPA “*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*” and MPH set out its concerns regarding the effect of vibration and groundborne noise from construction of the Metro works. The submission focused on the following issue within item 8 of the MPH submission:

- MPH comments upon the vibration predictions and operating criteria set by RPA.
- MPH comments on the proposed mitigants and its view that the Stop box and tunnel alignment should be moved further away from MPH.
- The development of vibration monitoring both during construction and operation.

In its submission of 8 February 2010, MPH set out its concerns regarding the effect of vibration and groundborne noise from construction of the Metro works. The submission focused on the following issues within item 4.2.1 and 4.2.2 of the MPH submission:

- The accuracy of the vibration predictions provided.
- The working hours of the tunnel boring machines considered by MPH to be appropriate.
- The provision of groundborne noise levels from stop box construction.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects of vibration and groundborne noise have been appropriately mitigated.

Discussions on the subject of vibration and groundborne noise have been concluded with MPH and the following agreement has been reached:

#### Vibration and Groundborne Noise from Stop Box Construction

RPA has predicted the vibration and groundborne noise levels that will arise during the construction of the Stop box including the second entrance. These have been essentially accepted by MPH as being correct. The acceptable criteria for vibration in terms of clinical equipment and patient welfare have been agreed with MPH. Where the limiting criteria cannot be achieved, mitigation measures have been agreed between RPA and MPH.

In regard to vibration limits, MPH have stated that “*The results for vibration testing in the Theatres suggest that the tolerance level should be set at 20µm/s*” The predicted levels exceed this tolerance in some theatres for a short duration. In addition the predicted vibration levels exceed the operational tolerances for a limited number of items of clinical equipment, again for a short duration.

The criterion for noise intrusion to be met inside all wards from external sources is 40 dB<sub>L<sub>Amax,S</sub></sub> daytime where daytime is defined as 07h00 to 19h00 Mondays to Fridays and 07h00 to 16h30 on Saturdays. The predicted groundborne levels do not exceed this criterion.

Mitigation measures have been identified that include reduction in the hydrofrise power output should that be necessary to achieve the agreed criteria. However, in the event that it transpires that these criteria cannot be met where the works are at

the closest to MPH and in recognition that the works have to be constructed it has been agreed that the following further mitigation would be acceptable to MPH:

- MPH has accepted that weekend working may exceed the criterion of 40  $\text{dB}_{\text{L}_{\text{Amax,S}}}$  daytime. This is in recognition that wards in the MPH west wing which are the closest to the works are not occupied at weekends. Similarly, since clinical equipment will not be in operation vibration limits set for that equipment may be exceeded.
- MPH has agreed that if necessary it would temporarily suspend affected services.

#### Vibration and Groundborne Noise from Excavation by Tunnel Boring Machine

RPA has predicted the vibration and groundborne noise levels that will arise during the tunnel boring machine excavations. These have been essentially accepted by MPH as being correct. The acceptable criteria for vibration and groundborne noise in terms of clinical equipment and patient welfare have been agreed with MPH.

In regard to vibration limits, MPH have stated that “*The results for vibration testing in the Theatres suggest that the tolerance level should be set at 20 $\mu\text{m/s}$ ” The predicted vibration levels are in excess of this vibration limit. As such, during the day if the TBM were to operate then all theatres throughout MPH would have to suspend services for a duration of about one week (per tunnel boring machine).*

In regard to groundborne noise limits, MPH has stated that for patients to be able to sleep at night a tolerance level at night of 40  $\text{dB}_{\text{L}_{\text{Amax,S}}}$  must be met. The predicted noise levels are such that for many of the wards the limit would be exceeded. As such, during the night if the TBM were to operate then many wards throughout MPH would have to suspend services for a duration of about one week (per tunnel boring machine).

In recognition of the dilemma noted above RPA considers that work by tunnel boring machine over the very limited section of the alignment passing MPH would best be carried out by working continuously over weekends (18h00 Friday to 0600 Monday). This would last for between three and four weekends per tunnel boring machine. It is considered that this very temporary effect on a limited number of residents in the area is more appropriate than the suspension of clinical services.

#### **4.8 Electromagnetic Interference**

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of electromagnetic interference. The submission focused on the following issues:

- The need to determine the DC, AC and RF immunity of all clinical equipment.
- The need to model magnetic field emissions.
- The need to consider mitigation measures including active cancellation, shielding and buried conductors.

