



REPORT – Condition D19 – Permanent Noise Barriers

Project Name: WestConnex New M5

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Document Approval

Rev.	Date	Prepared by	Reviewed by	Recommended by	Approved by	Remarks
01	19/8/16	██████████				
Signature:						

Details of Revision Amendments

Document Control

The Project Director is responsible for ensuring that this Report is reviewed and approved. The Support Services Director (SSD) is responsible for updating this Plan to reflect changes to the Project, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Director before being distributed or implemented.

Revision Details

Revision	Details
00	Prepared for internal review
01	Addressed RMS suggestions

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1. Introduction

1.1 Context

The New M5 Project is the Stage 2 component of the WestConnex scheme, a NSW Government initiative to connect Sydney's west and south-west with Sydney Airport and the Port Botany precinct. It is being delivered by the Sydney Motorway Corporation (SMC), formerly the WestConnex Delivery Authority (WDA).

The CPB Contractors Dragados Samsung Joint Venture (CDS-JV) will deliver the design and construction of WestConnex Stage 2, also referred to as the New M5 (the Project). The Project will run from the existing M5 East corridor at Beverly Hills via tunnel to St Peters, providing improved access to the airport, South Sydney and Port Botany precincts. The Project will substantially improve the east - west corridor access between the Sydney CBD, Port Botany and Sydney Airport precincts and the South West growth areas.

The Project will deliver approximately nine kilometres of two-lane twin tunnels with capacity to operate three lanes in the future, motorway to motorway connections to the upgraded King Georges Road Interchange at Beverly Hills, and a new interchange at St Peters. Infrastructure Approval was granted for the project on 20 April 2016. Major works are expected to commence in mid-2016 and the New M5 tunnel is scheduled to open to traffic in late 2019.

1.2 Condition D19

Condition D19 of Infrastructure Approval SSI-6788 (the Project Approval) reads as follows:

“The Proponent must implement operational noise mitigation measures (such as noise barriers or at-property architectural treatments) in areas where the documents referred to in conditions A2(b) and A2(c) have identified the receivers would be subject to construction noise impacts and in areas where existing noise barriers are to be altered or removed prior to commencement of construction, where feasible and reasonable. Where this is not feasible and reasonable, the Proponent must submit to the Secretary for approval a report providing justification as to why along with details of the temporary measures that would be implemented to reduce construction noise impacts until such time that the operational noise mitigation measures are implemented.

The report must be provided to the Secretary prior to the commencement of construction works which would affect the identified receivers.

Nothing in this condition prevents the Proponent from submitting separate reports for separate areas of construction.”

The condition relates to managing construction noise impacts at affected receivers but only for areas identified as requiring permanent noise mitigation measures to manage operational noise.

Further condition D19 requires the submission of a Report to the Secretary for the Secretary's approval where it will not be feasible and reasonable to install the operational noise mitigation measure/s prior to commencement of construction works which would affect the identified receivers. Further details of mitigation measures to reduce the construction noise need to be detailed should we be unable to implement the operational treatment.

This Report (the Report) constitutes a Report under condition D19, specifically in relation to the installation and removal of existing barriers and installation of new permanent barriers at Kingsgrove / M5.

Please note that the removal and installation of new barriers only occurs at Kingsgrove / M5. No other removals or installation of new barriers is required on the remainder of the Project.

In order to address the requirements of D19, this report provides for the following:

- Location and Design
- Construction timing
- Feasible and reasonable reasons for not being able to install the barrier/s prior to construction, and
- Interim temporary mitigation measures.

2. Location, Design and Construction Methodology

2.1 Location

The location for the permanent noise wall are provided in Figure 1. The noise walls are located on the northern and southern sides of the M5 Motorway. There are 4 types of noise barriers with substructure details . The locations of these are provided below on figure 1. The cross sections providing the noise walls and substructures details for figure 1 are provided in section 2.3 of this report, specifically figures 2 to 5.

