7. Construction methodology and staging

This section provides an overview of the construction methodology and staging. It provides a description of proposed construction compound locations, site access and service relocations.

Director-General's Requirements	Where addressed
A description of the project including: *Construction facilities, including construction compounds, lay-down areas and spoil stockpiling/management areas.*	*Section 7.8*
General construction impacts – the environmental assessment must consider the potential impacts associated with the construction of the project, and present a management framework for construction works to ensure that impacts are mitigated, monitored and managed	*Chapter 7, Chapter 9, Appendix F*

7.1 Construction strategy

The construction strategy would be based on the principal objectives of constructing the project in a timely and efficient manner and ensuring impacts are minimised through the provision of appropriate management measures. The strategy for construction consists of the following key elements:

- Provision of an off-motorway cycleway to allow the breakdown lanes to be utilised for traffic movements or construction areas. Windsor Road, Christie Road / Herring Road ramps to be completed early in the construction program to facilitate early access for traffic in these areas.
- Completion of the new eastbound and westbound lanes, as early as practicable to facilitate access and returning efficient traffic flow to the M2 Motorway.
- Major construction works primarily accessed from the M2 Motorway to minimise effect on local roads and minimise site clearance works.
- Minimise impacts to traffic flow on the M2 Motorway and local roads.
- Eastbound tunnel to be completed first followed by the westbound tunnel to meet peak traffic flow conditions.
- Safe construction of the project works, for travelling motorists using the M2 Motorway and local roads, for the workforce and for stakeholders.

7.2 Construction phases and activities

A summary of the likely construction phases and activities for the project is provided in Table 11.

Table 11 Summary of construction elements and activities

Construction phase	Activity
Environmental management system set-up	▪ Environmental management plans. ▪ Relevant licensing and approvals.
Site establishment	▪ Site set out. ▪ Compound site and ancillary sites (stockpile and storage sites).
Relocation of services	▪ Services location, identification and consultation with service provider. ▪ Relocation works.
Alternative off-motorway cycle route	▪ Establishment of alternative cycle route. ▪ Signposting and line marking.
Site preparation	▪ Clearing and grubbing. ▪ Removal of topsoil, spoil and stockpiling. ▪ Preparation of site access for construction. ▪ Installation of site fencing and safety barriers. ▪ Installation of temporary noise barriers. ▪ Traffic management setup and line marking. ▪ Temporary median works.
Demolition/Earthworks	▪ Excavation of cuts. ▪ Spoil transport and processing. ▪ Fill embankments. ▪ Batter treatments. ▪ Demolition of Beecroft Road bus ramp.
Drainage	▪ Preparation of construction diversion drains and sedimentation ponds. ▪ Extension of existing drainage systems (culverts and pipes) to accommodate widening. ▪ New drainage lines and pits. ▪ Extension of existing detention basins and new.
Pavement widening construction	▪ Cross stitching of existing pavement. ▪ Excavation / boxing out and construction of trench drainage. ▪ Pavement construction including sub-base and base. ▪ Placement and compaction of select material. ▪ Pavement surfacing and resheeting (remove and replace surface layer).
Ramp works	▪ New west facing ramps at Windsor Road. ▪ New east facing ramps at Christie / Herring Road.

