1 Introduction

On 13 January 2014 the East West Link Assessment Committee (the Committee) issued a Request for information under section 57(4) of the Major Transport Projects Facilitation Act 2009 (the Request) to the Linking Melbourne Authority (LMA) as project proponent for the East West Link (Eastern Section) Project (the Project).

This document complete with Appendices A - Q contains the LMA's response to the Committee's Request in accordance with the Committee's directions dated 20 January 2014. This response adopts the same headings, sub-headings and paragraph numbering as the Request by the Committee with the specific request preceding LMA's response.

This response should be read in conjunction with the Comprehensive Impact Statement (CIS) prepared by LMA for the Project which contains additional detail and technical assessments on many of the matters contained in this response. The CIS is available at: www.linkingmelbourne.vic.gov.au
2 Terms of Reference and assessment of scope

The LMA is requested to provide its opinion on the interpretation of the following:

1. Whether the Assessment Committee (AC) is constrained by the Terms of References dated 21 October 2013 (TOR) in terms of its powers, function and discretions under ss 73(4)-(5) and 236(2) of the Major Transport Projects Facilitation Act 2009 (the Act) in any way and, if so, what way?

The Committee’s first question can be broken into two parts:

a. First, whether terms of reference issued by the Planning Minister under section 35(b) of the Major Transport Projects Facilitation Act 2009 (Vic) (the Act) can bear upon the operation of sections 73(4), 73(5) and 236(2) of the Act; and

b. Second, if the answer to the first question is yes, whether the particular Terms of Reference issued by the Planning Minister to the Committee in this instance (the Terms of Reference) do in fact constrain the Committee in any way.

It is convenient, before addressing these specific matters, to first outline the relevant statutory framework within which the Committee has been established, and within which it is required to operate.

The Legislative Framework

Two parts of the Act are particularly relevant in this respect:

a. Division 5 of Part 3 of the Act provides for the establishment of assessment committees and describes the manner in which they are to assess comprehensive impact statements prepared in respect of declared transport projects; and

b. Part 8 of the Act concerns assessment committees specifically, containing (amongst other things) the administrative provisions relating to the formation and functioning of assessment committees, as well as provisions relating to the conduct of hearings by assessment committees.

The critical parts of this framework for present purposes are those concerning the establishment of assessment committees and those defining the role that terms of reference play in the assessment process.

The establishment of assessment committees is governed by Subdivision 2 of Division 5 of Part 3 of the Act.

Section 35 of the Act provides that, after publishing the scoping directions for a comprehensive impact statement, the Planning Minister “must”:

a. establish an assessment committee in accordance with Part 8 of the Act to assess the comprehensive impact statement;¹ and

b. “give the assessment committee the terms of reference under which it will assess the comprehensive impact statement in accordance with this division” (emphasis added).²

¹ Section 35(a).
It is clear as a consequence that terms of reference issued by the Planning Minister under section 35 play an important role in defining the manner in which an assessment committee is to undertake its assessment of a comprehensive impact statement.

Indeed, given the strict terms of section 35, an assessment committee has no power to undertake its assessment of a comprehensive impact statement otherwise than in accordance with such terms of reference.

The provision makes clear, in addition, that the terms of reference are to influence each aspect of an assessment committee’s assessment of a comprehensive impact statement under Division 5 of Part 3 of the Act (which, relevantly for present purposes, includes sections 73(4) and 73(5) of the Act).

The matters that can be the subject of direction under terms of reference are specified in section 36 of the Act. They include, but are not limited to, directions concerning:

a. the conduct of the preliminary hearing;

b. “the matters which the assessment committee is to consider”;

c. the matters that may be “under consideration at a public hearing”; and

d. the conduct of cross-examination.

Two observations are made in respect of this provision:

a. First, that terms of reference issued by the Planning Minister are in no way limited to procedural or administrative matters, and can properly operate to define the matters that an assessment committee can consider in assessing a comprehensive impact statement.

b. Second, that the Act draws a distinction between the matters that an assessment committee must consider in assessing a comprehensive impact statement, and the matters that may be considered at a public hearing conducted in accordance with Subdivision 7 of Division 5 of Part 3 of the Act. Indeed, it is clear that the Act expressly contemplates that the scope of matters that can be the subject of consideration at the public hearing can, depending on the terms of reference, be more confined than those that must be taken into account by an assessment committee in making its ultimate recommendation to the Planning Minister. As will be discussed in greater detail below, this is what has occurred here with respect to the Terms of Reference.

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2 Section 35(b).
3 In particular the use of the word “will” in the context of the obligation on the part of an assessment committee to assess the comprehensive impact statement in accordance with the terms of reference.
4 Section 36(2) makes clear that the list of non-exhaustive matters identified in section 36(1) does not limit what may be included in the terms of reference given to an assessment committee.
5 Section 36(1)(a).
6 Section 36(1)(b).
7 Section 36(1)(ba).
8 Section 36(1)(c).
Further, terms of reference are relevant not only to the role of an assessment committee. The Act makes clear that they also determine the matters that can be validly made in public submissions concerning a comprehensive impact statement. Indeed, section 52(3)(e) provides that a submission is not properly made unless it “is within the scope of the terms of reference of the assessment committee”.

**The Terms of Reference and Sections 73(4), 73(5), and 236(2) of the Act**

The first part of the Committee’s question relates specifically to the interaction between Terms of Reference and sections 73(4), 73(5), and 236(2) of the Act.

Sections 73(4) and 73(5) concern the matters that an assessment committee must have regard to in making an assessment committee recommendation. These matters include:

a. the project proposal;\(^9\)
b. the CIS;\(^10\)
c. all properly made submissions;\(^11\)
d. any issues raised in meetings and correspondence referred to in consultations undertaken pursuant to section 56 of the Act, a preliminary hearing, or a formal public hearing;\(^12\)
e. the comments of the persons that were consulted in accordance with a direction of the Planning Minister;\(^13\)
f. any consultation with or advice received from an applicable law decision maker;\(^14\) and
g. every applicable law relevant to the declared project including the applicable law criteria under that law.\(^15\)

An assessment committee may, in addition, have regard to “any other matter the committee considers relevant”.\(^16\)

The fact that these matters do not expressly include any terms of reference issued by the Planning Minister does not mean that an assessment committee’s assessment of a comprehensive impact statement can proceed without regard to those terms of reference.

On the contrary, for those reasons set out above, terms of reference are expressly intended to define, and / or confine, the scope of an assessment committee’s powers and obligations under the entirety of Division 5 of Part 3 of the Act (which includes sections 73(4) and 73(5)).\(^17\)

Sections 73(4) and 73(5) of the Act must accordingly be read in conjunction with, and subject to, the matters specified in any terms of reference.

This is made clear by section 73(2) which provides that an assessment committee “must not” make an assessment committee recommendation that is “inconsistent with the committee’s terms of reference”.

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9 Section 73(4)(a).
10 Section 73(4)(b).
11 Section 73(4)(c).
12 Section 73(4)(d).
13 Section 73(4)(e).
14 Section 73(4)(f).
15 Section 73(4)(g).
16 Section 74(5).
17 Section 35(b).
It follows that the Act, when properly construed, requires that an assessment committee:

a. **must** conduct its assessment of a comprehensive impact statement in accordance with any directions contained within its terms of reference;

b. **must**, in doing so, have regard to those matters identified in sections 73(4) and 73(5); and

c. **must not** make an assessment committee recommendation that is inconsistent with its terms of reference.

The matters specified in section 73(4) and 73(5) cannot operate to expand or modify the scope of any terms of reference. Where section 74(5) provides that an assessment committee can have regard to “any other matter the committee considers relevant” in making its recommendation, those additional matters must be matters that fall within the scope of the terms of reference. If they are not within that scope, they cannot properly be regarded as relevant to the assessment that the assessment committee is required to conduct.

This much is made explicitly clear by Part 8 of the Act.

Section 236(2) provides, in this respect, that:

“**[s]ubject to this Part**, in carrying out its functions in relation to a matter referred to it by the Planning Minister, an assessment committee may inquire into and inform itself in relation to the matter in any manner it sees fit” (emphasis added).

Section 251, which forms part of Part 8 of the Act, expressly provides that:

“an assessment committee may take into account any matter it thinks relevant in making an assessment committee recommendation, **subject to any directions given to it by the Planning Minister**” (emphasis added).

That terms of reference constitute “directions” from the Planning Minister is (for the purposes of this provision) made clear by the express terms of section 36 of the Act, which specifies the type of “directions” that the Planning Minister may include in terms of reference.

**To What Extent do the Terms of Reference Issued by the Planning Minister to this Assessment Committee “Constrain … [its] Powers, Functions, or Discretions”?**

The second part of the Committee’s first question calls for a detailed examination of the Terms of Reference issued by the Planning Minister to this Committee on 21 October 2013.

The Terms of Reference make clear, at the outset, that the “powers, functions and discretions” of the Committee are “subject to the Terms of Reference”. They similarly specify, in respect of the preparation of an assessment committee recommendation and report, that the Committee’s power to carry out an assessment of the CIS is “subject to the terms of reference”.

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18 Clause 1.
19 Clause 1(3)(a).
An important direction in this respect is set out in clause 1(3)(b) of the Terms of Reference (which forms part of the identification of the “task” of the Committee).

The Committee is required, in making its recommendations to the Planning Minister in respect of whether he should make an approval decision that grants any, some, or all of the applicable approvals that are necessary for the Project, to confine its assessment to a project that may be implemented (in the sense of aligned) on land that is within the project boundary. It is entitled to assess alternative alignments for the project that may be implemented within the project boundary but not beyond.

The Committee may, for instance, consider whether parts of the Project should, or should not, be contained within a tunnel within the project boundary. Further, it may consider and assess the merit of any specific alternative alignment if that alignment can be implemented within the project boundary (for instance, some of those identified by the City of Melbourne, the proposed modification of the Elliott Avenue interchange, or some alternative to the Elliott Avenue interchange that can be aligned within the project boundary).

The Committee cannot, however, assess an alignment for the Project (either above or below ground) if that alignment cannot be implemented within the project boundary.

Furthermore, the Committee is precluded from making any recommendations to the Planning Minister that would require the Project to be aligned outside of the project boundary as part of its ultimate assessment committee recommendation, as to do so would be inconsistent with the Terms of Reference.

Another important component of the Terms of Reference is the distinction between the matters that the Committee must consider in undertaking the task of assessing the Project – set out in Part 1 of the Terms of Reference – and the more limited matters that can be the subject of the formal public hearing – set out in clause 2(7) of the Terms of Reference.

The first limitation in this respect is that the formal public hearing must be confined to “properly made submissions”. As noted above, in order to qualify as a “properly made submission”, a submission must be made within the scope of the Terms of Reference (and be otherwise in accordance with section 52(3) of the Act). Submissions that propose alignments for the project outside of the project boundary accordingly do not qualify as such.

This is not to say that documents submitted to the Committee that contain a number of contentions on discrete issues must be disregarded in their entirety if they propose such alternatives. Rather, it is only those contentions contained within a document that concern matters that are outside the scope of the Terms of Reference that must be disregarded by the Committee.

A further set of limitations in respect of the permissible scope of the formal public hearing is set out in clauses 2(7)(a) – (i) of the Terms of Reference. These matters are limited to an examination of the extent to which the Project will give rise to a series of different impacts and whether those impacts have been appropriately addressed and / or managed.

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20 Clause 2(7).
21 Section 52(3)(e).
2. **Having regard to Task 1(3)(b) of the TOR, is the “Figure 1 (dated 2 October 2013)” referred to therein the same as Figure 1 (dated 3 October 2013), entitled “Overview”, in the CIS Mapbook that has been provided to the AC?**

Yes, LMA understands that the reference to “2 October 2013” is a typographical error, and that the correct reference should be “3 October 2013”.

3. **What does the term “project boundary” referred to in Task 1(3)(b) mean?**

It is convenient, for the purposes of addressing this question, to set out clause 1(3)(b) in full:

*In preparing the Assessment Committee Recommendation and report, the Assessment Committee is directed to:*

* ... (b) consider the alignment, design and performance requirements for the project that may be implemented within the project boundary identified in Figure 1 (dated 2 October 2013) of the Mapbook.*

Figure 1 of the Mapbook presents an “overview” of the East West Link (Eastern Section) Project in the sense that it illustrates a cross-city road link spanning from the Eastern Freeway in the east to CityLink and the Port of Melbourne in the west.

Whilst the overview provided within Figure 1 is contained within the proposed project boundary, it does not delineate the proposed project boundary.

As is evident from the express terms of the balance of the Mapbook, the proposed project boundary is instead delineated as a blue dotted line on each of the detailed road alignment plans (being drawings EWL-DES-DR-1100 – EWL-DES-DR-1130) contained within the Mapbook.

The reference to the project boundary in Task 1(3)(b) can and should be read as being consistent with this delineation.

LMA contends that the phrase “Figure 1 (dated 2 October 2013) of the Mapbook” is intended, in the context of clause 1(3)(b) of the Terms of Reference, to describe the “project” (as shown in overview in that Figure) as opposed to the “project boundary”.

If follows that Task 1(3)(b), properly construed, should be read as follows:

*In preparing the Assessment Committee Recommendation and report, the Assessment Committee is directed to:*

* ... (b) consider the alignment, design and performance requirements for the project[,] that may be implemented within the project boundary[,] identified in Figure 1 (dated 2 October 2013) of the Mapbook.*

Thus the words “that may be implemented within the project boundary” qualify the word “project”, and, in this context, “implemented” effectively means “aligned”.

Thus, the Committee must confine its consideration to an assessment of the alignment, design and performance requirements for a project that may be implemented within the project boundary, and more specifically, the Project identified in Figure 1 of the Mapbook.
It is also important to bear in mind the distinction between the terms “project boundary” as used in the Terms of Reference, and “project area” which is defined in section 3 of the Act as follows:

**project area**, for a declared project or an approved project, means the area of land designated by Order under section 95, as varied by Order under section 96 or consolidated by Order under section 97.

Pursuant to section 95(2)(b), the designation of an area of land as the project area must (in the present circumstances) be made by the Minister after the making of an approval decision with respect to the Project. This is because the Governor in Council has not declared the Project to be a “declared project to which this Act (other than Parts 3 and 8) applies”.22

Accordingly, the reference to project boundary in the Terms of Reference must be read and understood as being the area that is proposed to ultimately form the project area. However, the designation as to what land will ultimately comprise the “project area” is a matter for the Minister that must necessarily occur after the making of the approval decision. It is not part of the approval decision.

Further, because the designation of the project area is not part of the approval decision, the extent of the project area is not a matter that the Committee can, or should, consider.

**4. Is the ability of the AC to recommend conditions to any grant of an applicable approval under s73(3) of the Act constrained in any way, and if so what way to the area that is defined by the dotted blue line as the “proposed project boundary” within sheets 1-27 and the alignment concept contained in the CIS Mapbook (the proposed project boundary)?**

Section 73(3) of the Act provides that if, as part of its written report to the Planning Minister the Committee recommends that the Planning Minister grant all or some of the required applicable approvals, the Committee must specify:

(a) The conditions;
(b) The relevant applicable law under which the conditions are being imposed; and
(c) The person or body authorised under the relevant applicable law to a Planning Minister to administer compliance with the conditions.

For the reasons identified above, the Terms of Reference make clear, at clause 1(3)(b), that the scope for the Committee to consider the Project is limited to a project that may be implemented within the geographical area delineated as the proposed project boundary.