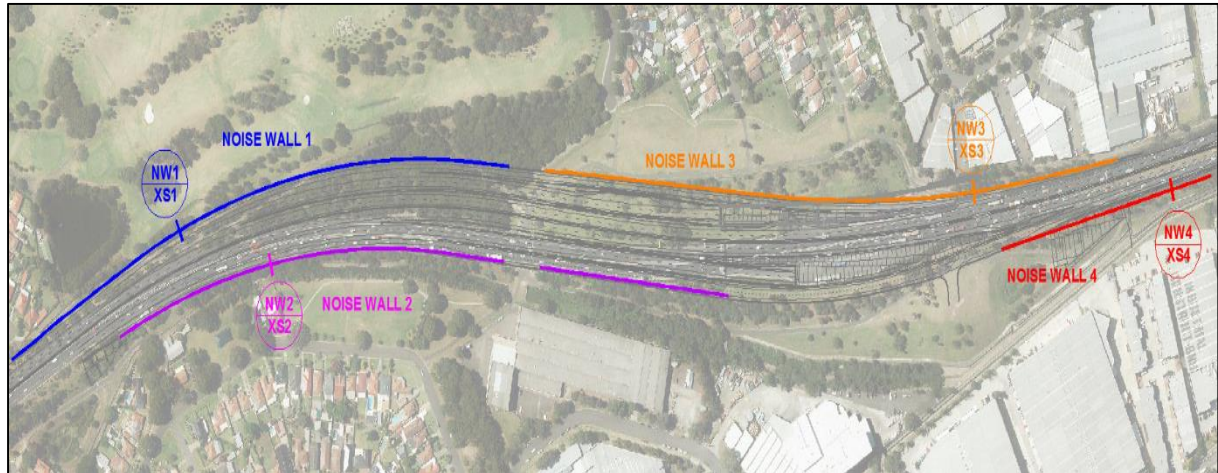


Figure 1 - Concept Design Permanent Noise Barrier Locations

2.2 Design

The noise barriers as depicted in Figure 1 are currently undergoing final design. The location and heights have almost been completely finalised and it is anticipated that the permanent noise barriers will comprise of a traditional steel post and panel configuration.

One of the key components for noise barrier mitigation is the location of the barrier. Noise barriers best mitigate operational noise when located as close as possible to the operational source. In this instance the source form operational noise is east and west bound traffic on the M5. Design has focused on placing the barriers as close as possible to traffic. By locating the barriers close to traffic it has subsequently meant the barriers needed to be integrated into the final roadway design. In essence the permanent noise barriers are installed on top of the final road and / or permanent alignment structures associated with the permanent road. In this instance the barriers north and south of the M5 are located upon permanent alignment structures such as reinforced earth walls, bridge barriers and insitu concrete retaining walls. These are illustrated in the cross sections for figures 2 to 4 in section 2.3 of this report.