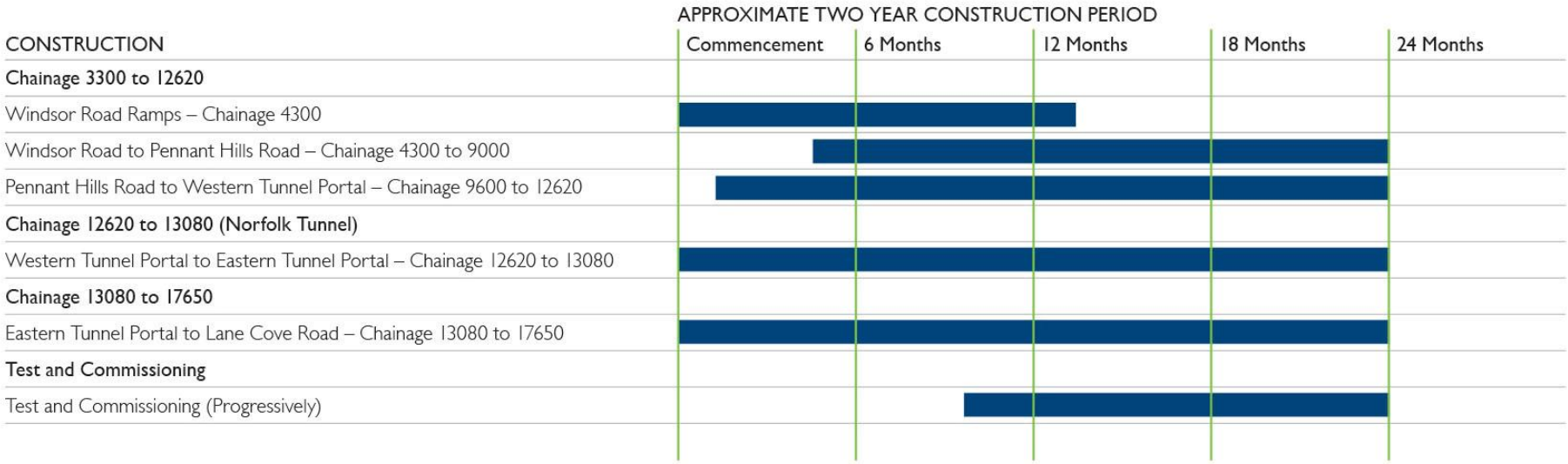
Construction phase	Activity
Norfolk Tunnel Widening	▪ Tunnel widening eastbound and westbound, including; ▪ Rock bolting. ▪ New drainage lines. ▪ Relocation of supply power lines. ▪ Lowering of cross passages. ▪ New switchboard niches. ▪ Tunnel lining. ▪ Lighting. ▪ Rock cutting. ▪ Shotcreting.
Bridge modification works	▪ Abutment works on widened side. ▪ Additional piles. ▪ Extension to the deck slabs.
Ancillary works	▪ Relocation and construction of noise walls. ▪ Property access and modifications. ▪ Existing Motorway works. ▪ Crushing plants, stockpile and storage sites.
Other works	▪ Toll plaza realignment. ▪ ITS - backbone cabling. ▪ Installation of permanent noise walls and relocation of existing noise walls. ▪ Construction of new retaining walls.
Finishing works	▪ Landscaping activities. ▪ Line-marking. ▪ Installation of road furniture, signposts, traffic barriers.

The activities in Table 11 would be subject to refinement during the detailed design phase. A more detailed construction staging and methodology would be prepared in accordance with the detailed design prior to commencement of construction works and as part of the Construction Environmental Management Plan (CEMP). An outline of the CEMP is provided in the Construction Environmental Management Framework (refer to Appendix F).

An indicative construction program is shown in Figure 13.

Figure 13 Indicative construction program

M2 Motorway Upgrade – Construction program



7.3 Construction methodology overview

The construction methodology used on the roadwork elements of the project would be conventional techniques generally employed to construct additional carriageway lanes. Construction techniques would be adapted to account for various environmental constraints that occur along the M2 corridor.

The project would have a construction period of approximately two years. During the construction period, M2 Motorway traffic would be reduced to one lane in sections for limited periods of time during the night or in off peak day time periods, when traffic flow allows. The construction staging has been planned to minimise disruption to road users. However, safety of road users, neighbouring residents and construction staff is the main priority during the construction phase.

The construction strategy for the project may be subject to modification as a result of further design and construction method refinements throughout the detailed design phase. The staging of the project is not likely to have an impact on the construction environmental impacts.

7.3.1 Motorway functionality during construction

Functionality of the M2 Motorway would be maintained throughout the construction phase of the project. To ensure that M2 Motorway traffic flow is sustained where practicable, the following objectives have been developed as a benchmark:

- Two lanes would be maintained for morning peak flow in the eastbound direction.
- Three lanes would be maintained for afternoon peak flow in the westbound direction (between Lane Cove Road and west of Beecroft Road).
- Two lanes would be maintained for afternoon peak flow in the westbound direction west of Beecroft Road.
- One dedicated bus lane would be maintained for bus use in the peak direction by tidal flow (between Windsor Road and Pennant Hills Road, and between Pennant Hills Road and Kent Street footbridge). The other bus lane would be taken for use as a general traffic lane during traffic management operations.
- Alternative cycle provision would be adopted on local roads during construction.

For further discussion regarding traffic impacts and management during construction, refer to Section 9.2 and Technical Paper 1.

7.3.2 Pedestrian and cycle access during construction

Pedestrian crossing points

Pedestrian access in the vicinity of the M2 Motorway is currently provided via crossing points in the form of overbridges, underpasses and footbridges. Direct pedestrian access to the M2 Motorway is prohibited. During the construction period, works on some of the overbridges would be required. This would require the diversion of pedestrians. Table 12 describes the likely diversions of pedestrians at the bridges and intersections along the M2 Motorway.

Footbridges and pedestrian and cycle paths on surrounding roads would be re-instated following construction.