In this context, it is necessary to have regard to the terms of the declaration of the Project that has been made under section 10(1)(a) of the Act (“the Declaration”) to understand what comprises the Project. The declared project is described in the Declaration as:

...the transport project known as the East West Link Project (Eastern Section) being the proposed freeway-standard link between the Eastern Freeway and the Tullamarine Freeway generally along the

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22 See: Declaration Of A Transport Project, dated 19 December 2012 made by the Governor in Council and published in the Victorian Government Gazette No.S 446 on 20 December 2012. See also section10 of the Act, which allows for two alternative forms of declaration, and identifies that the declaration in this instance has been made under section 10(1)(a).
Alexandra Parade corridor, with a further southerly connection to the Port of Melbourne area …

Two things are clear from this definition. Firstly, the declared project is one that is identified as being “…generally along the Alexandra Parade corridor”. Thus, there is no scope for the Committee to consider a project along any other corridor, including the alternative northern and southern corridors that are identified in the CIS.

Secondly, the declared project is comprised of the “proposed freeway-standard link” and the “further southerly connection”. This does not include mitigating roadworks, facilitative or consequential works, or enhancement actions that may be either necessary or desirable.

In view of the above matters, there is accordingly no scope for the Committee to recommend, by way of condition on any applicable approval to be issued in respect of the Project, any change to the alignment of the Project that cannot be implemented within the project boundary.

This is not to say, however, that the Committee’s assessment of the impacts of the Project are limited to this area, or that it cannot recommend conditions in respect of, or that may impact upon, land that is outside of the project boundary.

A project of this magnitude will clearly have impacts beyond the project boundary delineated in the Mapbook and the Committee can, and should, consider and assess those impacts within the scope of its Terms of Reference. Where those impacts warrant conditions affecting land outside of the project boundary, or which require some actions (other than the declared project itself) to be taken on land outside the project boundary, then those conditions could be validly recommended (subject to the proviso identified above and subject to them otherwise meeting the tests for the validity of conditions that apply in the context of each of the applicable laws).

An example of conditions in relation to land outside of the project boundary might be a condition requiring mitigating road works in proximity to the Project, or a condition requiring that an offset be secured on land in respect of native vegetation removal permitted as part of the Project. Another example would be a condition requiring the monitoring of noise impacts on locations that are outside of the project boundary.

5. **Is the ability of the AC to consider the development (as opposed to the impact) of the declared project limited only to the area within the proposed project boundary?**

For those reasons set out above the answer to this question is yes. The Committee is required to confine its assessment of the Project to the extent that it may be implemented (in the sense of aligned) within the project boundary.

6. **If the answer to question 4 and / or 5 is yes, is the ability of the AC to consider further options under Part 3 Division [5] Subdivision 8 of the Act constrained in any and, if so, what manner, other than by the Subdivision provisions themselves?**

The scope for the Committee to consider further options under Subdivision 8 of Division 5 of Part 3 of the Act is limited to freeway alignments that can be implemented within the project boundary.

Subdivision 8 of Division 5 of Part 3 of the Act sets out a mechanism for the preparation of supplementary comprehensive impact statements.

It allows, in “exceptional circumstances”, for an assessment committee to recommend to the Planning Minister that the Planning Minister direct that a supplementary comprehensive impact statement be prepared in respect of a “prudent and feasible alternative to the preferred option contained in the comprehensive impact statement”.

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There are a number of preconditions to an assessment committee making a recommendation to the Planning Minister under this provision:

a. the first is that a “further option” must be identified in the course of “a formal public hearing” or “a properly made submission”;

b. the second is that an assessment committee must consider that the further option provides a “prudent and feasible alternative to the declared project”;

c. the third is that an assessment committee must consider that the further option “has not been given sufficient consideration”; and

d. the fourth is that an assessment committee must be satisfied that “exceptional circumstances” exist which warrant the preparation of a supplementary comprehensive impact statement.  

The Terms of Reference influence the first of these preconditions in two important respects:

a. first, they limit the matters that can be properly addressed at the formal public hearing to those matters identified in clause 2(7) of the Terms of Reference; and

b. second, they define what constitute “properly made submissions”.

As described above, the Terms of Reference preclude consideration of further options for the Project as part of the formal public hearing (other than to the extent that they fall within the matters identified in clause 2(7)), and preclude further options being explored within properly made submissions (other than to the extent that the further options can form part of a project that may be implemented within the project boundary in accordance with clause 1(3)(b)).

Furthermore, and equally importantly, the Terms of Reference expressly apply to the entirety of Division 5 of Part 3 of the Act (which includes Subdivision 8 of Division 5) and are intended to direct the basis upon which the Committee assesses the CIS. Consistent with the task that the Committee is charged to perform under the Terms of Reference, there is no scope for the Committee to make a recommendation under section 69(2) in respect of any further options for the Project, other than in respect of those further options that can be implemented within the project boundary, and that the Committee considers have not been adequately addressed within the CIS.

Additional Matters

Direction 25 of the Committee’s Directions issued on 20 January 2014 (the “Directions”) requires that the LMA “[i]nclude in its response to Questions 1 to 6 of Document 1 (the section 57(4) paper), a response to matters raised by Yarra City Council including whether the LMA intends to revise the CIS, and the implications of this …”.

As indicated at the Preliminary Hearing the LMA does not intend to revise the CIS. The LMA understands that the remainder of the matters referenced in direction 25 of the Directions, being matters raised by Yarra City Council at the Preliminary Hearing,  

23 Section 69(3) provides guidance concerning what constitutes exceptional circumstances in this respect.
were matters consequential on the preparation of a revised CIS by the LMA. They accordingly do not arise for consideration in this instance.
3 The Reference Project

3.1 Consideration of alternatives

The LMA should advise what alternatives were considered (if any) and then discounted for inclusion in the reference project for the following project elements. An explanation of why any alternatives were discounted should be provided.

The development of the Project involved the consideration of a broad range of alternatives, including alternative alignment and interchange options to the north and south of the preferred alignment, as well as a range of tunnelling, surface and elevated road way configurations which might be implemented within the preferred alignment.

In discussing alternatives which were considered during the Reference Project development, including alternative options proposed in submissions, it is important to stress that the design of East West Link (and every other major road project) is constrained by well-established Australian design rules and safety standards which cannot be compromised. These are set out in further detail below but include Austroads Guidelines and the VicRoads Supplement to these guidelines.

A summary of this consideration of alternatives is set out in Volume 1, Chapter 4 of the CIS, as is a summary of the reasons why the central corridor was ultimately chosen as the preferred alignment.

With regard to the identified project elements, the following options were the main alternatives considered in developing the Reference Project.

(a) The rationale for the major tunnel construction methods proposed;

The CIS does not mandate the use of any particular tunnel construction method for the construction of those parts of the Reference Project that are identified as being within a tunnel.

Rather, the CIS identifies performance requirements that must be achieved, including those with regard to noise and vibration, regardless of the major tunnel construction method that is ultimately employed.

However, in the preparation of the CIS, regard has been had to the most likely forms of tunnel construction method that may be employed, as a means of identifying and assessing possible impacts. In this regard, there are four principal tunnelling methods that are currently used to construct road tunnels. These are:

- road header excavation, where specialised machines grind the tunnel face to break out the rock in the tunnel profile;
- excavation by tunnel boring machine (TBM), where the TBM removes the full area of the tunnel face as it progresses along the tunnel alignment;
- top down construction, where a slot from the surface is excavated and covered enabling the tunnelling space to be provided; and
- drilling and blasting, where hard rock is removed by the use of explosives.

Melbourne’s other major road tunnels (CityLink and EastLink) were constructed using road headers, with some minor use of explosives where the rock became particularly hard. However, ongoing improvements in TBM technology mean that these machines are now able to be constructed at a size which would accommodate a three lane
traffic envelope (15 + metre diameter), and therefore, for the East West Link (Eastern Section) tunnels, TBM excavation would be a practical tunnelling method.

However, TBMs are expensive items and the tunnel needs to be sufficiently long to justify their selection. In the case of East West Link (Eastern Section), where the tunnels are around 4.4km, TBM excavation is likely to be a cost effective option.

While the CIS does not mandate the tunnel construction method that must be used, in calling for tenders the LMA has required that a conforming tender be one where the majority of the tunnel is to be excavated below the surface employing one or more of methods 1, 2 and 4 identified above.

This means that top down or cut and cover construction would not be allowed except in the areas approaching the portals (and identified as such in the Reference Project) where this method would be necessary or desirable for technical reasons.

Summary

The development of the Reference Project has considered all the likely tunnel construction methods that might be utilised for the construction of those parts of the Reference Project that are identified as being within a tunnel. The CIS does not propose any particular method of tunnel construction, nor discount any method (other than top down tunnelling construction in the areas approaching the portals, and as identified in the Reference Project). Construction of the majority of the tunnel using the top down construction method was discounted because of the extensive adverse impacts that such a process would have on the existing urban environment.

The CIS identifies the likely impacts of tunnel construction, and identifies performance requirements that must be met, regardless of the particular method (or methods) that is ultimately employed.

(b) The location and design for tunnel portals and ventilation outlets;

Although a range of options were considered for the East West Link (Eastern Section) connection, the decision to require a long tunnel was made in order to minimise the impacts of the Project.

In effect, the full length of the connection between the Eastern Freeway and CityLink is proposed in the Reference Project to be located in tunnel, except where it is necessary to achieve connections to those existing freeways. This means that the alignment will generally pass under the residential and commercial areas along Alexandra Parade, Princes Street, the Melbourne General Cemetery, and most of Royal Park.

At each end of the tunnel the roadways being connected are either at the surface or elevated. Accordingly, it is necessary for the portals to be located in such a way that the connecting ramps can pass to and from the tunnel.

The locations for the tunnel portals that are identified in the Reference Project represent locations where it is possible to achieve an acceptable connection with existing surface or elevated road structures.

Other than in terms of general location, the precise design of the portals and any associated ventilation outlets is not mandated by the CIS. Rather, the CIS identifies performance requirements that must be met regardless of the final location, and / or design of the portals and ventilation outlets.
With respect to the design of the portals and the ventilation outlets, these performance requirements will include a requirement to achieve the outcomes identified as appropriate by the Urban Design Framework prepared for the Project.

In terms of ventilation, the CIS recognises and acknowledges that ventilation of the tunnels will be required to meet operational and safety requirements. For a tunnel of the length and type that it is proposed in the Reference Project it is expected that longitudinal ventilation would be employed. This means that air is drawn into the tunnel in the direction of traffic and extracted from the tunnel near the exit portal. Therefore, it is necessary for a ventilation station to be constructed at, or near, the location of each tunnel portal. It is possible that the necessary ventilation equipment could be accommodated in underground chambers meaning that the ventilation shaft would be the only visible component of the ventilation system.

However, the CIS does not mandate either the location or design of the ventilation outlets. Rather, it prescribes performance requirements for the ventilation outlets that must be achieved regardless of their final design and location. This will include performance requirements specified in the CIS with regard to urban design, and achieving appropriate environmental standards and outcomes.

**Summary**

Portal locations in the Reference Project have been identified on the basis that they minimise the extent of surface roads, and yet at the same time still allow for a safe and workable connection to existing surface and elevated roadways. Portal locations that did not minimise the extent of impact on surface roads were discounted because of the impact they would have on the existing urban environment, including Alexandra Parade and Royal Park.

It is expected that ventilation systems will need to be co-located with the tunnel portal. However, the CIS does not mandate any particular location or design of the necessary ventilation systems. Accordingly, no ventilation location or design has been expressly discounted. Rather, whatever the location and / or design, all performance requirements will need to be met.

*Interchange designs, particularly at the Hoddle Street Interchange, Elliot Avenue, Ross Straw Field, and connections from the existing road network to the project;*

The operational success of Melbourne’s freeway network depends in large part on the connectivity between the freeways and the surface road system. It is necessary for motorists to have frequent points of entry and exit so that they can effectively move around the city.

A key consideration in the preparation of the Reference Project was the need to have full connectivity between the Eastern Freeway / East West Link (Eastern Section) and Hoddle Street at the eastern end.

At the western end, the obvious connections between East West Link (Eastern Section) and CityLink provide for freeway to freeway connectivity, but do not connect East West Link (Eastern Section) to the surface road network. The intersection of Flemington Road, Mt Alexander Road and Racecourse Road to the North West of the CBD provides a unique nucleus of transport linkages. Racecourse Road provides connections with major arterial roads in the west such as Ballarat Road and Geelong Road. Mt Alexander Road provides accessibility to the inner north west suburbs, while Flemington Road and adjoining roads such as Boundary Road, provide linkages into North Melbourne and the north of the CBD. As such, it was determined that a connection to the surface road network in the vicinity of this important transport
linkage would be of great value to the connectivity of the transport network as a whole.

An interchange at Elliott Avenue was thought appropriate to provide the connectivity to the surface roads in this area while also providing increased access to the Melbourne Zoo, University of Melbourne and the medical precinct. If surface road connectivity is not provided at these locations the Project would only cater for much longer journeys and would provide a lower level of service to the community. With respect to alternative interchange designs at these locations, there were many varied design options considered and ultimately discarded before arriving at the configurations provided in the Reference Project, some of which were:

**Eastern End**

- At Hoddle Street, there were options developed which took the two East West Link carriageways onto structure from the Eastern Freeway up and over the Clifton Hill Rail Line and Hoddle Street bridge before descending into tunnel on the Western side of Hoddle Street. This option was discarded due to the high cost and perceived negative visual impact of such significant freeway structures.

- Other options considered the tunnel section starting to the east of Hoddle Street, closer to Merri Creek. This option had constraints on tunnel grades and the ability to provide safe and efficient ramp connections to and from Hoddle Street. It was also a high cost option.

- Consideration was given to proving the south to east movement from Hoddle Street to the Eastern Freeway through a typical at-grade intersection, however this provided a significant reduction in level of service for this movement and further congested Hoddle Street in the afternoon peak back towards Johnston Street. This option was discarded in favour of the current Reference Project flyover for this movement which provides a high level of service and the ability to provide bus priority.

- The Reference Project interchange was ultimately chosen as it provides a very neat solution of keeping the main East West Link carriageways on the surface and descending into tunnel on the western side of Hoddle Street while still fitting under the Hoddle Street bridge structure and within the piers and abutments. This option also provided for all necessary ramp movements in a safe and efficient configuration.

**Western End**

- Many options were considered at this location which ranged from elevated structures to tunnel alignments and at grade connections.

- Some options considered the East West Link ramps joining CityLink in the median rather than on the outside, although these were discarded because of constructability issues, as they would have needed more significant closures to CityLink during construction.

- Options were considered which had a tunnel portal further to the east and connected to an elevated viaduct on the eastern side of CityLink. This was discarded due to the significant impacts on Royal Park, east of Ross Straw Field and the significant private property acquisition required. These options also required very complicated structures to cross CityLink at the southern end near the Port of Melbourne for the full east west link
connectivity. These structures would have had an even larger footprint and associated private property acquisition and subsequent cost.

- The Reference Project was selected as it was believed that this arrangement of ramps provided the minimum impact on Royal Park, while maintaining the required functionality with appropriately designed safe and efficient connections.

- The provision of a ramp connection to Ormond Road was considered early in the project development but discarded due to design constraints of previous options. As the Reference Project developed, the ability to connect to Ormond Road northbound was more realistically achievable. In addition, through the development of the CIS, it was determined that this ramp would provide a superior traffic distribution outcome while improving access to these north western suburbs.