2.3 Construction Methodology

2.3.1 Noise Wall 1

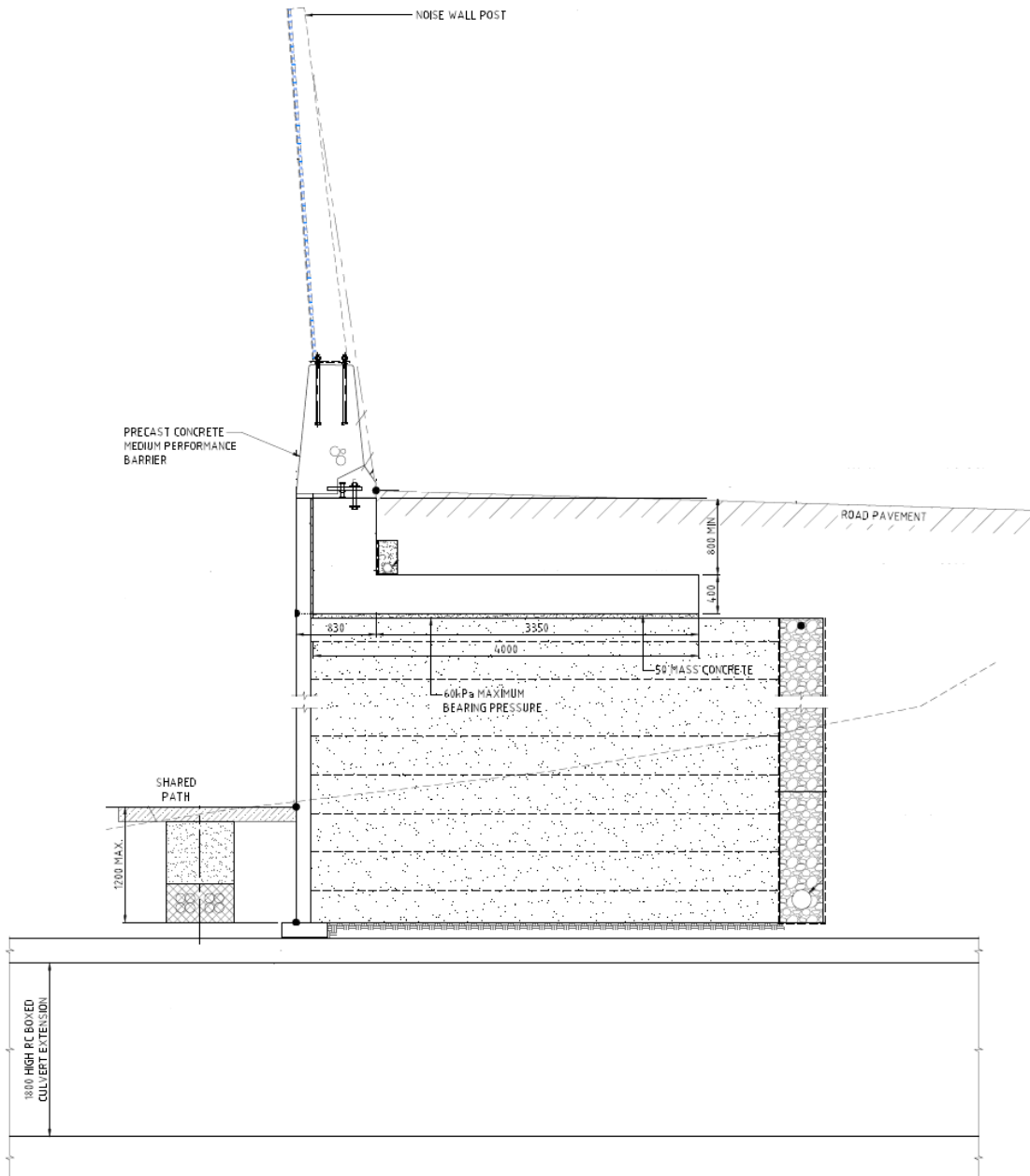


Figure 2 – Noise Wall 1 (Figure 1 cross section – NW1 – XS1)

This typical arrangement in figure 2 shows that significant substructure construction works must be completed prior to permanent noise wall 1 being constructed. This includes the following scopes of work:

- Removal of existing unusable materials and site preparation
- Foundation ground treatments
- Construction of reinforced box culvert extensions
- Construction of reinforced earth retaining wall
- Construction of Kinderlin bridge widening
- Construction of barrier foundation on top of retaining wall
- Construction of new formation and pavements
- Construction of roadside barriers

Permanent noise barrier construction for noise wall 1 can only commence upon the completion of the above listed founding structure elements. A detailed assessment of noise wall 1 predecessors can be

found in Appendix A, this program shows all tasks which must be completed prior to the commencement of permanent noise barriers.