Table 12 Location and impact on pedestrian access during construction period

Location	Facility type	Diversions (indicative)
Windsor Road	Bridge.	During construction of the new west facing ramps at Windsor Road it is likely that all pedestrians would be diverted to the east footpath.
Barclay Road	Road Bridge (and pedestrian ramp to M2 bus stop).	During construction there would be one of two footpaths closed for the lengthening works at the northern end. A temporary road crossing may be used to facilitate access.
Devlins Creek (from Allerton Road to Welham Street and Austral Avenue)	Paths under M2 Motorway Bridge.	During construction some local detours would be required to avoid construction areas. Access under the M2 Motorway from north to south would be maintained.
Kirkham Street / Kirkham Street	Bridge.	During construction, one of the two footpaths would be closed for the lengthening works at each end. A temporary road crossing may be used to facilitate pedestrian access.
Beecroft Road	Road Bridge.	During construction, the footpath on the west side may be altered. A temporary road crossing may be used to facilitate pedestrian access.
Christie Road	Road Bridge.	During construction the footpath on the eastern side may be altered. A temporary road crossing may be used to facilitate pedestrian access. The access to the council car park may be closed for some periods.
Herring Road / Talavera Road	At Grade.	During construction the footpath on the east side may be altered. A temporary road crossing may be provided to facilitate pedestrian access.
Khartoum Road	Road Underpass.	During construction, one of the two footpaths would be closed. A temporary road crossing may be used to facilitate pedestrian access.

Cyclist access

The project would affect cycle use of the M2 Motorway from west of Windsor Road to east of Lane Cove Road due to the removal of the breakdown lane during construction. An alternative route would be provided using non-Motorway roads that stay close to the alignment of the M2 Motorway where practical. The alternative cycle route would be formulated in consultation with local councils and cycle groups during the detailed design phase. The alternative cycle route would be in place prior to the commencement of construction.

The underpass at Vimiera Road is part of a north-south route used by pedestrians and cyclists between Macquarie Park and South Turramurra. The structure would be extended to allow widening of the embankment on the northern side. Short term closures would be required for some construction activities, with advance notification provided to minimise disruption to users. When works are being undertaken on this underpass during normal working hours, access would be maintained for the public by means of personal escort or dedicated exclusion zone through works.

Walking tracks

During construction, access to some bush walking tracks would be restricted, however, wherever possible an alternative path would be provided. In areas where the walking track passes below a M2 Motorway bridge structure, such as bridge structures at Terry's Creek, Devlins Creek and Darling Mills Creek, provision of an alternative path would not be possible as worksites under these bridges would cover the entire area. Access to bush walking tracks would be re-instated following construction.

7.4 Construction program and traffic management

7.4.1 Construction staging

Due to the integrated nature of the proposed upgrade and the need to undertake works under traffic conditions, it is anticipated that construction would be carried out concurrently in a number of areas. As indicated in Section 6.5 staged opening is envisaged.

7.4.2 Traffic management

Traffic management measures would be implemented in accordance with *Australian Road Rules AS1742.3: Traffic control devices for works on roads*, RTA's *Traffic Control at Worksites Manual* and other relevant standards or guidelines. Traffic Management Plans (TMPs) would be developed by the contractor and implemented for the duration of the construction of the project. TMPs would cover all aspects of construction that would require temporary changes to the M2 Motorway and local road layout using barriers or lane occupancies.

Reduced speed limits would be applied on the M2 Motorway during construction.

The communication of proposed changes to traffic conditions would vary depending on the extent and the nature of changes. The processes for advising the general public of changes would be included in the Community and Stakeholder Consultation Plan and, where appropriate, would include:

- Portable and permanent Variable Message Signs.
- Letter box drops and newsletters.
- M2 Upgrade project and RTA websites.
- Radio advertising.
- Metropolitan and local newspaper advertising.

Road user delays would be kept to a minimum and access would be maintained for road users. This would be achieved through the planning and consultation phases and implemented during the construction phase.

7.5 Construction plant and machinery

During the construction stage the following typical equipment may be used:

- Excavators and loaders.
- Bulldozers.
- Backhoes.
- Cranes.

- Drilling rigs / piling rigs.
- Graders.
- Concrete saws / cutters.
- Rock saws.
- Hydraulic hammers / rock breakers.
- Jackhammers.
- Rock Crushers.
- Asphalt laying machines.
- Transit mixers.
- Low loaders.
- Road headers.
- Shotcrete rigs.
- Rock drill rigs.
- Concrete boom pumps.
- Rollers and compaction equipment.
- Trucks (bogies, haul and dump trucks, etc).
- Line marking machines.
- Paving machines.
- Generators.
- Water carts.
- Elevated work platforms.

The above list is indicative only and the actual equipment used onsite would be further refined during the detailed design stage.

7.6 Workforce and working hours

7.6.1 Workforce

Construction personnel numbers would vary depending on the construction phase. The total workforce, including design and construction personnel is estimated to be up to 550 persons at any one time during the construction period. This includes 350 labourers working on-site and 200 engineering, design, environmental and management staff.

7.6.2 Construction work hours

Standard working hours for construction activity would be:

- 7.00am to 6.00pm Monday to Friday.
- 8.00am to 1.00pm Saturdays.