In addition to the designs at these locations there were considerations for additional connections from the tunnel to the road network in Carlton or Fitzroy. These options were discarded due to their requirement for significant impact on private property acquisition in this area, poor ramp grade outcomes, their high cost and traffic impacts to these local areas. Overall the provision of ramps at these midpoint locations did not fit in with the primary objectives of this Project to provide enhanced east to west connectivity.

In the process of developing the Reference Project and the CIS, a wide range of possible alternatives were considered for the various interchanges. Ultimately, however, the final form of the interchange designs are controlled by basic geometric requirements, provision for operational needs and traffic demands.

Traffic modelling has identified the anticipated volumes that would be likely to utilise the various ramp connections. These volumes dictate the number of lanes required for those intersections, and the number of stand-up lanes required at the intersections to ensure that traffic is cleared as efficiently as possible through each signal phase. In some instances, such as the north-bound to east-bound connection between Hoddle Street and the Eastern Freeway, the predicted volume of traffic has led to the need for a direct connection as reflected in the Reference Project “flyover”.

The length of the ramps is also influenced by a number of considerations. These include the need to transition from an underground level to the surface or above at a grade which supports efficient traffic movements. Grades of up to 6% have been considered for traffic emerging from the tunnel ramps, with 4% for the main tunnel carriageways. Higher grades than this would see the potential for stalling or very slow traffic speeds for traffic queued back from a red signal. In addition, provision has to be made for ramp metering storage so that the East West Link ramps can be operated as part of Melbourne’s overall freeway management system. Ramp metering, which releases vehicles individually to join the mainline traffic stream, means that traffic will queue at the signal points. It is necessary to contain such queued traffic within the ramp and not allow this queue to extend out onto the surface arterial roads.

Australian (and Victorian) road design standards also need to be accommodated. Ramp tapers, which facilitate the smooth integration of ramp traffic into the through traffic stream, have to meet geometric standards for the design speed. Similarly, intersection geometry to accommodate large turning vehicles needs to be designed to meet the appropriate standards. These standards also include elements such as vertical and horizontal clearances to allow passage of legally registered vehicles and to meet sight distance requirements.
Within the framework of the above constraints, the Reference Project proposes interchange configurations which are efficient, safe and workable, while at the same time being aware of the need to minimise impacts on adjacent properties and community facilities. At Hoddle Street, for example, the scope for variation in design is limited. Although it would be possible to conceive a more complex arrangement, the design process identified that physical impacts of such a design on the surrounding community would be significantly greater than what is proposed in the Reference Project. LMA has formed the view that the Reference Project would be able to achieve an appropriate intersection connection, but at the same time minimise the impacts as much as is possible.

The western interchange is similarly constrained and although variations to the Reference Project are possible, the fundamental need to connect roadways emerging from the tunnel to CityLink (with minimum impact) has once again resulted in the outcome proposed in the Reference Project. The design for the Elliott Avenue interchange has been developed with the objective of maximising the amount of underground roadway and achieving connectivity to Elliott Avenue largely within the current road reserve. Again, more elaborate interchange arrangements could be developed to provide greater overall traffic capacity but these would be at the expense of the loss of additional parkland and increased visual impacts.

**Summary**

Interchange designs which did not provide the necessary connectivity between the freeways and surface road networks were discounted as they would not provide the necessary traffic demands that this Project has to meet.

(d) **Locations for a viaduct adjoining CityLink and Moonee Ponds Creek for the section linking to the Port of Melbourne, in the context of the development of the Arden Precinct, as well as existing land uses (including public housing at Debneys Park Estate, and apartments in Bent Street) and waterway values; and**

**Port Connection along Moonee Ponds Creek**

Several alternatives were considered for the Part B connection between Part A and the Port area, including an alignment on the east side of CityLink, and continuation of the tunnel under Flemington Road with a portal north of Sutton Street, North Melbourne.

The assessment of the design alternatives had to consider the significant constraints and existing features in this complex urban environment, which includes CityLink, the Upfield rail line, major arterial roads, transmission power lines, and existing and proposed residential areas.

Locating the Part B connection on the east side of the CityLink viaduct was assessed as unfeasible because:

- there is insufficient space between the rail line, CityLink and existing multi-storey buildings on Racecourse Road;

- it would have very significant negative impacts on Royal Park in relation to removing parkland, disruption to sport facilities including community facilities such as Urban Camp and visual amenity as the viaduct would need to start at Elliot Avenue;

- weaving distances between the entry ramp at Racecourse Road and the Dynon Road exit would restrict the connection to CityLink; and
the Part B connection needs to be located on the western side of CityLink in the port area, so it can connect to the western section of East West Link.

The option of continuing the tunnel to a portal north of Dynon Road and Sutton Street was found to present substantial additional complexity, cost, and impacts on open space and residential areas. In particular:

- this option would require two pairs of two-lane tunnels, which would considerably increase the cost to construct Part A and require higher impact cut and cover construction in Royal Park near The Avenue, Parkville; and
- the transition from the tunnel to and over CityLink would need to be located north of Sutton Street, resulting in significant impacts on the Arden-Macaulay area.

Each design option considered would have some impacts on residential and open space areas.

In comparison with the options described above, LMA determined that the Reference Project for the Port Connection would require less private property acquisition, reduce impacts on Royal Park, significantly reduce the construction cost of Part A, and enable greater connectivity.

(e) Location of temporary road alignments (i.e. for traffic diversions, laydown areas and site compounds to be used during construction).

Temporary Road Alignments

The CIS does not identify the location of temporary road alignments, other than the proposed temporary realignment of Alexandra Parade that is identified in the Reference Project, in order to accommodate Alexandra Parade traffic during construction (as the excavation for the cut and cover tunnel construction would occupy the majority of the median and part of the eastbound carriageway in Alexandra Parade from east of Gold Street to Wellington Street).

The CIS identifies possible locations for construction work sites, and possible impacts including, in some cases, the need for traffic diversions. However, the final location of such traffic diversions will be a matter to be determined with the successful tenderer and will be subject to ensuring compliance with the relevant performance requirements identified in the CIS.

However, in preparing the CIS and the Reference Project, it has been necessary to have regard to the likely construction needs, and to identify how such needs might be satisfied. For example, provision has been made for the temporary realignment of Alexandra Parade to enable the transition between the Eastern Freeway and the driven section of the tunnel to be accommodated. The only other possible realignment would be on the southern side of Alexandra Parade and this was considered but is likely to be less desirable because it would impact a greater number of residential properties, result in greater local access disruption and involve more complex construction staging. At the western end, it is expected that some temporary realignment of roads such as Brens Drive and Manningham Street will be necessary to facilitate construction.

In all cases, however, it will be necessary for those carrying out construction activities to identify the location for temporary road alignments and other construction sites that are capable of meeting the performance requirements identified in the CIS and which are designed to minimise impacts on the community. The former Fitzroy Gasworks site at the corner of Alexandra Parade and Smith Street, and the Melbourne
Wholesale Fruit and Vegetable Market site on Footscray Road, are included in the project area and are available for project related purposes. Both sites are State owned land and could be used for project office purposes, workforce parking, storage of equipment and materials.

Summary

Whilst alternative temporary road alignments were not discounted, the provision that has been made to accommodate construction of the Reference Project is considered to be reasonable, and to represent an acceptable means of managing construction activity so as to minimise impacts.

8. The LMA should provide a response to proposed design modifications, including but not limited to:

(a) City of Melbourne's suggested use of the existing CityLink viaduct for the East West Link and other modifications proposed in section 2.1 of its submissions;

2.1.1: The City of Melbourne considers that the existing City Link viaduct between the Port of Melbourne and Flemington Road provides sufficient capacity until 2031 and that Section B of the Project is not required

LMA considers Part B to be an essential component of the East West Link.

The need for improved cross-city connections has been clearly articulated in Sir Rod Eddington’s East West Link Needs Assessment Study and outlined in Section 1 of the CIS.

The CIS has been prepared on the basis that the East West Link (Eastern Section) would ultimately form part of a full East West Link between Hoddle Street, Collingwood and the Western Ring Road, Deer Park.

To achieve the full East West Link, it is necessary to provide the section parallel to CityLink between Footscray Road and near Flemington Road, as proposed in the CIS.

When the full East West Link is in operation, the existing CityLink would not have the capacity to carry both the north-south travel demand catered for by CityLink, and the 60,000 vehicles per day expected to use the Port Connection once the full East West Link is in place.

It is therefore necessary to secure the corridor for Part B (Port Connection) to allow its construction at the earliest possible opportunity and provide certainty for land use changes as proposed in the Arden-Macaulay precinct.

2.1.2 and 2.1.3: The City of Melbourne submission considers that the proposed Arden Street Ramps be removed and the local road network in the Arden-Macaulay precinct be improved

As the Arden-Macaulay area develops into a significant employment and residential inner urban precinct over the coming decades, it is imperative that good access be provided, including, if practicable, from the East West Link.

It is considered that this access could be provided by a half diamond interchange at Arden Street that incorporates a grade separation with the Upfield rail line, associated bridgeworks over Moonee Ponds Creek, road works at Lloyd Street and Arden Street, as proposed in the Reference Project.

Future provision of East West Link ramps at Arden Street would provide direct access from the freeway network into the precinct, thus reducing road traffic demand on the
arterial road network in the area. LMA is of the view that the land identified for future provision of the Arden Street ramps should be reserved as part of this planning process.

**2.1.4: Melbourne City Council has requested that the Upfield Rail Line between Flemington Bridge and Macaulay be upgraded.**

Upgrading the Upfield Rail Line is outside of the scope of the East West Link (Eastern Section) Project. The Project however makes allowances to ensure that any future upgrade is not precluded.

**2.1.5: If needed in the long term, allow for a tunnel link connection between Royal Park and the Port of Melbourne.**

The possibility of an extended tunnel link was considered as part of the Reference Project options development, as outlined in CIS Volume 1, Chapter 4. As the CIS explains, this option was discounted for a number of reasons.

Firstly, the geology of the area and presence of low strength Coode Island silt materials along Moonee Ponds Creek and in Dynon / Footscray Road area is unsuitable for constructing large diameter tunnels.

Secondly, even without these conditions, the additional tunnel length would increase construction costs significantly.

(b) City of Melbourne's suggested options outlined in section 2.2 of its submission to reduce the impacts of the Western Portal on Royal Park and West Parkville including the:

i. Wetland Option
ii. Earth mound Option
iii. Alternative Ramp Alignment Option

**2.2.3.1 Wetland option, and 2.2.3.2 Earth Mound option**

In principle, LMA has no objection to either the Wetland or the Earth Mound options, as proposed in the City of Melbourne submission. In principle, they represent possible means by which the impacts of the Project could be mitigated. Each could also provide individual benefits depending on the option.

However, while these options have merit, they have not been the subject of detailed scrutiny, and the feasibility of such options would need to be fully considered in the context of:

- functionality of connection ramps to CityLink;
- their relationship in horizontal and vertical planes;
- geology under Ross Straw Field (i.e. Coode Island silt)
- settlement implications;
- detailed design;
- capital cost;
- social and environmental impacts; and
- ability to meet the performance requirements.

LMA considers that the design depicted in the Reference Project represents an acceptable and appropriate outcome having regard to the considerations above, and one that it considers would be able to meet the performance requirements identified in the CIS.
2.2.3.3: Alternative ramp alignment option

The City of Melbourne has suggested an alternative arrangement with regard to the area around Manningham Street and the Ross Straw Field. The City of Melbourne is not proposing any change to the north bound connections to City Link, but is proposing alternatives to the two south bound connections.

The City of Melbourne alternative proposals as presented are schematic only and have not been fully developed so as to demonstrate feasibility. Accordingly, LMA is not in the position to fully respond to the proposed design modifications, but provides the following preliminary comments:

(i) North bound ramp from CityLink to EWL

This option was considered as part of the detailed planning for the East West Link (Eastern Section), however, it was rejected, because:

- the design radius of the curve is approximately 240 metres which is not acceptable from a design speed and safety perspective;
- such ramp would constrain, and possibly prevent, construction of the Port Connection (Part B) as currently proposed by the Reference Project; and
- the proposed structure is located within 6 metres of the façade of the “Lombard” Building on Mt Alexander Road.

(ii) South bound ramp from East West Link to City Link

The City of Melbourne submission proposes a ramp from the tunnel portal along an elevated viaduct above the Upfield rail line from the East West Link crossing right through to Racecourse Road.

Whilst a design in exactly this form has not previously been considered by LMA, it is similar to a design option that was considered by LMA for the Port Connection to the east of CityLink, but ultimately discounted.

Having regard to the outcomes of that assessment, LMA does not support the proposed design modification. It considers that the proposed modification would:

- have significant implications on tunnel design and in-tunnel operation arising from the proposal for three consecutive exit ramps (i.e. exiting ramp to Elliott Avenue, the City of Melbourne proposed ramp to CityLink southbound, and the East West Link Port Connection (Part B) southerly ramp);
- require more extensive cut and cover construction in Royal Park to provide four tunnel lane cross section, as ground conditions are unsuitable for adopting below surface tunnel methods;
- impact on private property both to the north and south of Flemington Road that is currently not affected by the Reference Project;
- have additional visual impacts, as the ramp would be over the elevated section of the Upfield rail line; and
- have higher capital cost.
(c) City of Melbourne’s options to reduce the impacts of the Elliot Avenue portal on Royal Park as outlined in section 2.3 of its submission;

2.3.1: Delete the north east branch of the portal

The proposed interchange at Elliott Avenue provides for a half diamond interchange with easterly facing ramps.

The City of Melbourne submission suggests that the right turn from the East West Link to the north-east be deleted, and that the tram line relocation be reconsidered due to its impact on trees.

The traffic movements in this area have been carefully considered by LMA. At the present time there is a reasonable demand for the movement to the north east.

If the movement was deleted from the interchange, it would force traffic wanting to access these areas to travel in a westerly direction either to Flemington Road and / or do a U Turn at Brens Drive, with the latter providing an inferior outcome.

The key need for this interchange, as outlined in the response to the Committee’s Request no 7(c), is to provide for connectivity to the important transport linkages and high value land uses in the immediate vicinity. Alternative configurations of such connections would be considered by the LMA, providing that the appropriate movements and connections could be provided without adversely impacting road safety or operational performance. Simply deleting the north east branch of the interchange does not address these issues.

The actual design of the re-aligned tram line has not been finalised at this stage. However, LMA considers that the re-alignment required is likely to be relatively minor, that impacts of the re-alignment are unlikely to be significantly detrimental to Royal Park, and that the performance requirement to minimise impact on Royal Park can be readily achieved.

2.3.2: Close Macarthur Road

It is understood that the closure of Macarthur Road was first proposed by the City of Melbourne in 1984 as part of its Draft Master Plan for Royal Park.

Macarthur Road is an arterial road providing an important connection through Royal Park. It is also part of VicRoads over dimensional route OD3.

Given its strategic importance, it is not proposed to close Macarthur Road as part of East West Link (Eastern Section) Project. It is likely that VicRoads would oppose such an outcome, and the Committee may wish to seek advice from VicRoads as to its attitude in this regard.

It should be noted that if the City of Melbourne were to proceed with such a closure the likely impacts would be a redistribution of traffic to other road alternatives, including the section of Elliott Avenue which runs directly past the Melbourne Zoo access points, thereby increasing traffic through this area.