In its submission of 16 November 2009, MPH responded to RPA “*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*” and MPH set out its concerns regarding the effect of electromagnetic interference from operation of Metro. The submission focused on the following issues within item 9 of the MPH submission:

- Discrepancies between RPA and MPH in regard to the level of track current that will eventuate.

- The effect of coasting ferromagnetic light rail vehicles.
- The results of testing within MPH which were not available at the time of the submission.
- Additional testing of a linear accelerator elsewhere.
- Mitigation strategy utilising a “third rail”.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects of electromagnetic interference have been appropriately mitigated.

In its submission of 8 February 2010, MPH provided no further comment.

Discussions on the subject of electromagnetic interference have not been finally concluded with MPH. However RPA has previously stated that *“RPA confirm that should it finally be proven that there is any detrimental effect by electromagnetic fields caused by the operation of the Metro then suitable measures will be provided to ensure that such effects are mitigated.”*

In addition RPA has also stated that the same would apply to any detrimental effect caused by construction of the works.

The following studies are to be completed as agreed between RPA and MPH:

- An updated forecast of track current following mitigation measures proposed by RPA in terms of the traction layout along with an associated calculation of the predicted electromagnetic fields.
- Testing of the effect of coasting light rail vehicles.
- Cathode ray tube immunity testing within MPH.

These studies will further inform the detailed design of the track traction layout. The resulting track traction layout to be provided it is expected will fully mitigate the effects of electromagnetic interference.

#### **4.9 Utilities**

In its submission of 29 October 2008 and 16 November 2009, MPH sought that conditions be imposed upon RPA that RPA provide redundant services for all incoming utility services and for additional backup equipment within the hospital itself. As such they sought an additional alternative electrical and gas supply, redundant telecommunications lines along with a back-up generator and additional UPS capacity.

MPH has subsequently agreed with RPA that such additional services or back-up equipment would not be appropriate or necessary. However, RPA has agreed that the following provisions would be appropriate:

- That MPH is provided advance notice of any planned service outages requested by the Metro North contractor(s).
- That in the event of any unplanned outage caused by the Metro North contractors every effort will be made by the contractors in discussions with the service providers to effect repairs immediately.
- That MPH will be afforded the opportunity to comment upon contractors method statements for works on services that, should such services be interrupted, could affect the security of MPH supplies.

#### 4.10 Construction Nuisance

In its submission of 29 October 2008, MPH set out its concerns regarding the effect of dust emissions and deposition of mud. The submission focused on the following issues:

- That dust emissions and possible intake into MPH pose a real and credible risk to patients and RPA should provide a workable solution to ameliorate this risk.
- That there are no site specific mitigation measures for MPH and that no account has been taken of construction methodology.
- That RPA be required to provide a detailed methodology of how dust emission be minimized.
- That RPA agrees that should dust deposition cause any malfunction of air control/filtration equipment that construction activities would stop immediately.
- That the impacts of mud are mitigated and twice daily inspections of all adjoining roads are undertaken along with the maintenance of a complaints register.

It is the view of RPA that each issue has been dealt with during ongoing discussions with MPH and all aspects dust and mud nuisance have been appropriately mitigated.

In its submission of 16 November 2009, MPH responded to RPA "*Further Information Request, Item 1 Part 3, Impact Assessment, Mater Private Hospital, Eccles Street*" and MPH noted that RPA had provided an undertaking to provide a dust control plan but added that there was little additional information provided and the concerns raised in the original submission have not been addressed.

In its submission of 8 February 2010, MPH had no comment in relation to dust emissions.

Discussions have concluded with MPH and the following has been agreed:

- Mitigation measures for the prevention of dust shall be provided as set out in the RPA response to Request for Further Information, Item 1 Part 3, Clause 13.2.3.
- The appropriate sections of the contractors' environmental plans that deal with the prevention of dust emissions shall be provided to MPH for comment.

#### 4.11 Monitoring and Liaison

RPA confirms that it will carry out all monitoring required in agreement with MPH to ensure the safe operation of all clinical equipment and patient welfare. Such monitoring will be provided for ground movement, airborne noise, vibration and groundborne noise and electromagnetic interference for both the construction and operational phases.

RPA confirms that MPH will be afforded a direct contact with the individual(s) responsible for the construction of the Mater Stop and adjacent tunnelling such that matters of environmental concern may be discussed both before and during the works.

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