Construction for some activities would also be required outside of these standard working hours (including on Saturdays, Sundays and public holidays), subject to obtaining approval from DECCW. This would be required to minimise disruption to traffic and to ensure the safety of construction personnel and other road users. The start and finish times of construction activities undertaken on the M2 Motorway may also vary depending on the location of the works site relative to the peak traffic flows.

This flexibility of working hours between various project worksites would assist to minimise impacts on traffic resulting from construction vehicles entering sites during peak periods. Appropriate communication with potentially affected community and stakeholders would be made.

At certain stages, construction works on the M2 Motorway carriageway would be necessary outside standard construction hours (also referred to as night works) to minimise unacceptable impacts on daytime traffic flow and congestion. The types of activities that may be undertaken on the carriageway outside normal working hours include, but not limited to:

- Activities associated with the upgrade of the ITS system.
- Construction activities that require lane closures.
- General traffic management activities (relocating barriers and the like).
- The delivery of materials outside of approved hours as required by the Police or other authorities (including RTA) for safety reasons.
- Where it is required to avoid the loss of lives, property and/or to prevent environmental harm in an emergency.
- Where permitted in accordance with an environmental protection licence for licensable works issued by the DECCW.

Other than the construction activities associated with the widening of the Norfolk Tunnel, night works that are to occur would commence after the evening peak once the traffic volumes are confirmed by the M2 Motorway Control Room (MCR). A detailed assessment of the potential impact of night time work is provided in Section 9.4 and Section 10.7. Generally, the requirement for night works is related to providing a safe work environment and minimising impact to the motorway and local road users.

Targeted community consultation with residents in the vicinity of night works is proposed during the public exhibition period for the proposal and would continue for the duration of the night works should the proposal be approved.

Night works are described in the following subsections and assessed in Section 9.2 (construction traffic and transport) and Section 9.4 (construction noise and vibration).

Pavement cross stitching

Cross stitching is needed to reinforce existing road pavement joints to ensure that, in areas where the motorway is being widened, the new pavement areas would be adequately supported. To achieve this, holes would be drilled across existing joints and steel rods installed to pin the road pavement sections together.

In some locations, because the cross stitching would take place behind temporary barriers that separate the construction works zones from motorway traffic, the work would be undertaken during standard working hours. However, where the pavement joints are inaccessible inside the separated work zones additional lane occupancies or contraflow traffic conditions would be needed. As such, in these locations, cross stitching would need to be undertaken during times of low traffic volumes to ensure the safety of road users and construction personnel.

Based on current information, it is estimated approximately half of the proposed cross stitching work would need to be undertaken during late evening and night time periods.

Motorway median crossovers

To facilitate proposed traffic management measures such as contraflow, bus tidal flows and other traffic staging activities, cross over points in the motorway median would be required. To create cross over points it would be necessary to establish a working zone in the motorway median, which would potentially affect traffic flow.

To maintain the safety of road users and construction personnel as well as minimise the impact on motorway operations during periods of high traffic volumes, these works would need to be undertaken in the evening or during the night.

Transverse drainage lines

In certain locations, water drainage lines would be required to cross the motorway and adjacent local roads (transverse drainage). Due to possible safety risks to road users and construction personnel as well as potential impacts on motorway operations, this work could not be undertaken during live traffic conditions.

As such, these works would need to occur at night, outside periods of high traffic volumes, to enable suitable alternative traffic arrangements to be safely implemented.

Asphalting works

As a consequence of setting up alternative lane alignments and road marking, as part of traffic management activities, there is the potential for the existing road surface to be damaged. Once the road has been widened in each location, asphalting works would be undertaken to address potential road surface damage.

To enable this work to be undertaken, lane occupancies and contraflow conditions would be required to ensure the safety of road users and construction personnel. This means asphalting could not be undertaken during periods of high traffic volumes and would need to occur during evening and night time periods.

Motorway connections to local roads

Where new or modified on- or off-ramp connections between the motorway and local roads are proposed (Windsor Road, Christie Road, Herring Road), lane occupancies and significant changes to local traffic conditions would be required at certain times to facilitate completion of the required construction work.

As such, this work would need to occur outside periods of high traffic flow to maintain the safety of road users and construction personnel as well as minimise potential traffic impacts.

Demolition of Beecroft Road bus ramp

Removal of the Beecroft Road bus ramps would involve removing sections of the bus ramp that are directly above the motorway and the Beecroft Road off-ramp. For safety reasons it is not appropriate to remove, manoeuvre or lower the sections of ramp with live traffic passing underneath. Also, cranes and other equipment may need to be set up within the motorway and off ramp areas to facilitate the removal.

Undertaking these works during periods of high traffic volumes would pose unacceptable safety risks to road users and construction personnel. As such, it would be required to undertake certain activities associated with bus ramp removal during the late evening and night time periods.