(d) City of Moonee Valley’s proposed transport impact mitigation measures contained in section 3.1 of its submission;

LMA has reviewed the transport impact mitigation measures proposed by Moonee Valley City Council (MVCC) in section 3.1 of its submission and has prepared a response to each of these, contained in Appendix A of this document. Some of the proposed measures are not feasible or are outside the project boundary.
LMA intends to discuss these measures further with MVCC during the performance requirement discussions required under Direction 29 of the Committee’s Directions dated 20 January 2014.

(e) City of Moonee Valley’s Open Space Design Interventions and Mitigation Requirements documented in Appendix A of its submission; and

MVCC has undertaken an extensive assessment of the possible impacts of the Project on open space located within the Moonee Valley municipality.

In general, the mitigation of impacts from East West Link on open space are addressed in the performance requirements and particularly LU1, U2, LU3, C1, LV1, LV2 and LV3, as well as the Urban Design Framework. LMA considers that the achievement of these proposed performance requirements would ensure that impacts on that open space arising from the Project are mitigated as far as is reasonably practical, and adverse impacts are minimised.

MVCC has made a number of recommendations that are more akin to upgrades, rather than mitigation. Many of these proposals are based on current master plans for various open spaces, so could be considered in the context of the precinct issues and design opportunities presented in the Urban Design Framework (pages 23 to 39).

The proposal to develop new master plans is beyond the scope of the Project, and differs from the master plan funding agreed with the City of Melbourne given the significant impacts on open space and recreation facilities in Ross Straw Field, Royal Park.

LMA's response to the specific mitigation measures proposed by MVCC in its Open Space Design Interventions and Mitigation Requirements, documented at Appendix A of its submission, is at Appendix B of this document.

(f) City of Yarra’s suggested diverging diamond intersection between Hoddle Street and the East West Link (submission p 42).

Many alternative interchange designs were considered at this location. One of the primary reasons for the bridge structure in the Reference Project is to provide a free flow movement for traffic travelling from the south to the east onto the Eastern Freeway in the afternoon peak. Without this bridge and using conventional interchange design it is expected that significant queuing and delays would occur on Hoddle Street. This bridge structure has also allowed for the introduction of a bus lane on this movement providing public transport efficiency gains.

The LMA has undertaken in depth analysis and review of the concept of a Diverging Diamond Interchange (DDI) and has a number of concerns.

The concept of a DDI aims to divert traffic onto the opposing carriageway for a small distance through the middle of the intersection. The DDI enables right turning traffic to have a free-flow movement onto the ramp once through the initial intersection. This typically occurs in a two phase operation which allows faster cycling of lights and therefore significant green-time. While this interchange configuration would provide an improved level of service for this right turn movement onto the freeway over the conventional diamond interchange, it is a reduction in level of service and performance compared to the Reference Project.

Due to the high traffic volumes for this movement, in order for the DDI to work effectively it would require around 4-5 standup lanes at the southern crossing point. Typically with a DDI, these lanes need to be provided at an angle no less than 40 degrees so that vehicles do not end up travelling on the opposing carriageway.
However with the large cross section, this angle needs to be even higher resulting in significant curves and reverse curves to accommodate the appropriate design considerations. Due to the significant geometric constraints in this area it would likely still result in the acquisition of private property on one or both sides of Hoddle Street.

Bus lanes are yet to be attempted in the context of a DDI. This would require additional lanes at the southern crossing location resulting in 5 lanes at this location as a minimum. This lane would need to be in the middle of the other lanes (two through lanes on the left and two right turn lanes on the right). With a bus stop in close proximity to this intersection it does provide a complex issue of ensuring that the bus is always able to merge across to the middle lane. This movement would be increasing more difficult to achieve in peak periods.

These interchanges also present problems for pedestrians and cyclists to navigate. While pedestrian crossings can be provided it does result in traffic approaching these crossings from the other direction. Non-familiar users may not be accustomed to this and in particular it could present issues for the visually impaired.

Above all, this interchange design represents a significant departure from normal driving conditions that Victorians are familiar with. In adopting a design of this nature there would need to be significant development of the design to address road safety concerns and combine this with the appropriate public education campaign to inform drivers as to how to negotiate the unfamiliar configuration.

The Reference Project developed does not have these concerns and so this was deemed to be the appropriate design for inclusion with the CIS.

The LMA supports the principle of a DDI, however, there are a number of specific and significant design constraints at this location.

9. The LMA should advise whether alternative tunnel or link designs were considered that could provide greater capacity over a longer transport planning time horizon.

The traffic analysis in the Comprehensive Impact Assessment indicates that the volume / capacity ratio in the morning peak for a three lane tunnel would be in the order of 0.7 - 0.9 in 2031. This will provide an acceptable level of service for an inner urban environment with six lanes providing daily capacity in the vicinity of 120,000 vehicles for east west cross city movements.

It should be noted for context that the tunnels would be developed with a maximum grade of 4% which improves the capacities of these tunnels over others on the network such as the Burnley tunnel which has grades in excess of 6%.

It should also be noted that throughout the majority of the day, there is ample spare capacity for the tunnels to accommodate additional traffic growth.

Any alternative of a four lane cross section would be significantly more expensive to build and would not provide any value for the additional cost until sometime in excess of 20 years.

Accordingly, the Reference Project provides an acceptable balance between long term travel demand and capital cost.

3.2 Impact on transport policy and projects

In developing the Reference Project, and in the preparation of the CIS, regard has been had to how other proposed road and rail projects might interact with the East
The projects include:

- Melbourne Metro;
- Melbourne Metro 2;
- the Doncaster Rail Link; and
- a potential light rail connection to the Fisherman's Bend urban renewal area.

Firstly, LMA notes that none of these projects are constrained in any physical sense by the Reference Project. The various projects are largely physically separate from the East West Link and, where they do interact, both projects could be accommodated without significant difficulty.

This is particularly so with regard to the proposed Melbourne Metro project, and the preferred alignment of the proposed Doncaster Rail. This will be expanded upon in addressing 10(b) of the Committee’s Request.

Secondly, it must also be recognised that, as Plan Melbourne makes clear, each project is designed to respond in a particular way to existing deficiencies in Melbourne’s transport system. For example, the East West Link responds, amongst other things, to a long identified need to improve east-west connectivity across the Melbourne metropolis, as well as significantly increasing the efficiency of Melbourne’s freight network by improving connections to export gateways and freight precincts.

On the other hand, the Melbourne Metro project is designed to increase the capacity of the inner metropolitan rail network, and to allow for any future extension of rail services.

The CIS recognises (as does Plan Melbourne) that addressing transport and connectivity issues in Melbourne requires a number of different solutions. Plan Melbourne identifies how the various projects identified therein will respond, in an integrated and complementary way, to those issues.

The LMA should advise how proposed road and rail projects that might interact with the East West Link - Eastern Section have been considered in the CIS and, if so, how the Reference Project ensures that these can be accommodated. Specifically, information is sought on the following:

(a) What steps have been taken for project integration as required under the Transport Integration Act 2010 (Vol. 2, Ch. 8, Section 18.3, (p2) of CIS); and

It is first necessary to identify just what is “required” for project integration under the Transport Integration Act 2010 (Vic) (TIA).

Section 1 of the TIA states that:

The purpose of this Act is to create a new framework for the provision of an integrated and sustainable transport system in Victoria consistent with the vision statement.

The vision statement is set out in section 6 of the TIA. It states that:

The Parliament recognises the aspirations of Victorians for an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State.
Division 2 of the TIA identifies the transport system objectives. They include the objective set out at section 11, which is entitled "Integration of transport and land use."

Section 11(1) states that:

_The Transport system should provide for the effective integration of transport and land use and facilitate access to social and economic opportunities._

Accordingly, while LMA understands that the Committee’s Request relates to a more confined concept of “integration” (namely the need to integrate road and rail projects), it is important to bear in mind that the TIA also speaks of integration in the wider sense, namely, the need to integrate the transport system with current and future land use, so as to facilitate access to social and economic opportunities.

Table 18-1 of the CIS (pages 3 to 5 of Volume 2 Chapter 18) identifies how the Project responds to the decision-making principles that are identified in the TIA.

In order to ensure that both the Reference Project and the CIS were developed in a manner that was consistent with the principles of the TIA (and in particular the principle of integration) the following steps were taken:

- Establishment of an Agency Liaison Group in February 2013, which met on a regular basis and included members from the key regulatory agencies including Aboriginal Affairs Victoria, EPA, Melbourne Water, Heritage Victoria, VicRoads, Department of Environment and Primary Industries, and the Department of Transport, Planning and Local Infrastructure (State planning). The meetings provided a forum to co-ordinate policy and ensure effective communication between departments and agencies responsible for various parts of the transport system.

- Development and implementation of a comprehensive community engagement program to engage stakeholders, ascertain the transport system user perspective and improve transparency. This included online forums, a community advertising campaign, letters to individuals, the publication of newsletters, holding several public information displays in the affected municipal areas, conducting a community survey and taking incoming phone and email inquiries. Further detail in relation to the community engagement strategy is included at Volume 1 Chapter 6 of the CIS.

- Development of the Environmental Management Framework and performance requirements.

- Development of the Urban Design Framework.

- Consideration of transport user needs through the community engagement activities noted above, the Traffic and Social Impact Assessments conducted as part of the CIS, as well as coordination and dialogue with VicRoads, PTV and VicTrack.

- Engagement with local councils.

- Consideration of a range of complementary public transport works (refer to discussion below).
Plan Melbourne

The development of the East West Link (Eastern Section) has had proper regard to the TIA objective to ensure integration of transport projects, both with existing and future land use, and other transport infrastructure proposals can be demonstrated by reference to Plan Melbourne.

Plan Melbourne is the State government’s Metropolitan Planning Strategy, which identifies the East West Link as a “major city-shaping project”.

Direction 3.1 of Plan Melbourne is to “Transform the Transport System to support a more productive central city”. Key challenges in this regard include the need to improve “travel across and within the expanded Central City and inner Melbourne…” and the need to “consider options to minimise cross-city and bypass traffic in the Central City”.

To meet these (and other) challenges, initiative 3.1.1 of Plan Melbourne is to “Build the East West Link as an integrated transport and land use project”. Page 73 of Plan Melbourne articulates in detail the reasons why the East West Link is considered one of the means of addressing Direction 3.1, and the many benefits that it will bring to the community.

The construction of Part A is identified as a short-term priority, followed by completion of the full East West Link freeway in the long term to connect the Eastern Freeway to the Western Ring Road.

East West Link is also identified as an integral part of the Integrated Economic Triangle proposed by initiative 1.1.2, and which will connect the Hastings–Dandenong corridor with the Hume corridor to the north and the Wyndham–Geelong corridor to the south-west.

The Integrated Economic Triangle is proposed to encompass the following elements:

- an expanded Central City;
- the Port of Hastings;
- the East West Link and the North East Link;
- the Melbourne Metro project (that will connect Dandenong and Sunbury); and
- the Outer Metropolitan Ring Road (that will connect Geelong and Avalon with the Hume Freight Corridor).

In addition, the East West Link project is specifically identified as contributing to the following directions and initiatives in Plan Melbourne:

- **Direction 1.1**: Define a new city structure to deliver an integrated land use and transport strategy for Melbourne’s changing economy.
  - **Initiative 1.1.2**: Recognise and depict the evolution of an Integrated Economic Triangle in the State Planning Policy Framework.

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24 At page 73.
Initiative 1.2.1: Plan for industrial land in the right locations across Melbourne's five subregions to support investment and employment.

Initiative 1.4.1: Expand the Central City to retain competitive advantages and attract diverse value-adding businesses.

Direction 1.6: Enable an investment pipeline of transit-oriented development and urban renewal.

Initiative 1.6.2: Identify new development and investment opportunities on the planned transport network.

Direction 3.1: Transform the transport system to support a more-productive Central City.

Initiative 3.1.1: Build the East West Link as an integrated transport and land use project.

Initiative 3.1.4: Support growing areas of the Central City by strengthening bus services to and around central Melbourne.

Direction 3.5: Improve the efficiency of freight networks while protecting urban amenity.

Initiative 3.5.1: Improve the efficiency of road freight connections.

Direction 4.6: Create more great public places throughout Melbourne.

Initiative 4.6.2: Develop Melbourne’s network of boulevards.

The LMA has had regard to all of the above considerations in preparing the Reference Project and in the preparation of the CIS. In doing so, it has followed the principles of the TIA with regard to project integration.

Complementary Works

In addition, significant consideration has been given to the implementation of a number of additional rail and road projects that, while they fall outside the scope of the East West Link Project, could complement it.

Future Rail Tracks

In consultation with PTV the design is to make allowance for the following future infrastructure:

- two additional standard gauge tracks on the Upfield rail line, to the west of the existing tracks, allowing for freight trains (although not double stacked container); and

- three broad gauge stabling tracks to the east of the existing tracks on the Clifton Hill rail line.
Eastern Freeway Widening

With the construction of the East West Link (Eastern Section), it is likely that additional traffic would use the Eastern Freeway to access the East West Link. LMA understands that, as a consequence, VicRoads is considering treatments to meet the future needs of traffic along the Eastern Freeway east of Yarra Bend Road, and which may include one or more of the following measures:

- providing additional lanes in some sections;
- making the most of existing lanes using a Managed Motorways system, including ramp metering and Intelligent Transport System (ITS) similar to the M1 and the Western Ring Road; and
- provision for priority for bus movements.

The Eastern Freeway works are designed to meet the future transport demands for this stretch of road and improve travel times and reliability for all road users. These works will also provide for high quality bus services along the corridor to enhance bus operations, and will not impact upon the ability to implement a proposed Doncaster Rail corridor.

The planning approvals for the Eastern Freeway works will be separate from the Major Transport Projects Facilitation Act approvals that are being pursued for Part A.

Funding for these works has, however, been included in the estimated full cost of the East West Link Stage One which is expected to be around $6 billion to $8 billion.

Inner North Public Transport Project

LMA understands that VicRoads is working closely with PTV to identify improvements for bus and tram routes in the inner north that could be implemented once the East West Link (Eastern Section) Project is completed, so as to achieve travel time benefits to public transport users.

It is understood that these improvements might include enhanced bus priority measures (particularly on the Doncaster bus routes) such as more priority through connected bus lanes operating for more of the day and improved signal operations.

Bus route improvements in the inner north would be complementary to the infrastructure works proposed for the Eastern Freeway, and which are concentrated on removing delays on those sections with the greatest numbers of bus users.

LMA understands that VicRoads and PTV will also investigate tram priority treatments, such as adjusting traffic light priority sequences along Alexandra Parade to give trams shorter wait times at these critical locations, as well as at other east-west routes that will carry reduced traffic once the tunnel is open. LMA expects that consideration would also be given to other treatments (such as greater separation from general traffic) along tram routes that could provide cost effective benefits to trams. There are several tram routes operating in the north-south direction, and these include tram routes 1, 8, 19, 86, 96 and 112.

Alexandra Parade Renewal

Alexandra Parade currently carries over 75,000 vehicles every day. The heavy traffic causes long waiting times at north-south traffic lights for trams, cyclists and pedestrians and discourages walking and cycling and other uses of Alexandra Parade.
Following construction of the East West Link (Eastern Section) tunnel, it is forecast that traffic volumes on Alexandra Parade will fall, creating opportunities to improve amenity in the area and provide better conditions for public transport, walking and cycling.

LMA has been and will continue to work closely with the Department of Transport, Planning and Local Infrastructure (DTPLI), VicRoads and PTV to identify opportunities to improve and renew Alexandra Parade during and after construction of the East West Link (Eastern Section) tunnel.