2.3.2 Noise wall 2

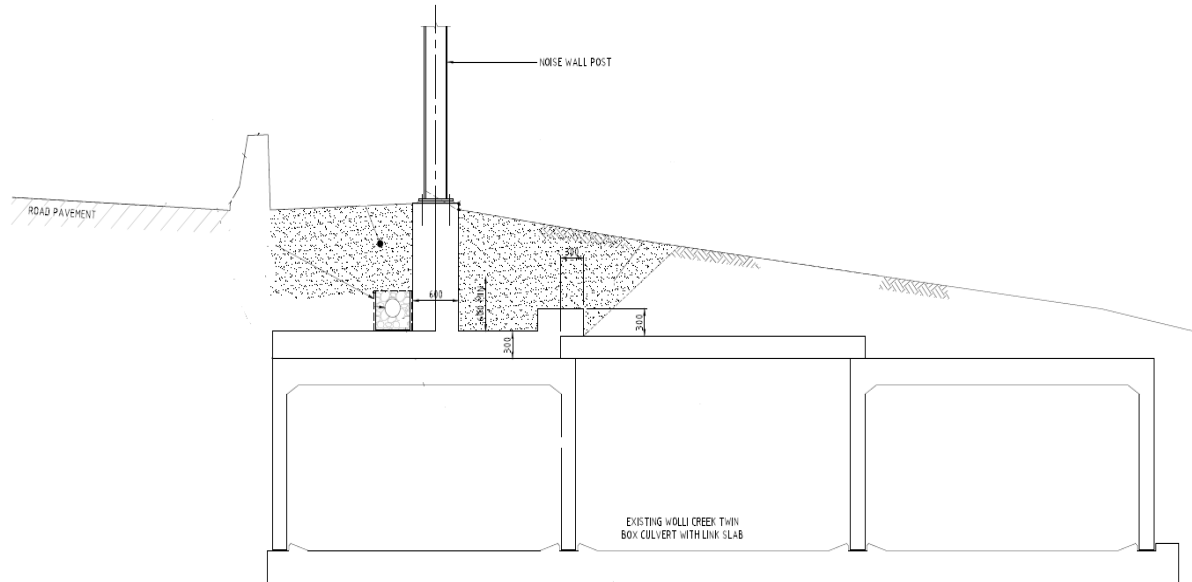


Figure 3 – Noise Wall 2 (Figure 1 cross section – NW2 – XS2)

This typical arrangement shows that significant construction works such as the below must be completed prior to permanent noise wall 2 being constructed.

- Removal of existing unusable materials and site preparation
- Foundation ground treatments
- Construction of barrier foundation on top of reinforced box culvert
- Construction of new formation and pavements
- Construction of roadside barriers

Permanent noise barrier construction for noise wall 2 can only commence upon the completion of the above listed founding structure elements. A detailed assessment of noise wall 2 predecessors can be found in Appendix A, this program shows all tasks which must be completed prior to the commencement of permanent noise barriers.