Intelligent transport system upgrade

As part of the motorway Intelligent Transport System (ITS) cables and other subsurface infrastructure are installed at various locations along the motorway. New cabling and other infrastructure are proposed. Where the ITS upgrade works are proposed outside the construction work zones (for example along the median) safe working areas would be required to facilitate the works without affecting the safety of road users and construction personnel. These works would therefore be required in the late evening and night time periods when traffic volumes are comparatively low.

Bridge works

Certain works associated with the proposed modification of bridges along the M2 Motorway would be required outside standard working hours. These works include the delivery and installation of bridge girders. Contraflow traffic conditions are generally required in these circumstances as there is insufficient space within the motorway to facilitate the unloading of girders during live traffic conditions without creating unacceptable safety risks to road users and construction personnel. Similarly positioning and installing girders during live traffic conditions would create unacceptable safety risks to the traffic below. These works are required to be undertaken outside periods of high traffic volumes during the evening and night time periods.

In addition, for structural reasons concrete works associated with bridges must also occur during the night where a new structure requires connection to an existing structure. Vibrations associated with traffic movements over bridges can affect how the new concrete would effectively bond to existing concrete surfaces. High vibration levels in the existing concrete caused by high traffic volumes can result in poor quality bonding between the existing and new concrete. Warmer temperatures during the day can cause concrete to set and cure more rapidly, which can affect concrete strength characteristics and increase the chance of cracking, lessening the quality and durability of the concrete structures. As such, the concrete works associated with the proposed bridge modifications need to occur during the night to maintain structural integrity of the overall bridge structure.

Tunnelling works

The construction activities associated with the widening of the Norfolk Tunnel and supporting works, including haulage of spoil to disposal, are proposed to occur continuously (24 hours a day, six days a week) over certain periods.

Full possession of the tunnel tubes would be required to facilitate preliminary works associated with the tunnel widening. Services relocations, rock bolt installation to support the additional tunnel span and the construction of a proposed barrier is required to isolate the work areas from the trafficable portions of the M2 Motorway. This could not be completed with live traffic operating within the same tunnel tube due to the potential for significant safety risks to road users and construction personnel. Similarly, the contraflow traffic arrangements required to maintain traffic flow in both directions along the motorway during a full tunnel tube possession could only occur safely during times of low traffic volumes. As such, full possession of a tunnel tube could only occur in the evening and night-time periods generally between 8.00 pm and 5.00 am when traffic volumes are low.

A key challenge associated with the proposed tunnel widening is maintaining the structural integrity of the tunnel. Excavation works within the Norfolk Tunnel are proposed on a 24 hours a day, six days a week basis for approximately four to six months in each tunnel tube. For safety reasons during tunnelling operations it is necessary to stabilise the newly cut surface as soon as possible to maintain ground stability. Stabilisation is achieved through the installation of rock bolts, shotcrete and other devices. A continuous tunnelling process (24 hours a day, six days a week) would reduce the duration between excavation and stabilisation and ensure tunnel integrity. This is required to enable the works within the tunnel to be completed within the proposed two year construction period and to minimise safety risks to motorists and the construction workforce.

7.7 Resource consumption

7.7.1 Construction materials

The project would require the following typical construction materials during the construction stage:

- Road base/fill.
- Sand.
- Aggregate.
- Asphalt.
- Precast concrete (drainage culverts, bridge girders and the like).
- Concrete (aggregate, cement, water).
- Steel (reinforcement, street furniture, and fencing).
- Timber (formwork, street furniture).
- Topsoil (for landscaping).

The above list is indicative only and the precise material types and quantities would be determined during the detailed design stage. It is expected that bulk fill material would not be required due to a likely surplus of material. Speciality products, such as pipe bedding sands, base material, general sand and concrete aggregates would be imported to the site.

Manufactured items, including reinforcing steel, pre-cast bridge components, and stormwater pipes and pits, would also be required for the project. Products imported would be sourced from existing commercial providers, and where possible, from local and regional providers as required.

7.7.2 Spoil disposal

The project would necessitate approximately 500,000 tonnes of material to be cut. Of the cut material, there is estimated to be 230,000 tonnes of general fill and the 270,000 tonnes of sandstone material, which can be used for retaining wall backfill and in the upper pavement layers. Sandstone would require processing (crushing) onsite before it can be reused.

It is estimated that 320,000 tonnes of fill would be required for the project, generating an indicative 180,000 tonnes of surplus material, which is largely made up of the general fill classified material.

Classification of material is based on preliminary rock mapping and is pending the full geotechnical investigation and detailed design. Excess spoil material would be made available for reuse as part of other major construction projects. Spoil found unsuitable for reuse would be disposed of in accordance with the Waste Classification Guidelines: Parts 1 and 2 (DECCW 2009c).