While Alexandra Parade will continue to be an important route for traffic, the construction of the East West Link (Eastern Section) would create an opportunity to make Alexandra Parade into a more attractive and amenable inner-city boulevard that can better serve multiple uses.

Outcomes could include:

- better conditions for public transport, walking and cycling;
- a stronger sense of connection between Collingwood / Fitzroy, North Fitzroy and Carlton / North Carlton;
- more green spaces and landscaping; and
- streetscape improvements.

It is likely that there will be opportunities for community input and involvement in the renewal project and that communities in the inner north, public transport users, cyclists and pedestrians (and the relevant Councils) would be able to provide input into the development of these opportunities.

(b) The LMA should advise how and where the Reference Project interacts with the following projects and ensures there are not significant constraints on their design and construction:

i. Melbourne Metro Rail Project
ii. Doncaster Rail Link

The Reference Project has been designed to ensure that it does not impact on the proposed routes for the proposed Melbourne Metro or Doncaster Rail.

PTV has prepared and published a Network Development Plan (NDP) in December 2012. The NDP presents a comprehensive strategy for the development of Melbourne’s rail system over the next 40 years, including development of Melbourne Metro and Doncaster Rail. Key projects listed in the NDP are:

- Regional Rail Link;
- Melbourne Metro; and
- South Morang rail services diverted into a new tunnel between Clifton Hill and Southern Cross, allowing construction of a new line to Doncaster.

Interaction with the Melbourne Metro and Doncaster Rail

Melbourne Metro project

Part B of the East West Link is proposed to cross the proposed Melbourne Metro in North Melbourne at a location between Dynon Road and Arden Street. See Figure 1.
At this location, it is proposed that the East West Link will be on an elevated structure, and the Melbourne Metro will be in tunnel. Accordingly, neither is likely to represent any type of significant constraint on the other.

While there is no specific performance requirement proposed to ensure co-ordination of the East West Link and Melbourne Metro projects, LMA and PTV have been working collaboratively to ensure that neither project is constrained by the other project. This close collaborative working relationship will continue in the future.

**Doncaster Rail project**

The Doncaster Rail Study recommended Rapid Transit Option 1 as the preferred option. Figure 6-2 from the Phase One Recommendations Report (Draft), dated December 2012, is reproduced at **Figure 2**. This identifies the proposed route for that preferred option.
For this preferred option, the proposed Doncaster Rail would be constructed so as to take advantage of the wide central median of the Eastern Freeway between Bulleen Road and Yarra Bend Road. It would then pass under the westbound lanes of the freeway, rising up to bridge over Merri Creek before descending into a short tunnel before connecting into the Hurstbridge line at a location around Victoria Park.

Accordingly it can be seen that the Reference Project design does not compromise the preferred option for the proposed Doncaster Rail, nor is it likely to present any significant constraint upon the design and construction of that transport project.

**South Morang Rail**

In addition to the two projects discussed above, consideration has also been given by the LMA to the proposed South Morang to Southern Cross railway line.

The PTV’s NDP states (at section 3.2, page 92) that –

*Strong patronage growth on the Clifton Hill Loop Line (formerly the Clifton Hill Group) will continue to put pressure on the trunk section from Clifton Hill to the City Loop. This issue, coupled with the intention to integrate a Doncaster rail line into the metropolitan rail network, will drive the need for a new track pair to be constructed into the city from Clifton Hill.*

*The solution will involve the creation of the South Morang – Southern Cross Line, which will accommodate the South Morang line through a new tunnel running from Clifton Hill to Southern Cross, via interchanges at Parkville and Flagstaff. There will be the option of including additional stations in the Carlton or Fitzroy areas.*
As can be seen, the proposed South Morang to Southern Cross rail line will cross under East West Link to the west of Hoddle Street and then run parallel as far as Lygon Street.

Accordingly it is very unlikely that the East West Link Reference Project design would impose any significant constraints on the design or construction of a future rail line from South Morang to Southern Cross.

### 3.3 Project definition

11. The LMA should provide detailed plans and diagrams of the Reference Project showing:

Each of the drawings listed below is contained in Appendix C of this document. At the request of the Committee communicated in an email from Emma Moysey dated 29 January 2014, only one set of drawings in A1 size has been provided, with the remaining 14 copies provided in A3.

Appendix C also contains additional drawings showing typical cross sections of various elements of the Reference Project for the Committee's reference, although these have not been specifically requested in this Request.
(a) Elevations at portals and relevant interchanges in AHD;

The following drawings show typical cross sections for different project elements: EWL-DES-DR-1142-C; EWL-DES-DR-1145-C; EWL-DES-DR-1146-C; EWL-DES-DR-1147-C; EWL-DES-DR-1148-C; EWL-DES-DR-3143 A.

In addition to the above drawings, a number of screen shots from the Urban Circus Model are also provided in Appendix C which show the Reference Project at the Hoddle St interchange, Elliott Avenue exit ramps, the western tunnel portal and at Ormond Road.

(b) Tunnel grades and vertical and horizontal alignments of the Reference Project tunnels at A1 or A0 scale including tunnel separation and the location of major utility services;

Longitudinal sections of the tunnel, including indicative levels in AHD, are contained in drawing numbers: EWL-DES-DR-1164-C; EWL-DES-DR-1165-C; EWL-DES-DR-1166-C; EWL-DES-DR-1167-C; EWL-DES-DR-1168-C; EWL-DES-DR-1169-C; EWL-DES-DR-1170-C; EWL-DES-DR-1171-C.

The following drawings show the horizontal alignments and locations of major utility services within the project boundary: EWL-DES-DR-1201-D; EWL-DES-DR-1202-D; EWL-DES-DR-1203-D; EWL-DES-DR-1204-D; EWL-DES-DR-1205-D; EWL-DES-DR-1206-D; EWL-DES-DR-1207-D; EWL-DES-DR-1208-D; EWL-DES-DR-1209-D; EWL-DES-DR-1210-D; EWL-DES-DR-1211-D; EWL-DES-DR-1212-D; EWL-DES-DR-1213-E; EWL-DES-DR-1214-E; EWL-DES-DR-1215-D; EWL-DES-DR-1218-D; EWL-DES-DR-1219-D; EWL-DES-DR-1220-D; EWL-DES-DR-1221-D; EWL-DES-DR-1223-D; EWL-DES-DR-1224-D; EWL-DES-DR-1226-C; EWL-DES-DR-1227-B.

(c) Road surface grades;

The following show the road surface grades for that part of the Reference Project that is not in tunnel: EWL-DES-DR-1161-C; EWL-DES-DR-1162-C; EWL-DES-DR-1163-C; EWL-DES-DR-1172-C; EWL-DES-DR-1173-C; EWL-DES-DR-1174-C; EWL-DES-DR-1175-C; EWL-DES-DR-1176-C; EWL-DES-DR-1177-C; EWL-DES-DR-1178-C; EWL-DES-DR-1179-C; EWL-DES-DR-1180-C; EWL-DES-DR-1181-C; EWL-DES-DR-1182-C; EWL-DES-DR-1183-C; EWL-DES-DR-1184-C; EWL-DES-DR-1185-D; EWL-DES-DR-1186-C; EWL-DES-DR-1187-C; EWL-DES-DR-1188-C; EWL-DES-DR-1189-C; EWL-DES-DR-1190-A.

(d) CityLink from chainage 30000 to 29600 to clearly indicate how the Racecourse Road off ramp and the ramp to the tunnel (i.e. Western portal) interact with each other;

The following drawing shows CityLink from chainage 30,000 to 29,600: EWL-DES-DR-3122-A.

(e) Vertical alignments of the route from chainage 4900 to chainage 3300;

The following drawings show vertical alignments of the route from chainage 4900 to 3300: EWL-DES-DR-1166-C; EWL-DES-DR-1167-C; EWL-DES-DR-1170-C; EWL-DES-DR-1171-C. Note that both carriageways match into existing Eastern Freeway pavement levels at around chainage 3480.

(f) Actual cross sections, as distinct from typical cross sections, at chainages 4800, 4600, 4500 and 4300; and

The following drawings show actual cross sections at chainages 4800, 4600, 4500 and 4300: EWL-DES-DR-3144-A; EWL-DES-DR-3145-A; EWL-DES-DR-3146-A.
(g) For the Ormond Road off ramp, LMA should provide information on the vertical alignment of the ramp, relevant actual cross sections and confirm whether a noise wall is proposed.

Drawing number EWL-DES-DR-1146-C shows an indicative cross section of the Ormond Road off-ramp and drawing number EWL-DES-DR-1190-A shows the actual levels at this location, further to the screenshot of the Urban Circus model listed in (a) above.

In relation to noise treatments at Ormond Road, performance requirement NV1 will apply to protect the amenity of residences at this area and it is expected that this may result in requirement for noise attenuation.
4 Traffic and Transport

Introduction

The following points should be noted when considering the responses related to forecast traffic volumes produced using the Strategic Transport Model.

The Strategic Transport Model forecasts of traffic volumes along proposed and existing roads are based on:

1. Model inputs, such as but not limited to:
   a. known travel behaviours and assumptions;
   b. the extent of future transport systems;
   c. future population and employment numbers and distribution; and
   d. other variables that can impact on travel behaviour such as toll rates, public transport fares and car operating costs.

2. The quality of the base model calibration to existing conditions. A strategic model needs to be appropriately validated and calibrated to reasonable and industry accepted criteria.

The Strategic Transport Model produces forecasts for up to 20 years in advance of the current day. While the forecasts produce a definitive volume, that volume should only be considered as an indicative volume for a number of reasons. For example, the model base year link volume may vary from the actual.

Further, actual volumes will depend on the actual circumstances that exist at the time, and will also depend on the extent to which the factors listed at (a) to (d) above vary from the model inputs.

Notwithstanding the above, traffic volume forecasts that are produced from a well calibrated and validated model, and using realistic model inputs, can provide a realistic indication of future traffic volumes, which can then inform an understanding of the likely traffic impacts of a project on the network. The traffic volume forecasts that have been produced by the Strategic Transport Model are examples of this type of forecast.

4.1 Background reports

12. The LMA should provide the following:

   a. A description of all traffic analysis and / or studies undertaken by or on behalf of the LMA or other organisations (and whom) to assess the impacts of the East West Link throughout the metropolitan area;
   b. The authors, titles and dates of all such analysis or studies; and
   c. The organisation that is able to produce the analysis or study.

The following list identifies the traffic analysis and modelling undertaken by or on behalf of LMA for the preparation of the CIS:
Given the scale of the East West Link, it would be common practice for other agencies to consider the impacts of the project in broader network modelling and analysis however the reports listed above are the sources of traffic modelling used to prepare the CIS.

In addition to those identified above, the following additional studies and policies informed the development of the Traffic Impact Assessment which is contained in Appendix E of the CIS. A copy of these can be provided by LMA to the Committee on request:

- City of Moonee Valley, *Tackling Transport Towards 2020, Integrated Transport Plan (ITP)* (undated)
- Department of Transport, *Victoria - The Freight State* (2013)

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25 The G1 Scenario (dated September 2013) is the most current version of the report and was used in the preparation of the CIS. Previous versions of this report exist however, they were superseded by the September 2013 version.
4.2 Traffic predictions - project

13. The LMA should provide a like-for-like comparison of the Eddington Report (figure 71, p131), with Chapter 7 of the CIS figure 7.7, p11 including a composite plan showing traffic distribution to the same zones based upon both the Eddington Report and GHD (Veitch Lister Consulting) findings. The plan should include four zones suggested by the Assessment Committee as follows, with a common eastern boundary of Merri Creek / Epping railway line / Hoddle Street / Punt Road.

Zone 1
North boundary - Glenlyon Road / Ascot Vale Road / Maribyrnong Road
West boundary - Maribyrnong River
South boundary - Alexandra Parade and Western Extension / Elliot Avenue / Racecourse Road / Smithfield Road

Zone 2
North boundary - as per south boundary of Zone 1
South boundary - Victoria Parade / Victoria Street / Dynon Road
West boundary - as per Zone 1

Zone 3
North boundary - as per south boundary in Zone 2
South boundary - Yarra River / Maribyrnong River
East and west boundaries - as per Zone 2

Zone 4
North boundary - as per south boundary of Zone 3
South boundary - Fitzroy Street / Port Phillip Bay
East and West boundaries - as above per Zone 2

The requested information is not able to be produced from the previous studies as LMA does not have the raw data that the original figures were produced from, and thus cannot reconfigure that data into the form that has been requested.

Notwithstanding this, the following data is provided to assist the Committee. This data shows:

- the distribution of trips at the end of the Eastern Freeway (daily) based on the CIS Strategic Model 2011 base year, divided into the zones requested; and

- the distribution of trips at the end of the Eastern Freeway (daily) based on the CIS Strategic Model 2011 base year, divided into the Eddington zones identified in Figure 71.
The data presented above demonstrates that in terms of the longer distance movements that are identified in the Eddington Study as using the Eastern...
Freeway to travel across the city, 14% travel towards the northwest, 10% travel to the west and 14% travel to the southwest. These numbers are broadly consistent with those of the CIS modelling of 14%, 10% and 16% respectively.

Figure 5A: Zones used for Eddington study traffic modelling

The daily distribution of traffic from the Eastern Freeway in the 2011 base case model is as follows

<table>
<thead>
<tr>
<th>Destination</th>
<th>All Day</th>
<th>AM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Freeway to Zone 1</td>
<td>13%</td>
<td>11%</td>
</tr>
<tr>
<td>Eastern Freeway to Zone 2</td>
<td>17%</td>
<td>24%</td>
</tr>
<tr>
<td>Eastern Freeway to Zone 3</td>
<td>23%</td>
<td>41%</td>
</tr>
<tr>
<td>Eastern Freeway to Zone 4</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Eastern Freeway to Other</td>
<td>37%</td>
<td>17%</td>
</tr>
</tbody>
</table>

14. The LMA should provide confirmation of the data used by GHD in its assessment of interchange levels of service and a copy of the results of any Microsimulation modelling done for the project.

The interchange levels of service were calculated for the signalised intersections and midblock locations within the vicinity of the interchange. The signalised intersections were calculated based on delays at the intersection, while the midblock locations were calculated based on the number of passenger car units (pcu) per lane per hour. LMA can confirm that the data used for the interchange levels of service is the data contained in Appendices A and B of the GHD East West Link - Eastern Section Traffic Modelling Report: Hoddle Street to CityLink, October 2013 appearing as Appendix B of the Traffic Impact Assessment in the CIS.
15. **The LMA should clarify in which areas of the CIS strategic modelling results were used and where Microsimulation data was used.**

Within the CIS the following chapters have used data obtained from the Strategic modelling:

- Chapter 7: Traffic and Transport;
- Chapter 11: Air Quality;
- Chapter 12: Noise and Vibration; and
- Chapter 16: Social and Business.

Volume 2 Chapter 7: Traffic and Transport has also utilised the microsimulation modelling.

A description of how and where the strategic modelling and microsimulation modelling have been used is described in Chapter 4: Methods of the *Traffic Impact Assessment* in Technical Appendix E of the CIS.

It should be noted that the main inputs into the micro simulation modelling were derived from the strategic modelling.

16. **The LMA should provide a summary of traffic projections versus actual volumes post opening of recent major road projects including Peninsula Link, EastLink and CityLink.**

**Peninsula Link**

A summary of traffic projections versus actual volumes post opening is available for Peninsula Link, which opened in January 2013. This summary is detailed in *Appendix D*. It can be seen that the traffic volumes forecast for Peninsula Link (as part of the 2009 Frankston Bypass Environment Effects Statement) have largely proven to be realistic, with some parts of the new freeway experiencing volumes 10-20% higher than originally forecast.