2.3.3 Noise wall 3

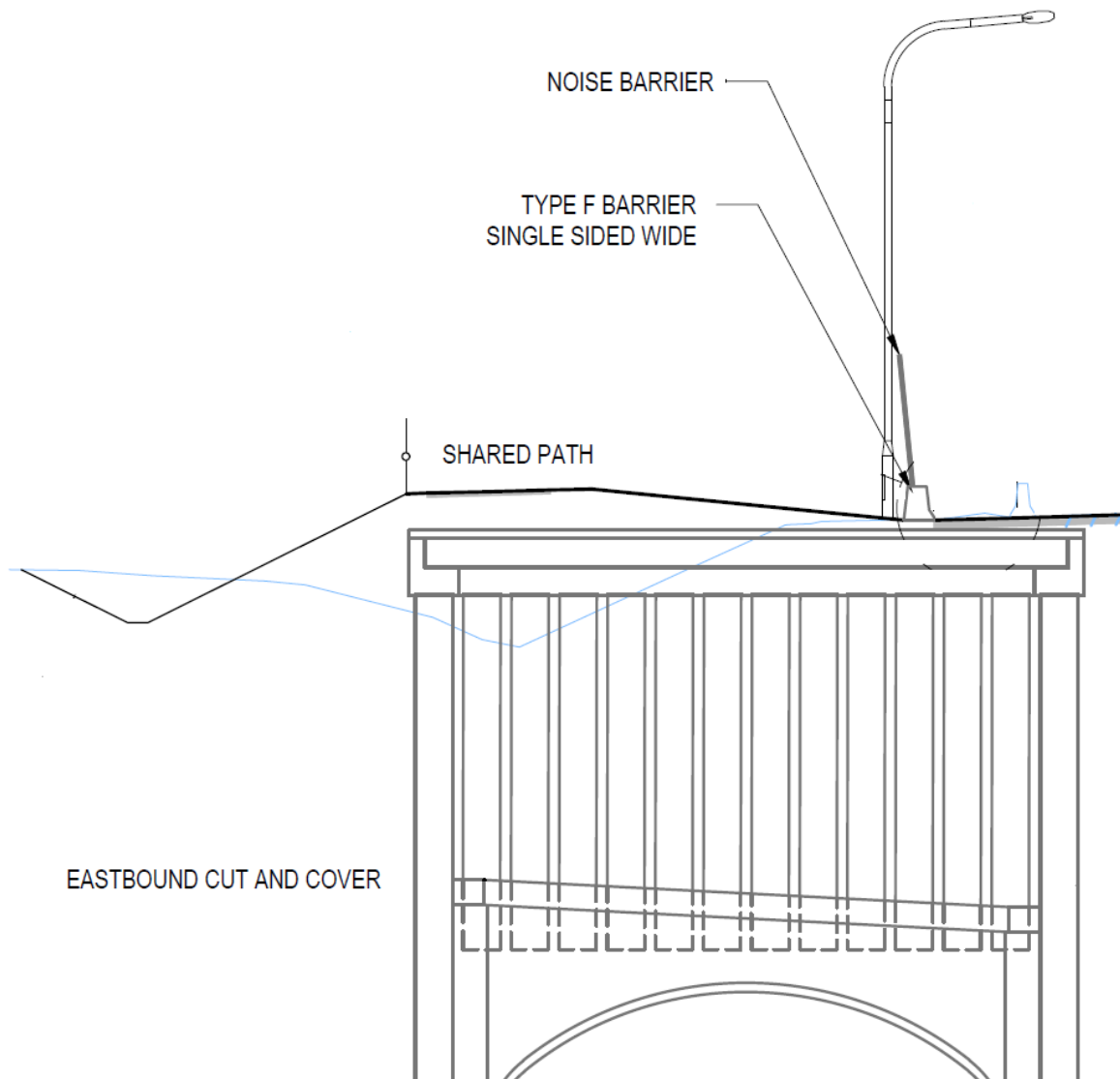


Figure 4 – Noise Wall 3 (Figure 1 cross section – NW3 – XS3)

This typical arrangement shows that significant construction works such as the below must be completed prior to permanent noise wall 3 being constructed.

- Removal of existing unusable materials and site preparation
- Foundation ground treatments
- Construction of piling platforms
- Construction of cut and cover piles
- Construction of Cut and Cover roof structure
- Construction of barrier foundation on top cut and cover roof
- Construction of new formation and pavements
- Construction of roadside barriers

Permanent noise barrier construction for noise wall 3 can only commence upon the completion of the above listed founding structure elements. A detailed assessment of noise wall 3 predecessors can be found in Appendix A, this program shows all tasks which must be completed prior to the commencement of permanent noise barriers.