7.7.3 Water usage

Water would be used for various activities throughout the construction process. These uses may include for dust suppression, compaction and pavement stabilisation during earthworks, wash down of plant equipment, drinking water and for toilets. Water would be supplied from the following key sources including:

- Water main: Metered connections to the local water mains would be installed. Water extracted from the mains would be used for the potable water requirements throughout the construction period for drinking water requirements.
- Sediment basins: Water stored in the sediment basins installed for construction would be used for the non-potable water requirements of the construction process including activities such as dust suppression.

Temporary above-ground pipes may be used to deliver water across the construction site. These temporary pipes would be located to avoid impacts on the environment.

7.8 Construction compound sites

7.8.1 Potential compound locations

A number of compound sites would be required during the construction period. The exact location and size of the actual construction compounds would vary according to the staging and planning of the construction activities.

The compound sites would be used to store construction materials, equipment, plant, and would also be used to house site amenities, including toilet facilities. Site offices would also be contained within certain construction compound sites.

The locations of the construction compound sites are potential only at this point in time and the final location of the compounds would be determined during the detailed design phase. Construction compounds would be managed in accordance with a Construction Environmental Management Plan (refer to Appendix G for the Construction Environmental Management Framework).

Table 13 describes the potential locations for construction compounds, which are shown in Figure 5. An operational assessment would be carried out including safety audits leading the development of TMPs. The rationale for selecting the potential compound site locations are described in the following subsection.

Compound site selection

Potential compound sites are scarce, as the majority of the existing M2 corridor is made up of either dense urban development or vegetated (exotic and native vegetation) areas. Specific limitations include:

- Sections of the M2 corridor is characterised by native vegetation and watercourses that warrant protection and would not be suitable for a construction compound site.
- The topography of the M2 corridor is undulating, with large sections of the M2 Motorway being in cut or on bridge structures. Compound sites necessitate areas relatively flat land of various sizes (larger areas for main compound sites) for activities such as amenities, laydown and heavy vehicle access.

- Large areas in proximity to the M2 corridor comprise low and medium density residential development, which is considered sensitive to construction noise.
- The only areas zoned for commercial or industrial use, which are less sensitive to amenity impacts in close proximity to the M2 corridor are the Macquarie Park and Wicks Road areas to the east and the Seven Hills industrial area to the west of the M2 Motorway.
- Preferred locations for potential compound sites are those immediately adjacent to the M2 Motorway, which facilitate use of the M2 Motorway for construction site access and minimise use of local roads where feasible.

Refer to Section 3.2.4 for description of the alternatives considered for the main compound sites.

Approach for selection of additional compounds

Due to the existing M2 corridor constraints described above, there are few suitable locations available for compound sites. Where additional or replacement compounds sites are required, these would be identified during the construction planning phase. The considered approach to identifying potential alternative compound sites involves assessing potential locations against the following environmental criteria:

- More than 40 metres from waterways.
- Areas of low ecological and heritage conservation value.
- No significant clearing of native vegetation beyond that already required for the project.
- Minimises impact on amenity of the closest sensitive receiver (unless a negotiated agreement is in place).
- On relatively level ground.

It is preferable that the compound sites would be already cleared. However, some clearing and grubbing works may be required for the compound sites. Where clearing and grubbing works are required, revegetation works would be carried out in accordance with the detailed construction methodology of the project (to be determined during the detailed design stage).

Description of potential compound sites

Table 13 describes the potential locations for construction compounds, which are shown in Figure 5.

Table 13 Indicative construction compound locations

Compound name	Location	Approx size (m2)	Proposed use	Proposed access	Anticipated average daily works traffic movement (by vehicle type)
Main compound (optional locations)					
TIDC Compound (previously used for Epping to Chatswood Rail project)	Large site south of Motorway, immediately off Delhi Road westbound on-ramp.	35,000	Primary compound site, where Main Office, Welfare, Canteen, Laboratory, Traffic Management, Stores and main car park, stockpiling, rehandling and laydown area would be located. Potential for 24 hour operation at all compounds.	Left in / left out off Delhi Road westbound on-ramp, as well as Entry / Exit off Wicks Road.	Light – 800 Heavy – 92
Construction compound site					
Windsor Road North	Windsor Road, North of M2 Motorway.	5,800	Bridge construction team office and laydown area. Potential for 24 hour operation.	Entry / Exit off Torrs Street, straight onto Windsor Road.	Light – 85 Heavy – 20
Darling Mills Creek	Compound under bridge at eastern end of existing Windsor Slip Road.	4,000	Bridge construction welfare and laydown area.	Entry / Exit off existing Windsor Road Ramps (in same direction as traffic flow).	Light – 38 Heavy – 12
Barclay Road	Between Barclay Road / Perry Street and M2 Motorway.	6,600	Stockpile / rehandling area and bridge crew.	Entry / Exit off Perry Street.	Light – 26 Heavy – 12 (Not intended to be in constant use)
Devlins Creek	Compound under bridge.	16,000	Bridge construction welfare and laydown area.	Entry / Exit (Bridge construction traffic only) off Allerton Road.	Light – 36 Heavy – 12 (Not intended to be in constant use)
Barombah Road	200 metres west of Beecroft Road.	3,500	Stockpile / rehandling area.	Entry / Exit of Barombah Road.	Light – 38 Heavy – 12
Beecroft Road (Old Bus Ramp)	Area directly below Old Bus Ramp adjacent to Derby Street.	1,460	Bridge construction welfare and laydown area. Potential for 24 hour operation.	Entry / Exit off Beecroft Road and Beecroft Road westbound off-ramp.	Light – 38 Heavy – 12