In addition to actual and forecast daily traffic volumes, *Appendix D* includes:

- Figures 1 & 2 showing the change in weekday traffic on the surrounding road network; and
- A table listing roads and the change in weekday traffic after Peninsula Link opened.

**Eastlink**

In the case of the EastLink toll road, Veitch Lister’s traffic forecast was within 10 per cent of the actual traffic volumes.

**CityLink**

The actual volumes (2000 to 2003) and the predicted volumes (for 2001 and 2011, taken from the Transurban Prospectus) for CityLink are also shown in Figure 5 below (*CityLink Graph*).

Shown at the bottom of the graph are the actual volumes in 1994 (taken from the Environment Effects Statement) on the sections of CityLink that existed prior to the CityLink project being constructed.
Veitch Lister Consulting (VLC) Forecasts

In addition to the above, Appendix E provides a table of volumes (forecast and actual) that have been produced by VLC.

This table identifies VLC forecasts for a number of major road projects throughout Australia that have been produced using the Zenith model (for that city). In relation to the forecast for the Clem 7 tunnel in Brisbane it should be noted that the model had not been specifically refined to model Clem 7 (that is, the base VLC Brisbane model was used).

LMA understands that the Zenith model:

- is currently being used for the long term prediction of toll road usage for all of South East Queensland's toll roads (both greenfield and brownfield projects); and
- is the basis for several major toll road investment decisions in South East Queensland (including the Queensland Motorway purchase of the Clem7 tunnel, Legacy Way tunnel and the Go Between bridge).

In addition to the above, LMA is aware that the Federal Bureau of Infrastructure, Transport and Regional Economics (BITRE) has been undertaking some work in reviewing issues with over optimistic patronage forecasts. Several reports and supplementary information can be found at: http://www.infrastructure.gov.au/infrastructure/public_consultations/patronageforecasting.aspx
The LMA should provide predictions of daily and peak hour truck volumes on interchange ramps and tunnels, including estimates of B-double and B-triple volumes.

The heavy vehicle volumes presented in Tables 7, 9 and 11 in the GHD Traffic Impact Assessment are outputs from VLC’s strategic model. The model provides outputs for cars, light commercial vehicles and heavy commercial vehicles (which generally align with tolling classifications). The model does not differentiate between the various classifications and therefore the heavy commercial vehicle volumes can only be presented as a totality. They cannot be used to make estimates of B-double or B-triple volumes.

The commercial vehicle volumes (heavy vehicle volumes) for the interchange ramps at the Eastern End, Western End and Elliott Avenue are presented in Table 1 below.

However, the number of B-doubles that would use the interchange ramps is expected to be very low due to the constraints of the inner road network, with the number of B-triples being minimal. B-triples require permits to travel on the road network and only along designated specific routes. Further, most of the heavy commercial vehicles using the tunnels would access them from the Eastern Freeway and CityLink, and therefore would be likely to have origins and destinations that are remote from inner Melbourne (with the exception of the Port of Melbourne).

Table 1  East West Link (Eastern Section) interchanges - 2031 Heavy Commercial vehicle volumes

<table>
<thead>
<tr>
<th>Location</th>
<th>Daily Volume</th>
<th>AM Peak 1 hour</th>
<th>PM Peak 1 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tunnels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East West Link Tunnel – Westbound</td>
<td>2,800</td>
<td>180</td>
<td>190</td>
</tr>
<tr>
<td>East West Link Tunnel – Eastbound</td>
<td>2,600</td>
<td>150</td>
<td>230</td>
</tr>
<tr>
<td><strong>Hoddle Street Interchange</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East West Link Tunnel to Hoddle Street</td>
<td>500</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Hoddle Street East West Link Tunnel</td>
<td>500</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>East West Link Tunnel to Eastern Freeway</td>
<td>2,600</td>
<td>150</td>
<td>230</td>
</tr>
<tr>
<td>Eastern Freeway to East West Link Tunnel</td>
<td>2,800</td>
<td>180</td>
<td>190</td>
</tr>
<tr>
<td><strong>CityLink Interchange</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East West Link Tunnel to CityLink (north)</td>
<td>1,500</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>East West Link Tunnel to CityLink (south)</td>
<td>500</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>East West Link Tunnel to East West Link Port Connection</td>
<td>600</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>CityLink (north) to East West Link Tunnel</td>
<td>1,100</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>CityLink (south) to East West Link Tunnel</td>
<td>600</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>East West Link Port Connection to East West Link Tunnel</td>
<td>600</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td><strong>Elliott Avenue Interchange</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elliott Avenue Interchange Exit Ramp - Left turn</td>
<td>500</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Exit Ramp - Right turn</td>
<td>100</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Entry Ramp - Left turn</td>
<td>100</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Entry Ramp - Right turn</td>
<td>600</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td><strong>Ormond Road Interchange</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ormond Road off ramp</td>
<td>500</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>
18. **The LMA should advise why 6pm to 7am for off-peak is used rather than the typical 7pm to 7am off-peak period.**

The Strategic Transport Model is divided into four time periods (based on travel behaviours) consisting of two peak periods defined as 7am to 9am and 4pm to 6pm, an inter peak period of 9am to 4pm, and an off peak period of 6pm to 7am. The development of these time periods was based on observed traffic data and the Victorian Integrated Survey of Travel and Activity (VISTA).

The most critical period in the afternoon peak is from 5pm to 6pm, which is adequately represented in the afternoon peak of the Strategic Transport Model.

19. **The LMA should advise whether the Reference Project has been designed to, or could, accommodate dedicated high-occupancy vehicle lanes and, if so, how and or where?**

High-occupancy vehicle (HOV) lanes are used to enable specific users to gain travel time advantages over other users and thus encourage carpooling behaviour. The Melbourne freeway network is currently being transformed with the implementation of Freeway Management Systems, which are primarily designed to remove congestion points on the freeways and keep traffic free flowing. This is undertaken by limiting the traffic entering the freeway network using ramp metering sites on freeway entry ramps.

Therefore the traditional benefit of HOV lanes along freeways is not realised in such a system. Benefits can however, be provided for such vehicles at the entry and exit points of the freeway by providing HOV lanes that bypass the ramp metering site of entry ramps, and similarly along exit ramps to bypass traffic queues exiting the Freeways.

As such the design for the East West Link includes a T2 lane along the city bound exit ramp of the Eastern Freeway to Alexandra Parade, so as to enable T2 lane users to bypass the expected queue of traffic along this ramp.

The Reference Project has not been specifically designed to accommodate dedicated HOV lanes along the length of the tunnel. However, HOV lanes could be provided at the expense of a traffic lane if so desired, although this would likely result in an unbalanced lane utilisation and would not provide value for money in regards to the high expense for tunnelled infrastructure.

20. **The LMA should provide or identify the traffic modelling inputs into noise and air quality assessments for 2021 and 2031.**

The traffic modelling inputs into the noise and air quality assessments for 2021 and 2031 have been taken from the VLC model outputs for the East West Link (Eastern Section) scenario. The model runs utilised for these assessments include:

- 2011 Existing Conditions;
- 2021 without East West Link;
- 2021 with East West Link - Eastern Section, Hoddle Street to Port Connection;
- 2031 without East West Link; and
- 2031 with East West Link – Eastern Section, Hoddle Street to Port Connection.

The 2021 traffic data was only utilised for the air quality modelling. The reason for using 2021 data is discussed in sections 4.3 and 5.4.1 of the Air Quality Assessment (Technical Appendix I of the CIS). To summarise, vehicle emission factors are
available for 2021, but not 2031. Based on current trends, vehicle emission factors are expected to be lower in 2031 than 2021, to the extent that total emissions in 2021 will be the worse than in 2031. Since vehicle emission rates are not yet available for 2031, 2021 emission data was used with 2031 traffic data for the 2031 air quality assessment.

The VicRoads Traffic Noise Reduction Policy requires design of noise mitigation to achieve compliance for 10 years after construction. The 2031 traffic data was therefore used to model traffic noise in the Surface Noise and Vibration Assessment (Technical Appendix J of the CIS).

4.3 Traffic predictions - eastern end

The LMA should provide a table showing 2011 daily and peak hour traffic volumes and projected 2021 / 2031 daily and peak hour volumes eastbound and westbound at am and pm peak hours for (as relevant):

- the Eastern Freeway at Yarra Bend Road;
- the Eastern Freeway off ramp to Hoddle Street;
- the Eastern Freeway eastbound on ramp;
- the tunnel west of Hoddle Street and Alexandra Parade at Wellington Street; and
- north and south bound volumes on Hoddle Street north of the Eastern Freeway off ramp and at Johnston Street.

All major road projects are designed to accommodate traffic volumes for 10 years after opening. As such the traffic impacts which need to be mitigated should focus on the 10 year horizon. In the case of East West Link, this best aligns with the 2031 model year. As there are forecasted to be more trips in 2031 compared to 2021 (due mainly to population growth) any impacts identified in 2031 are likely to be less in 2021. Subsequently, any mitigation treatments identified for 2031 will be more than adequate to accommodate 2021 traffic impacts.

Therefore, the traffic assessment which was undertaken as part of the CIS has not considered the impact of the forecasted traffic volumes in 2021. Consequently only 2031 vehicles numbers have been provided.

While LMA understands that 2021 forecast traffic volumes have been developed, this data was not relied upon in the preparation of the Traffic Impact Assessment contained in the CIS. LMA understands that modelled volumes were produced to inform the tolling and revenue analysis for the purposes of preparing the Business Case, but was not developed to consider broader network impacts.

LMA notes that the data would not be reliable or accurate for assessment of traffic impacts. This is because the network traffic volumes in the model runs do not consider the impacts of the road ramp-up period, which occurs as users become aware of the freeway and its benefits.

It is also expected that in this short timeframe there may be localised redistribution of some land use as a result of the East West Link (Eastern Section) Project. The model assumes that this would have fully taken affect by 2021, which would result in higher than expected volumes on the East West Link and therefore distort the likely impacts on other parts of the network.

Accordingly, the 2021 volumes forecast in the model would not provide a true representation of the likely traffic volumes, or the impacts expected on the broader road network. For these reasons they were not relied upon for the purposes of the CIS.
Table 2 below presents the 2011 daily traffic volumes (all vehicles) that are available, and the forecasted 2031 daily and peak hour volumes (all vehicles). These figures should be considered in light of the points raised in section 4.

**Table 2  Hoddle Street Interchange - 2011 and forecast 2031 traffic volumes**

<table>
<thead>
<tr>
<th>Location</th>
<th>Weekday Traffic Volumes (Actual 2011)</th>
<th>Weekday Traffic Volumes (Forecast 2031)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AM Peak 1 Hr</td>
<td>PM Peak 1 Hr</td>
</tr>
<tr>
<td>Eastern Freeway at Yarra Bend Road - Westbound</td>
<td>6,700</td>
<td>4,200</td>
</tr>
<tr>
<td>Eastern Freeway at Yarra Bend Road - Eastbound</td>
<td>3,800</td>
<td>6,400</td>
</tr>
<tr>
<td>Eastern Freeway off ramp to Hoddle Street</td>
<td>2,400</td>
<td>1,200</td>
</tr>
<tr>
<td>Eastern Freeway on ramp - from Hoddle Street</td>
<td>1,300</td>
<td>3,400</td>
</tr>
<tr>
<td>Hoddle Street north of the Eastern Freeway off ramp - Northbound</td>
<td>800</td>
<td>1,800</td>
</tr>
<tr>
<td>Hoddle Street north of the Eastern Freeway off ramp - Southbound</td>
<td>1,200</td>
<td>1,400</td>
</tr>
<tr>
<td>Hoddle Street north of Johnston Street - Northbound</td>
<td>1,700</td>
<td>4,200</td>
</tr>
<tr>
<td>Hoddle Street north of Johnston Street - Southbound</td>
<td>3,800</td>
<td>2,300</td>
</tr>
</tbody>
</table>

The GHD East West Link - Eastern Section Traffic Modelling Report October 2013 quotes average delays and queue lengths for the proposed Hoddle Street Interchange with 2031 traffic volumes.

22. The LMA should provide the same average delay and queue length data for the current Hoddle Street Interchange based upon 2011 traffic volumes and 95th percentile queue length data for both 2011 and 2031.

The average delay and queue length data for the current Hoddle Street Interchange is presented in Table 3 to Table 6 at Appendix F of this document.

The 95th percentile queue length data for both 2013 and 2031 of the Hoddle Street Interchange is presented in Tables 3 to Table 10 at Appendix F of this document.

It should be noted that the VISSIM (microsimulation model) has used 2013 as the base year rather than 2011, which was used as the base year for the strategic model. This difference is because the VISSIM model required data to be collected for the calibration process of the model. The 2011 data available was incomplete (with regard to matters such as queue length and travel time surveys) and hence additional data was required to be collected. Traffic conditions have altered between 2011 and 2013, and therefore it was not possible to add observed 2013 data to the available 2011 data. As a consequence, it was determined that the microsimulation model would use 2013 data, and hence the base year for this assessment is 2013.
Queue lengths in VISSIM are calculated over a specified time period, and show average and maximum queue lengths over this period. However, for the purposes of the request, queue lengths have been recorded in the model every 10 seconds and the 95th percentile queue has been calculated from these results. This information is presented in Appendix F of this document.

23. Table 23, page 65 of the GHD report indicates that Alexandra Parade carried 80,000 vpd, two way in 2011. The LMA should advise the proportion of these vehicles that are anticipated to be diverted to the tunnel.

The inclusion of the East West Link (Eastern Section) into Melbourne’s transport network would result in a redistribution of many trips around the network. While some trips will redistribute from Alexandra Parade to the East West Link (Eastern Section) tunnels, other trips using roads other than Alexandra Parade are also expected to redistribute into the tunnels.

The expected result of this is that the reduction in traffic along Alexandra Parade will then provide capacity to allow other trips to redistribute onto the better flowing Alexandra Parade.

Consequently, it is important to understand that the actual traffic volumes expected to divert from Alexandra Parade to the East West Link tunnels is expected to be higher than the overall net reduction in traffic on Alexandra Parade.

It is forecast that traffic volumes on Alexandra Parade will increase up to approximately 88,000 vpd (two-way) in 2031 without the East West Link. It is forecast that this volume will reduce by 20-30% due to the introduction of the East West Link (Eastern Section).

24. The LMA should explain the “additional six lanes” quoted in Table 23 of the GHD Report and the source of the 54,000 to 67,500 vpd additional movements on the Eastern Freeway.

The “additional six lanes” quoted in Table 23 of Technical Appendix E of the CIS is a reference to localised widening to provide the additional three lanes in each direction for traffic entering / exiting the East West Link (Eastern Section) tunnels from the Eastern Freeway, in addition to the existing ramps at Hoddle Street and Alexandra Parade.

The source of the additional movements on the Eastern Freeway is depicted in the following plots. The first plot (Figure 7) shows the daily origins of the additional westbound trips on the Eastern Freeway while the second plot (Figure 8) shows the daily origins of the additional eastbound trips. These plots were produced using data derived the strategic transport modelling.
The LMA should advise what the implications would be, if any, of not widening the Eastern Freeway.

The traffic data used in the Traffic Impact Assessment assumed no widening or capacity improvements of the Eastern Freeway.
The treatments that LMA understands are being considered for the Eastern Freeway are described in further detail under item 10 of this document.