2.3.4 Noise wall 4

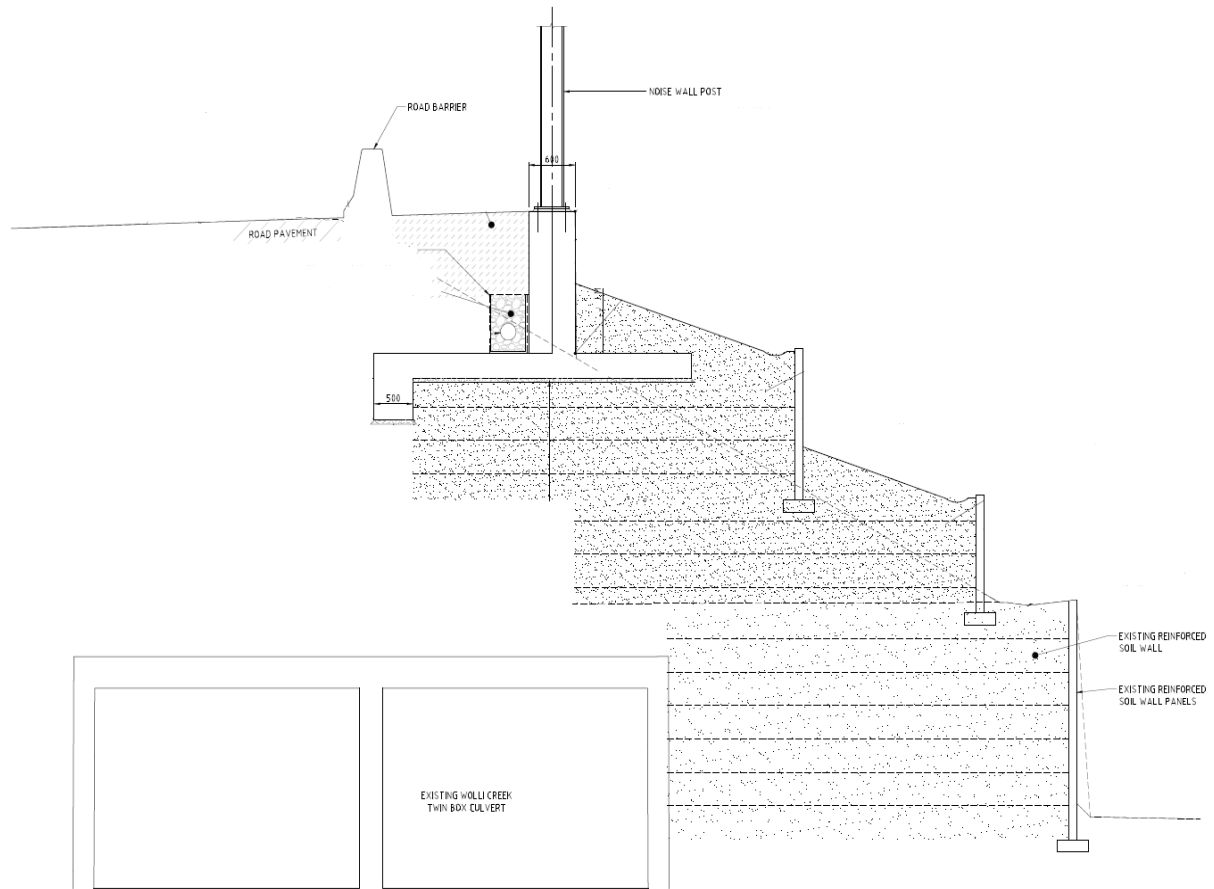


Figure 5 – Noise Wall 4 (Figure 1 cross section – NW4 – XS4)

This typical arrangement shows that significant construction works such as the below must be completed prior to permanent noise wall 4 being constructed.

- Removal of existing unusable materials and site preparation
- Foundation ground treatments
- Construction of reinforced retaining walls
- Construction of barrier foundation on top of retaining wall
- Construction of new formation and pavements
- Construction of roadside barriers

Permanent noise barrier construction for noise wall 4 can only commence upon the completion of the above listed founding structure elements. A detailed assessment of noise wall 4 predecessors can be found in Appendix A, this program shows all tasks which must be completed prior to the commencement of permanent noise barriers.

2.4 Construction Program

As detailed in Sections 2.2 and 2.3 the construction timing of permanent noise walls are dictated by the construction timing of supporting structures which is also dictated by construction traffic staging and traffic switches. Tables 1 to 4 below detail key program predecessor activities for permanent noise wall construction for each noise wall provided in Section 3 of this report. The overarching intent during construction will be to install permanent noise barriers as soon as possible and where the founding structures are completed to an extent where the barrier can be installed.

Table 1 – Noise Wall 1 Predecessors and Permanent Noise Wall Construction Durations

Noise Wall 1		Traffic Switch	Start Date	Finish Date
#	Predecessors			
1	North Compound - Clearing & Grubbing incl. Temporary Works	1	01 Aug'16	28 Aug'18
2	Sewer - Underbore Relocation	1		
3	Eastbound Trough - Piling / Capping Beams / Earthworks / Strut Installation	1		
4	Eastbound Bypass Ramp - Earthworks to Asphalt	1		
5	Temporary Westbound Roadworks Earthworks to Asphalt	2		
6	Pavements - Main Carriageway Earthworks to Asphalt	2		
7	Noise Wall Construction	3	07 Jul'18	03 Aug'18