Compound name	Location	Approx size (m2)	Proposed use	Proposed access	Anticipated average daily works traffic movement (by vehicle type)
Sutherland Road (Tunnel Compound)	Immediately north of M2 Motorway, adjacent to Sutherland Road.	3,800	Tunnel construction welfare and laydown area. Potential 24 hour operation.	Left in / Left out off eastbound carriageway, through existing Noise Wall. Entry / Exit off Sutherland Road.	Light – 46 Heavy – 12
Somerset Street (Terrys Creek western end)	Small strip compound at end of Somerset Street	2,850	Bridge Construction Welfare and laydown area	Entry / Exit off Crimea Road.	Light – 26 Heavy – 12
Terrys Creek	Long strip compound adjacent to westbound access at Crimea Road extending under bridge.	20,500	Bridge construction, welfare and laydown area.	Entry / Exit off (Bridge construction traffic only) off Somerset Road.	Light – 36 Heavy – 12
Vimiera Road	Immediately South of Motorway, at end of Vimiera Road.	8,200	Stockpile, rehandling and laydown area.	Left in / Left out off westbound carriageway, with suitable ramps constructed (Light vehicle access only off Vimiera Road).	Light – 60 Heavy – 18 (Not intended to be in constant use)
Busaco Road	Corner of Busaco Road and Talavera Road.	1,300	Bridge works.	Entry / Exit off (Bridge Construction Traffic Only) Talavera Road.	Light – 38 Heavy – 12
Toll plaza	50 metres east of eastbound toll plaza.	2,200	Stockpile, rehandling and laydown area. Potential 24 hour operation.	Entry 50 metres from eastbound toll plaza. Exit onto eastbound carriageway.	Light – 38 Heavy – 24
Christie Road Compound	Compound on the western corner of Christie Road and Talavera Road.	7,000	Bridgeworks. Potential 24 hour operation.	Entry / Exit off Talavera Road.	Light – 46 Heavy – 12
Macquarie Park	North of M2 Motorway	49,800	Stockpile rehandling and laydown and subcontractor roads. Potential 24 hour operation.	Left in / Left out (only) onto eastbound carriageway.	Light – 124 Heavy – 32
North Ryde Station Compound	Behind the North Ryde Station, opposite the Macquarie Cemetery.	11,500	Operative car park for hourly shuttle bus pick up and drop off for construction personnel.	Access from traffic lights on Delhi Road.	Light – 580 Heavy - 26

Note: All compound sites would require utilisation for the 24 month duration of the project.

The use of certain compounds is proposed on a 24 hour per day basis to support proposed works that need to be undertaken. These compounds are described below and assessed in Chapter 9.

TIDC main compound

The main compound would support most of the construction activities that would be required at night. These works include:

- Night-shift supervision and management.
- Traffic management activities.
- Bridge works (where there is no dedicated compound proposed, or where the proposed activities need to be undertaken from the main carriageway necessitating a lane closure).
- Night road works (median cross over installation and temporary pavement construction, asphalting, cross stitching and the like).
- Upgrading of the integrated traffic system and works at the toll plaza.
- Acting as the launch point for any other activities which require occupancy of the travelling lanes out of hours.

As there would be limited available space within the proposed work zones on the M2 Motorway, the construction work force would start their shifts, take breaks and finish their shifts in the main compound. Outside of standard construction hours the activities undertaken at this compound would include light and heavy vehicle movements in, out and around the compound to facilitate night time works along the M2 Motorway. An excavator, backhoe and/or crane would be used occasionally outside of standard construction hours to load vehicles with equipment as required.

Whilst the majority of deliveries to the main compound would occur during standard construction hours, special items (for example bridge beams and large plant or materials) would occur at times specified by the relevant road rules. Access to the main compound would be directly off the M2 Motorway on-ramp and via Wicks Road industrial area.

Windsor Road compound

The Windsor Road compound supports activities that need to be undertaken outside standard working hours predominately at the western end of the M2 Motorway. In particular it would support the works that are proposed at the Windsor Road interchange and Darling Mills Creek viaduct that need to be undertaken at night. Workers and staff would park at this compound to commence or complete their shifts.