26. **The LMA should clarify whether the east west traffic volumes on Alexandra Parade post 2026 will be similar to present volumes (as measured in 2011).**

Traffic volumes along Alexandra Parade are forecast to increase by up to 10% between now and 2031 without the East West Link.

The inclusion of the East West Link Project is likely to result in a 20 to 30% decrease in Alexandra Parade traffic volumes. Accordingly, it is expected that there will be in the order of a 10 to 20% reduction on Alexandra Parade in 2031 compared to current day.

27. **The LMA should clarify what percentage of the forecast Alexandra Parade traffic volumes, east of Brunswick Street, travels to / from east of Hoddle Street, by direction.**

In 2031, with the East West Link project, it is forecast that about 90% of all traffic on Alexandra Parade (between Brunswick Street and George Street) will travel to / from the east of Hoddle Street.

This 90% comprises 65% on the Eastern Freeway and 25% on Heidelberg Road. The remaining 10% comprises destinations (origins) to the north and south of Alexandra Parade (and west of Hoddle Street).

28. **The LMA should clarify why the traffic volumes on the Hoddle Street exit ramp from the Eastern Freeway are forecast to decrease by 3,000 vpd (GHD Report p71).**

The reduction in daily traffic volumes along the Hoddle Street exit ramp is caused by a redistribution of traffic following the introduction of the East West Link (Eastern Section).

It is reasonable to believe that some users of this exit ramp that travel to destinations such as North Melbourne or the Western suburbs would potentially redistribute to the East West Link tunnel. Similarly, there are vehicles that currently travel south down Hoddle Street which may travel further west along Alexandra Parade to travel south along one of the other north-south roads. Hence, there will be a decrease of traffic volumes.

As a result of the reduced volumes on this ramp, movements from the Eastern Freeway to Hoddle Street are expected to see reductions in delay and travel time through this interchange.

29. **Table 7-4 (Chapter 7, p32) indicates that Wellington Street traffic volumes will decrease by 10-15 percent by 2031 with the East West Link operating. The LMA should advise : As no change is forecast in Hoddle Street traffic volumes in 2031 post-East West Link why will Wellington Street volumes decrease?**

There will be a reduction in traffic on Hoddle Street for the reasons set out in response 28. The CIS indicates a reduction in traffic on Hoddle Street between Victoria Parade and Alexandra Parade of up to 10%.

This is because Hoddle Street is also acting as a key feeder road to the East West Link tunnel via the interchange at Collingwood. Due to this connection, there is some local traffic redistribution.

The Reference Project incorporates improvements to the Hoddle Street interchange to provide for more efficient movement of traffic through this key Melbourne arterial road. The fly-over bridge structure for the south to east traffic (including a dedicated bus...
The Reference Project separates this Hoddle Street traffic, bound for Alexandra Parade and the East West Link, prior to the intersection, thereby providing a largely free flow access for these movements.

Wellington Street is expected to have reductions in traffic volumes, as it is likely that some east west traffic would no longer use Wellington Street to access Alexandra Parade. Rather, this traffic is likely to relocate to Hoddle Street to access the East West Link (Eastern Section) tunnels.

4.4 Traffic predictions - western end

The freeway to freeway ramps between the tunnel and CityLink, northbound to Tullamarine and southbound towards Port of Melbourne, as shown on Sheets 5 and 6, provide a freeway standard connection that is now only available via the arterial road network. The LMA should provide:

30. An indication of the current demand for these movements, by direction during the peak hours and daily.

The Strategic Transport Model indicates that the demand for cross-city travel between the east and west of Melbourne (including Tullamarine and the Port of Melbourne) is currently around 300,000 vehicle trips a day (in both directions). This level of demand is expected to reach 440,000 vehicle trips in 2031.

Unfortunately, it has not been possible for LMA to further disaggregate this data into peak periods by direction within the time available to respond to the Committee’s Request.

However, as an indication, there are high traffic volumes on each of the on and off ramps along CityLink in this area (i.e. Flemington Road, Brunswick Rd, Moreland Road, Bell Street, Bulla Road, Racecourse Road, Dynon Road and Foostcray Road).

This indicates a high demand for movements to and from the north and south along this corridor. It is therefore reasonable to assume that a significant proportion of this demand has an origin or destination in the east or west, and that as a consequence a freeway to freeway connection from the East West Link has the potential to reduce the traffic load on many of these arterial roads.

The outputs of the strategic transport modelling supports this conclusion, with forecast reductions in traffic on many of the east west arterial roads.

31. The LMA should provide a Table showing projected 2021 and 2031 daily and peak hour traffic volumes at:

a. The tunnel portal defining traffic movements by direction to and from CityLink;
b. On the exit ramp from the tunnel at chainage 29000 showing separate volumes to CityLink and the new elevated structure;
c. On the new elevated structure at chainage 29600 showing volumes from CityLink and the new structure;
d. Entry and exit ramp movements by direction at the Elliot Avenue Interchange; and
e. The Ormond Road off ramp.

As stated previously in response to item 21, for a number of reasons the traffic assessment that was undertaken as part of the CIS did not consider the impact of the forecasted traffic volumes in 2021. Consequently, only 2031 vehicle volumes have been provided.

The following figures present the information requested in parts (a)-(c) of this request.
Figure 8a: Traffic exiting the East West Link Tunnel (westbound) (Daily / AM 1 hour peak / PM 1 hour peak)

Figure 8b: Traffic entering the East West Link Tunnel (eastbound) (Daily / AM 1 hour peak / PM 1 hour peak)

Table 3 below responds to parts (d) and (e) of this Request by presenting the forecasted 2031 daily and peak hour volumes. Once again, these volumes must be considered in light of the points raised in Section 4.

Table 3  Forecasted 2031 Traffic Volumes near the Western Portal

<table>
<thead>
<tr>
<th>Location</th>
<th>2031 Daily</th>
<th>2031 AM Peak</th>
<th>2031 PM Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>d. Entry and exit ramp movements by direction at the Elliot Avenue Interchange; and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elliott Avenue Interchange Exit Ramp - Left turn</td>
<td>8,500</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Exit Ramp - Right turn</td>
<td>2,300</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Entry Ramp - Left turn</td>
<td>2,900</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>Elliott Avenue Interchange Entry Ramp - Right turn</td>
<td>12,200</td>
<td>900</td>
<td>1,000</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td>e. The Ormond Road off ramp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ormond Road off ramp</td>
<td>12,100</td>
<td>700</td>
<td>1,200</td>
</tr>
</tbody>
</table>

32. The LMA should advise on page 25 of GHD Appendix B, the average queue length at the Ormond Road off ramp in the pm peak period is quoted as 57m. What is the 95th percentile queue length for the same time period?

The 95th percentile queue length for the Ormond Road ramp in the same time period as the average queue length of 57m quoted in Appendix B to the Traffic Impact Assessment contained in Appendix E of the CIS (second half of PM peak period, between 1700-1800) is 135m. The 95th percentile queue length for the Ormond Road ramp is 100m between 1600-1700. This queue can easily be accommodated on the off-ramp without impacting on the through movement.

Queue lengths in VISSIM are calculated over a specified time period and show average and maximum queue lengths over this period. The 95th percentile queue length is not a defined output from VISSIM. For the purposes of the Committee’s Request, queue lengths in the model have been recorded every 10 seconds and the 95th percentile queue length calculated from these results.

33. The LMA should advise on the current peak hour and daily demand for traffic movements between the ‘catchment’ of the Elliott Avenue ramps and the Eastern Freeway / Hoddle Street.

This is a complex request and accordingly LMA has been unable to prepare the data requested in the time available. However, LMA has prepared Figure 9, which identifies the proportional distribution of traffic at the Elliott Avenue exit ramp from the East West Link tunnel strategic modelling (the width of the bar represents the relative volume). As can been seen from this, approximately one third of the traffic turns right from the exit ramp to access Macarthur Road and Elliott Avenue north, with the remainder of the traffic travelling left to Racecourse Road, Mt Alexander Road, Flemington Road and destinations beyond.
34. The LMA should advise whether the projected daily volumes for the elevated roadway shown on Sheets 6 and 18 to 22 is 10,000 to 20,000 vpd without the western section of the route.

LMA can confirm that the projected daily volumes for that part of the elevated roadway are between 10,000 to 20,000 vpd without the western section of the route.

Further, the volume is forecast to increase to around 60,000 vpd when the full East West Link is operational (i.e. once the Western Section is also constructed).

35. The LMA should advise the status of the western section of the route as shown on Figure 1 in the CIS Summary Report, and whether work has been undertaken to define the alignment and whether there is a timetable for construction.

LMA commenced a planning and consultation study in 2009 for the section between the port area and the Western Ring Road. A preferred route was identified and made public in 2010, however further work will be necessary before formal planning approvals can be sought for this connection.

The need for the full 18 kilometre East West Link has been clearly articulated in Sir Rod Eddington’s East West Link Needs Assessment Study and in the CIS.

Subject to the planning and procurement process, the Victorian Government has committed to building the East West Link Stage One, between the Eastern Freeway and CityLink, as it will provide the most benefits as a stand-alone project.

The connection from CityLink to the Port of Melbourne area is included in the scope of the CIS.
5 Planning and Design

5.1 Design opportunities

36. The LMA should advise the consideration given to the “East West Link Project Incorporated Document”, or another proposed approval, being more specific regarding the realization of precinct specific design opportunities.

The intended function of the Urban Design Framework is to articulate the urban design principles to be applied in the planning and implementation of the Project and to describe the quality of urban design outcomes that are to be delivered as a component of the project.

Rather than prescribing specific design outcomes, however, the framework seeks to encourage innovation and excellence in urban design by establishing a performance-based regime. It is important that the regime be flexible to ensure that the urban design of the Project is properly integrated with the functional design of the Project.

The centrepiece of this regime is the urban design principles which have been replicated in Table 1 of the Incorporated Document. They consist of a series of qualitative benchmarks and are intended to establish the overarching performance requirements in respect of the urban design of the project.

The rationale for requiring, as part of the Incorporated Document, that the use and development of the Project be “generally in accordance with” the urban design principles is to ensure that the qualitative benchmarks are met in the design and implementation phases of the project.

The Committee’s question concerns whether LMA gave consideration to referencing the precinct specific design opportunities, which are outlined in the Urban Design Framework, within the Incorporated Document (or other applicable approval). The opportunities identified as precinct-specific design opportunities in the Urban Design Framework were considered in formulating the urban design principles outlined in Table 1 of the Incorporated Document. A design that is “generally in accordance with” the urban design principles will necessarily respond to some or all of those opportunities.

However, the precinct-specific design opportunities are, at least in part, more prescriptive than the urban design principles. It may, therefore, be possible to deliver high quality urban design outcomes consistent with the urban design principles that do not implement some of the more prescriptive design opportunities specified in the Urban Design Framework. It is for this reason that reference was not specifically made to the precinct-specific design opportunities within the Incorporated Document.

The precinct-specific design opportunities will nevertheless play a role under the regime to be implemented under the Incorporated Document, by providing context (as part of the Urban Design Framework) in respect of how the urban design principles might be given effect in each of the different precincts.

37. There are several documents listed in Appendix F, Part 3.4 to the CIS. The LMA should advise how the Reference Project is consistent with the listed documents.

Part 3.4 of Appendix F to the CIS outlines a number of local strategic documents that effect different portions of the proposed route of the reference project. Before turning to an assessment of how the Reference Project is consistent with these documents it is important to note the following three matters:
• First, it is not necessary for the Project to be consistent with each and every local policy or strategic document in order for it to possess strategic merit when assessed against the entirety of the planning policy framework. Instead, a key role of the Committee – particularly in assessing Planning Scheme Amendment GC2 – is to balance competing policies at both a state and local level in considering (amongst other things) the extent to which the Project will implement the objectives of planning in Victoria.

• Second, the status of the relevant documents should be borne in mind by the Committee in assessing to what extent (if any) the consistency of the Project with the strategy is relevant to the Committee’s task. Some of the documents have no formal status under the various planning schemes affected by the project, some constitute reference documents within the affected planning schemes, some have been adopted by the relevant planning authorities (but not incorporated within the affected planning schemes), and one is the subject of a planning scheme amendment that cannot yet be considered fully assessed given that it has not been the subject of review by an independent planning panel.

• Third, the Committee’s question specifically references the Reference Project as the basis of the assessment of consistency for present purposes. It is important to bear in mind, however, that the Reference Project has not been prepared as a comprehensive response to all of the performance requirements specified in respect of the proposal. It does not, for instance, implement each of the urban design principles articulated in the Urban Design Framework. The ultimate design of the Project will necessarily be more refined in respect of its presentation to the public realm than that of the Reference Project. This should be borne in mind when assessing the Reference Project against those strategies that call for the achievement of specific urban design outcomes.

Part 3.4 of Appendix F of the CIS describes the content of each of the strategic documents in question. Accordingly, other than to the extent that it is necessary or desirable as a means of assessing the consistency of the Reference Project with the strategic document in question, it is not proposed to supplement those descriptions within the response to this question.

Each of the documents referenced in Part 3.4 of Appendix F of the CIS are addressed in the table at Appendix G of this document.

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26 See, for example, the Draft Johnson Street Local Area Plan (2011). This plan has not been prepared in final form, let alone adopted by the Yarra City Council, and should accordingly be accorded little weight by the Committee.

27 Examples include the Royal Park Master Plan (1998) (Melbourne Planning Scheme), the Smith Street Structure Plan (2008) (Yarra Planning Scheme), and the Moreland Integrated Transport Strategy (2010) (Moreland Planning Scheme). These documents have a limited role to play in planning decision-making. They do not form part of the planning scheme. Their purpose is merely to provide background information as to the way in which the planning controls within the scheme were developed. They are not documents that are intended to, or can legitimately be used to, guide or influence the making of decisions under the planning scheme. See, for example: Design Unity v Maroondah CC [2012] VCAT 958 at [24] to [33]; Panel Report into Amendment C198 Greater Geelong Planning Scheme, August 2010 at page 124.

28 See, for example, the Yarra Urban Design Strategy (2011).

5.2 Tunnel protection

38. The LMA should advise how the proposed planning controls (DDO) protect the tunnels and other future development in the vicinity.

Planning Scheme Amendment GC2 constitutes an applicable approval under the Act.

A component of Amendment GC2 is the amendment of the City of Yarra and City of Melbourne Planning Schemes to introduce the Design and Development Overlay over the entirety of the tunnelled section of the project.

Copies of the proposed schedules to the DDO control are contained in Appendix A2 to the CIS.30

By operation of clause 43.02-2 of the relevant planning schemes, and clause 2.0 of the schedule to the DDO control, a planning permit is required in respect of any buildings or works that are more than 15 metres below ground level.

The requirement to obtain planning permission pursuant to the DDO control would “protect the tunnels and other future development in the vicinity” in the following ways:

a) First, notice of the application would be required to be given to the Roads Corporation by operation of clause 2.0 of the Schedule and clause 66.06 of the Scheme;

b) Second, in assessing whether a planning permit should be granted pursuant to the control, decision makers would be required to consider the following design objectives specified in respect of the East West Link Project Area:

   To ensure that the development of land above the East West Link tunnel is not adversely affected by the construction or operation of the tunnel.

   To ensure that the development of land above the East West Link tunnel does not adversely affect the construction or operation of the tunnel.