Table 2 – Noise Wall 2 Predecessors and permanent Noise Wall Construction Durations

Noise Wall 2		Traffic Switch	Start Date	Finish Date
#	Predecessors			
1	Southbound Noise Mound - Testing, Excavate & Removal	1	15 Aug'16	04 Jul'17
2	Westbound Cut & Cover - Piling Pad Installation	1		
3	Retaining Wall No.7 (RW-200-07) Piling / Earthworks & Foundations	1		
4	Westbound Roadworks Earthworks to Asphalt	1		
5	Noise Wall Construction	1	01 Jun'17	01 Jul'17

Table 3 – Noise Wall 3 Predecessors and permanent Noise Wall Construction Durations

Noise Wall 3		Traffic Switch	Start Date	Finish Date
#	Predecessors			
1	Clearing & Grubbing at North Compound (Ch:1100 - Ch:1570)	1	15 Aug'16	19 Jun'18
2	Eastbound Cut & Cover - Piling Pad & Pile Installation, Capping Beams, Level 1 Earthworks, Roof Beams Installation & Closure	1		
3	Eastbound Bypass Ramp - Earthworks to Asphalt	1		
4	Temporary Westbound Roadworks Earthworks to Asphalt	2		
5	Eastbound Median Roadworks Earthworks to Asphalt	3		
6	M5 Existing Finishing Works - Installation of Toll Gantries & Tech Shelters	3		
7	Noise Wall Construction	4	01 May'18	30 May'18

Table 4 – Noise Wall 4 Predecessors and permanent Noise Wall Construction Durations

Noise Wall 4		Traffic Switch	Start Date	Finish Date
#	Predecessors			
1	Southbound Noise Mound - Testing, Excavate & Removal	1	15 Aug'16	03 Jul'18
2	Westbound Cut & Cover - Piling Pad & Pile Installation, Capping Beams, Level 1 Earthworks, Roof Beams Installation & Closure	1		
3	Retaining Wall Piling / Earthworks & Foundations incl. Structural Fill	1		
4	Westbound Roadworks Earthworks	3		
5	Retaining Wall Piling / Earthworks & Foundations incl. Structural Fill	3		
6	Westbound Roadworks Pavements	4		
7	Noise Wall Construction	4	06 Apr'18	08 May'18

3. Justification and mitigation measures

3.1 Justification – Feasible and Reasonable

Section 2 of this report provides the design, construction methodology and program for permanent barriers north and south of the M5 motorway. The feasible and reasonable justification for not being able to install the permanent noise barriers prior to construction commencing are addressed as follows:

Feasible:

- In order to best mitigate operational noise, the permanent noise walls have been designed at locations to ensure the barriers are as close as possible to the operational noise source.

For this outcome to be achieved the permanent noise barriers needed to be integrated into the permanent works for the project. The installation of the permanent noise barriers is dictated by the construction of the other permanent alignment structures in which the permanent noise walls are founded. Permanent noise walls are located on top of structures (detailed in Section 2.3 of this report) with these structures including reinforced earth walls, bridge barriers, cut and cover roof structures and insitu concrete retaining walls.

The walls cannot be installed prior to construction commencing due to the large amount of the other permanent construction works need to be constructed first to enable the installation of the permanent noise walls. Section 2.4 of this report provides the earliest program dates for completion of the noise walls

- The construction of the permanent works requires the permanent works to be developed under a number of construction stages and traffic switches. These stages and switches dictate when we have access to areas to construct permanent works, which includes the permanent works to which the permanent noise walls are founded.