This compound would be used as a storage area for materials that would be required for the bridge modification work, as well as the launch point for traffic management installations that are required for works at the western end of the M2 Upgrade project. The activities that would occur at this compound outside of standard construction hours would include light and heavy vehicle movements in, out and around the compound to facilitate night time works along the motorway. An excavator, backhoe and/or crane would be used occasionally outside of standard construction hours to load vehicles with equipment as required.

Beecroft Road (old bus ramp)

The Beecroft Road (old bus ramp) compound would be used to support proposed works associated with modification of the Beecroft Road bridge and removal of the Beecroft Road bus ramp. These works would occur within and above the trafficable parts of the existing M2 Motorway and Beecroft Road off-ramp. The alternative of undertaking these works during standard construction working hours would pose potential safety risks to road users and construction personnel. As such, the works would be required during periods of low traffic volumes in the late evening and night time periods when appropriate traffic management arrangements can be implemented.

As this compound would support works to the Beecroft Road bridge and removal of the Beecroft Road bus ramp, the use of the Beecroft Road (old bus ramp) compound outside of standard construction hours would be required. Outside of standard construction hours the compound would be used as a temporary equipment and material lay down and storage area for demolition works and construction, as well as a muster point for construction personnel. Light and heavy vehicle movements to and from this compound and some vehicle parking would also occur outside standard construction hours.

Sutherland Road (tunnel compound)

As described in Section 7.6.2, works associated with tunnelling would be required outside of standard construction hours. The Sutherland Road compound would support tunnelling works. This compound is selected as it is the only available vacant land within close proximity to the Norfolk Tunnel portals, which would minimise inconvenience to local residents when compared to other sites.

Outside of standard construction hours, the Sutherland Road compound would be used as a staging point by construction personnel and as a location from which to implement traffic management activities to support the proposed tunnelling works. Outside standards construction hours there would be light and heavy vehicle movements to and from the site and some loading and unloading of equipment and materials required for traffic management and tunnelling works.

Toll Plaza

The Toll Plaza compound would predominantly be used as temporary lay down area to hold large deliveries that are required to be transported outside standard construction hours (for example bridge beams, excavators and other plant transporting in or out) and potentially for the storage of temporary concrete barriers for traffic management. From this location the equipment stored would be deployed to the appropriate location along the motorway. This proposed compound is not within the vicinity of any residents and forms part of the larger Toll Plaza, which currently operates on a 24 hour basis.

Christie Road

The Christie Road compound would be used exclusively to support works to the Christie Road bridge. Certain bridge works, such as girder erection and concrete works would need to be undertaken at night, requiring night time use of the compound to support those works activities. Outside of standard construction hours, the compound would be used as a staging location for bridge works. Light and heavy vehicle movements would occur to and from work site, as would loading and unloading of materials and equipment.

Macquarie Park

The Macquarie Park compound would be allocated to sub-contractors for storage of equipment and for materials handling, such as temporary concrete barriers, concrete and asphalt waste and processing and recycling of project generated sandstone material.

Outside standard construction hours this compound would be used as a location to load and unload concrete barriers, tip concrete and asphalt wastes and tunnel spoil from night works activities such as tunnelling, asphalting, crossover construction and temporary pavement installation. Material processing or crushing would be restricted to daytime construction hours and would not be undertaken at night.

7.8.2 Compound site access

Routes to the construction compounds would be established to minimise impacts to residents. Where possible, construction traffic would primarily use arterial roads or sub arterial roads to access construction compounds and work sites. Local (collector) roads and residential streets would only be used when there is no alternative. Table 13 lists access roads that would be utilised for access to construction compounds sites and only the following sites would require the use of collector roads and some residential roads:

- Existing TIDC compound – off Wicks Road.
- Barclay Road – off Perry Street.
- Devlins Creek – off Allerton Road.
- Barombah Road – Barombah Road.
- Sutherland Road (Tunnel) – off Sutherland Road.
- Somerset Street – off Crimea Road.
- Terrys Creek – off Somerset Street.
- Vimiera Road – off Vimiera Road.

Temporary roads would be formed to access construction compound sites for bridge construction. These sites would be alongside and underneath the M2 Motorway, and would require clearing of vegetation and earthworks to enable vehicles to gain safe access. Generally, the accesses would be approximately five metres in width to enable crane access. Where such roads are not required for maintenance these would be rehabilitated in accordance with the measures outlined in Section 9.6 of this report.

The location of work sites adjacent to the existing M2 Motorway lanes would be required along the M2 corridor in sections during construction. These work sites may require lane closures to ensure traffic and construction safety is maintained. Reduced traffic speeds would also be required in these areas and signposting, traffic controls would be implemented.