Reasonable:

- Consideration has been given to redesign to accommodate operational noise barriers options prior to construction commencing. In order for the barrier to be installed they would need to be located outside the construction and permanent works zones. Despite the restriction of the narrow corridor, leaving the option only to integrate the barriers into the permanent works, a redesign of this nature would result in substantial commercial and time implications. Time and subsequent commercial implications would substantially outweigh the benefits of early installation as follows:
 - Redesign costs and time implications including:
 - project delay
 - potential to result in project modification
 - additional project resources
 - potential requirement for additional land
 - Cost and time associated with construction including:
 - changes to project construction methodologies, time and resources
 - stand down of current project resources until design was finalised
 - changes to planning approval documentation and resubmission and approval of the documentation
 - change to traffic switching and sequencing
- Change would result in a longer construction period and subsequent construction noise impacts
- Barriers could only be relocated to a location outside of the construction zone and permanent Roadworks which would subsequently mean the barrier would be located further from the operational traffic noise source. This subsequently delivers a reduced operational noise mitigation outcome

3.2 Interim mitigation measures

The project has considered a number of interim temporary noise mitigation measures as a result of construction works and the subsequent effects from the removal of existing permanent noise barriers at Kingsgrove / M5 and taking into account late installation of the walls as detailed in section 2 of this Report.

Several other conditions within the Planning Approval (the PA) take into account mitigation and management measures that address this issue. Conditions D20 and D68 (b) provide for Temporary Noise Barrier Strategy and Construction Noise and Vibration Management Plan respectively.

3.2.1 Kingsgrove Temporary Noise Barrier Strategy (TNBS)

The overall approach of the TNBS is to ensure that reasonable and feasible temporary noise barrier solutions are developed and implemented in accordance with CoA whilst specifically consulting with stakeholders and highly effected landowners to address their concerns.

A key component of the TNBS was the identification of sensitive receivers based on the proposed construction footprint. Sensitive receivers are detailed in the Construction Noise and Vibration Management Plan. Sensitive receivers are reviewed considering CoA D20 and specifically identified for consultation, especially landowners and residents directly adjacent to proposed temporary noise barriers. Noise barriers have been strategically positioned to account for optimum acoustic performance, key considerations were also given to minimize the visual impact to residents.

Modelling and assessment of traffic noise impacts have been determined using SoundPLAN v7.3 software, the modelling considers three different source heights to account for the different vehicle noise sources such as car exhaust/engine noise, tyre noise, truck engine noise, and high truck exhausts. For the purpose of this assessment the model has taken into account:

- traffic volume and heavy vehicle forecasts;
- vehicle speed;
- road gradient;
- location of the noise sources on the two carriageways;
- ground reference levels of the road and receivers;
- separation distances of the road to receivers;
- ground type between the road and receivers; and
- angles of view of the road from the receiver's position.

A noise management schedule has been prepared for the site identifying the noise mitigation strategies that are to be incorporated into the site design to minimise noise impact where it may occur. Predicted traffic noise impacts have been determined taking into account the removal of existing noise barriers, different temporary noise barrier combinations were considered to assist in reducing road traffic noise to receivers, especially as a result of the removal of earth mounds in the vicinity of Beverly Grove Park.

The impact from the removal of permanent noise barriers along the existing M5 was also assessed and temporary noise mitigation measures to reduce impacts during the construction phase were reviewed. This analysis forms the basis of proposed options which were consulted on with highly effected landowners and residents.

Barrier options have been developed considering a variety of acoustic ratings and noise wall performance levels, options have been subsequently matched to required Rw ratings determined from the modelling process. The overarching approach is to ensure that the installation of temporary noise barriers occurs prior to existing barriers being removed or as early as practicable subject to enabling access for noise barrier installation itself.

The TNBS Kingsgrove was provided to the Department of Planning and Environment (DPE) on 13 May 2016 and approved for use on 24 June 2016.

3.2.2 Construction Noise and Vibration Management Plan (CNVMP)

The CNVMP details on site management and other mitigation requirements to manage construction noise. Mitigation measures are outlined in Section 6 of the CNVMP. The measures include but are not limited to the following mitigation measures:

- Allocation of responsibilities and duties to various construction personnel
- Site training and inductions
- Use quieter & less noise emitting construction methods where feasible & reasonable
- Plan traffic flow, parking & loading/unloading areas to minimise reversing movements within the site
- Where reasonable & feasible, use structures to shield residential receivers from noise
- Regular verification checks on the noise emissions of all plant and machinery used for the Project
- Restricting hours of operations where feasible and reasonable

The CNVMP was provided to DPE on 27 May 2016 and was conditionally approved on 4 August 2016.

Appendix A