   To ensure that the Roads Corporation is informed of development above the East West Link tunnel and to facilitate comment by that authority on any specific requirements relating to the development to the extent that it impacts on, or is adversely affected by, the construction or operation of the tunnel.

c) Third, in assessing whether a planning permit should be granted pursuant to the control, decision makers would also be required to consider the following decision guidelines:

   The impact of the construction or operation of the tunnel on the development of land above the tunnel.

   The impact on the construction or operation of the tunnel from the development of land above the tunnel.

30 See for example DDO62 relating to the City of Melbourne Planning Scheme.
d) Finally, the imposition of the DDO in and of itself would serve to protect the tunnels and future development in the affected area, by alerting both planning decision makers and the wider community to the presence of the infrastructure and the need for proposed developments and land uses to have regard to, and where necessary respond to, that infrastructure.
6 Landscape and Visual

6.1 Urban design

39. The LMA should confirm the stage in the project development process that the Urban Design Principles were introduced.

The urban design principles set out within the Urban Design Framework were formulated after the project boundary and Reference Project had been developed. They were prepared with a view to ensuring that the ultimate project design achieves best practice urban design outcomes and that it responds properly to the specific urban design opportunities and challenges that arise within the project boundary.

It is important to understand, however, that the impact of the roadway on the public realm has been a key consideration in the formulation of the East West Link Project since its inception. The identification of the alignment of the project boundary, along with the more specific design parameters of the Reference Project, involved a detailed assessment of not only the key engineering and functional parameters of the project, but also the impact of the Project (visual and otherwise) on affected communities.

A joint venture composed of experienced design and construction personnel from local and international companies was engaged to resolve a design solution which would minimise community impacts and be capable of being efficiently delivered by the construction industry.

Aspects such as horizontal alignment, vertical geometry, alternative forms of construction, impacts on private property, parkland and utilities, visual amenity, constructability, affordability and connectivity to the existing road network were all important considerations. The end result was the formulation of a Reference Project which proposes that the majority of the new road be in tunnel with minimal lengths of elevated structures in residential areas to improve the amenity, accessibility and functionality of the local area.

40. The LMA should advise the design rationale for a ‘gateway’ at the Hoddle Street interchange and the elements of the Reference Project that contribute to the gateway.

The Design Rationale

The proposed gateway is situated at the entrance to the inner city from the end of the Eastern Freeway. The current transition from the Eastern Freeway to Alexandra Parade acts as a “gateway” into the higher density inner northern suburbs, although this transition is currently not well resolved. The Urban Design Framework recognises the gateway nature of this location, where visitors arrive from more distant destinations into inner Melbourne. The location of the tunnel portal will also emphasise the nature of this area as a changeover point, and aims to celebrate and enhance this aspect of its character.

It should be noted, also, that it is positioned at the intersection of Alexandra Parade and Hoddle Street where there is a transition to higher density, finer grained housing and urban infrastructure. As such, the crossing at Hoddle Street signifies an entry / exit into / from Melbourne city. Establishment of a ‘gateway’ or ‘threshold’ (as it is referred to in the Urban Design Framework) at this location is considered to be an appropriate urban design response at the regional and local scales, with the potential to make a conceptual link with other key gateways within Melbourne’s road network that individually and collectively make a strong contribution to Melbourne’s reputation for design quality in the urban environment.
The Hoddle Street Gateway is proposed to provide a well-designed, aesthetically engaging eastern entrance into the inner suburbs of Melbourne which:

- provides a memorable, recognisable ‘moment’ or threshold along the journey for drivers travelling north to south and east to west;
- acknowledges and responds to the change in the built form of the surrounding areas; and
- complements the public and private realms, including the pedestrian experience.

The Reference Project

The Urban Design Framework seeks to encourage innovation and excellence in urban design by establishing a performance-based regime. There are accordingly a number of different ways that a suitable gateway experience could be established at this location in accordance with the framework.

The Reference Project is a concept design and has not been developed as a detailed response to the Urban Design Framework. That said, components of the Reference Project that would contribute to the creation of a gateway experience at this location, include the elevated eastbound on-ramp (connecting Hoddle Street to the Eastern Freeway) and the tunnel portal itself. These elements of the project, along with other elements not resolved as part of the Reference Project (such as noise walls and barriers and artistic installations), would need to be integrated in their design to ensure a positive, coherent design outcome that gives effect to the design rationale described above.

41. The LMA should provide a summary of how the Reference Project responds to the 12 Principles of the Government's Urban Design Charter for Victoria.

Before turning to an assessment of the Reference Project against the principles articulated in the Urban Design Charter (UDC) it is convenient to first describe the relationship between the UDC and the Urban Design Framework (UDF) prepared as part of the CIS.

The UDC and the UDF

The UDC “is a commitment by the Victorian Government to make cities and towns in Victoria more liveable through good urban design”. It “identifies the following principles as essential qualities for the functioning of good public environments, in making places that are valued and significant for those who use them”:

- **Structure** - organise places so their parts relate well to each other.
- **Accessibility** - provide ease, safety and choice of access for all people.
- **Legibility** - help people to understand how places work and to find their way around.
- **Animation** - stimulate activity and a sense of vitality in public places.
- **Fit and function** - support the intended uses of spaces while also allowing for their adaptability.
- **Complementary mixed uses** - integrate complementary activities to promote synergies between them.
**Sense of place** - recognise and enhance the qualities that give places a valued identity.

**Consistency and variety** - balance order and diversity in the interests of appreciating both.

**Continuity and change** - maintain a sense of place and time by embracing change yet respecting heritage values.

**Safety** - design spaces that minimise risks of personal harm and support safe behaviour.

**Sensory pleasure** - create spaces that engage the senses and delight the mind.

**Inclusiveness and interaction** - create places where all people are free to encounter each other as equals.

These principles played an important role in the formulation of the UDF prepared in respect of the project. Indeed, not only did the UDC inform the preparation of the specific urban design principles set out within the UDF, but the UDC is specifically called-up under the UDF as a guide to inform the ultimate urban design response of the project.\(^{31}\)

**Best Practice Urban Design**

The Victorian Urban Design Charter 2009 encapsulates urban design principles applicable to all Victorian government projects. These general principles provide the basis for the project-specific principles that have been developed for the East West Link – Eastern Section, and are considered appropriate to guide the urban design response…

Performance requirement LV1 requires that the ultimate design of the Project “demonstrate how the Urban Design Framework, including the urban design principles, has been met”. The UDC must accordingly be taken into account, along with the more tailored urban design principles articulated in the UDF, in the formulation of the ultimate project design.

**The Reference Project**

It is important to recognise that the Reference Project is a concept design and that it does not constitute a considered response to the UDF.

That said, however, the final project, having implemented the UDF in accordance with the performance requirements, will implement the UDC in a number of ways. Some of these are discussed in more detail in the UDF. However a brief response against the provisions within the UDC is set out below:

**Structure & Connections** - the East West Link is an important connection that also facilitates access across and parallel to the East West Link by the provision of bicycle and pedestrian connections to and from adjoining communities. Green corridors, such as the Moonee Ponds Creek, have also been an important element in the project.

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\(^{31}\) At page 9.
Accessibility - the East West Link is focused on road connectivity and improving road access across Melbourne’s north, however it also provides support for different modes of travel as well as providing alternative bike and pedestrian routes.

Legibility – the Design Charter recognises that “a well-designed city, like good writing, needs to be intelligible to its audience, the public.” The Reference Project and the UDF have shown a response to wayfinding. This has been expressed in the potential for gateways that the portals could provide at a regional level. The express requirements to facilitate connections to the Principal Bicycle Network will also improve legibility at a local level.

Animation – “Good urban design introduces, maintains and intensifies human activity within the public realm.” In part this is realised in East West Link by the range of uses that have been put forward in the UDF as being suitable for spaces under viaducts or within the project boundary. These go far beyond the simple provision of a road.

Fit and function – the Design Charter talks about fitness as being the “need to accommodate varied events” and different activities. The UDF also proposes adaptive spaces in conjunction with the road network. The Project is not just a road as it combines possible treatments for Moonee Ponds Creek, wetlands, the potential for playgrounds and bicycle paths. Some of the activities envisaged for areas within the project boundary will be passive, others active.

Complementary mixed uses – the linear corridors in which the East West Link is located can also be used for bike and pedestrian connections as well as opportunities to develop wetlands and parkland areas.

Sense of place – by recognising and enhancing the qualities that give places a valued identity the East West Link can contribute to Melbourne’s urban fabric in a positive way. Recognition of the shot tower, the incorporation of gateways, the potential creation of wetlands, all can contribute to the sense of place.

Consistency and variety – balancing the order implied by a transportation route with the diversity of the precincts through which the East West Link will travel is an important balance sought by the project.

Continuity and change – the East West Link is an expression of the way a City can change yet respect existing values. The tunnel is one obvious example of the protection of existing values and other aspects of the Project commemorate the changes brought about by East West Link.

Safety – the road design is based on the needs for safety, but the design of the adjoining spaces, bicycle and pedestrian networks will also incorporate safety concerns. Increased useability and lighting are examples.

Inclusiveness and interaction – the design of public spaces adjoining and under the East West Link will incorporate these principles into spaces which may include wetlands to play areas which would be all publicly available.
6.2 Project conceptualisation

42. Provide a three-dimensional physical model of the western project area around the CityLink interchange covering:

   a. to the west: beyond the western portals;
   b. to the south: Robertson Street / Mark Street; and
   c. to the north: end of Map Sheet 5.

The model should show, at least:

- topography and existing land features (roads, rail, parklands);
- 'Melbourne Gateway' (yellow 'cheesestick', red sticks, sound tube);
- key buildings, including the closest two of the Debney Park towers, Debney Park community centre, Evo apartments, the Bent Street apartment building, the 25 storey building at the southern end of Mt Alexander Road;
- project boundary;
- proposed new roads coloured as in the Map Book; and
- other features to assist in understanding this part of the Reference Project.

Urban Circus has produced a virtual model of the Reference Project, on behalf of the LMA, which is available for viewing by the Committee and is proposed by LMA to be available during the formal public hearing (at least for the presentations of LMA and the Councils). The 3D Model provides benefits not afforded by a physical model, particularly the ability to provide specific perspectives such as visualisations from people's houses and local streets, and shadowing from structures at different times of the day.

The LMA has made extensive inquiries of Urban Circus concerning the scope to use the virtual model to prepare a physical model in the dimensions requested by the Committee. However, LMA has been advised that the scale of the model would be too small to be useful in assessing the Project and that it could not be produced in time for the formal public hearing. Conversely, a larger scale model would be impractical to transport, present and produce, and would face similar time constraints in terms of not being produced in time for the formal public hearing.

Urban Circus has advised, more particularly, that a model at 1:1000 scale would be approximately 2.2m long and 0.75m wide. Whilst a model of this size would be capable of being transported and presented to the Committee, the scale of the physical elements comprising the model would be so small as to make it difficult to appreciate any visual relationships.

For example, Urban Circus has advised that a model at this scale would show the height of the Project along CityLink near Bent Street at approximately 2.5cm, with the height of the 75m tower apartment building at Travencore at 7 to 8cm and the height of the apartments at the corner of Bent and Hardiman Streets at approximately 1.2cm. Urban Circus has also advised that it could take in excess of 7 weeks to produce such a model, with larger scale models taking even longer to produce.

For these reasons LMA is not able to prepare a physical model on the terms proposed by the Committee.
6.3 Overshadowing

43. The LMA should provide an assessment of potential overshadowing of residential areas and open space from proposed above ground structures, and advice on key areas of impact.

For images of overshadowing, see Appendix H.

1. Policy Review

1.1 Residential areas

The ResCode standards for assessing the impact of overshadowing from new buildings upon neighbouring residential land (private open space) as contained within the Victoria Planning Provisions (VPPs) are not strictly applicable but constitute a measure in assessing the impact of the proposal on residential areas.

ResCode Standards A14 (as it applies to one dwelling on a lot) and B21 (two or more dwellings on a lot and residential buildings) share the following common ‘test’:

Where sunlight to the secluded private open space of an existing dwelling is reduced, at least 75 per cent, or 40 square metres with minimum dimension of 3 metres, whichever is the lesser area, of the secluded private open space should receive a minimum of five hours of sunlight between 9 am and 3 pm on 22 September.

If existing sunlight to the secluded private open space of an existing dwelling is less than the requirements of this standard, the amount of sunlight should not be further reduced.

1.2 Public open space

City of Melbourne local planning policy Clause 22.02 Sunlight to Public Spaces applies in respect of the shadowing of public open spaces within the City of Melbourne. This policy is mentioned given that a large portion of the Project within that municipality will be located above public open space. The policy provides that:

Development should not reduce the amenity of public spaces by casting any additional shadows on public parks and gardens, public squares, major pedestrian routes including streets and lanes (including all streets within the retail core of the Capital City Zone), and privately owned plazas accessible to the public between 11.00 am and 2.00 pm on 22 September.

The application of this policy must clearly be tempered in circumstances such as this where parts of the Project are to be situated exclusively on public open space.

For completeness, it is also noted that Clause 22.25 Urban Design within Fisherman Bend of the Melbourne Planning Scheme was also referenced. This policy provides the following guidance in relation to the overshadowing of public spaces:

Ensure that new development does not overshadow public parkland or civic spaces between the hours of 10.00am and 2.00pm on the 22 June (winter solstice).

2. Review of Urban Circus Model

The model of the East West Link Project developed by Urban Circus has the ability to cast shadows (to scale) from project structures across selected dates and times.
For the purpose of this exercise, shadows cast at 9:00am and 10:00am on 22 September were examined for residential areas as these demonstrate the maximum extent of shadow cast by project structures.

In addition to 22 September, overshadowing of public open space was examined at various times between 10:00am to 2:00pm on 21 June (winter solstice).

A number of locations were reviewed in the model, with the shadowing applied. These included:

- Residential properties situated on the western side of Bendigo Street, Collingwood.
- Residential properties situated on the western side of Manningham Street, Parkville (where bordered by the project viaducts and existing CityLink corridor).
- Ross Straw Field (Royal Park).
- Residential properties off Delhi Court, Travancore (west of CityLink).
- Travancore Community Gardens off the south side of Brisbane Street (west of CityLink).
- Debneys Park proximate to the Department of Housing flats on the north side of Racecourse Road.
- Moonee Ponds Creek south of Racecourse Road.
- Residential properties off Bent Street, Kensington.

3. Assessment

3.1 Residential areas

The Project was assessed to comfortably comply with the ResCode standards described above. Overshadowing of residential areas adjacent to the Project should accordingly be considered acceptable.

Typically by 10am on 22 September, shadowing from project structures has largely withdrawn from residential land and does not impact upon associated areas of private open space.

3.2 Public open space

Above ground structures that impact upon public open space are principally associated with Ross Straw Field, Debneys Park, Travancore Community Gardens and the Moonee Ponds Creek environs.

In locations such as these detailed design treatments and urban design measures could be considered (including use of materials) as a means of limiting, to the extent practicable, the impact of overshadowing on the public realm. This will be addressed as part of the implementation of the UDF and performance requirements.
6.4 Light spill

The LMA should advise whether there are criteria that could be included for light spill (for sleep disturbance for example) and, if so, what measures could be employed to ensure these are met.

Appropriate provision of light is an important road safety requirement, and the performance requirements provide for mitigation of light spill impacts.

The following describes the relevant design standards and the approach taken on other major road infrastructure projects within this State.

Design Standards

The VicRoads Traffic Engineering Manual (TEM) specifies appropriate levels of lighting for local and arterial roads, including sections of continuous lighting and interchange lighting. In general, urban freeways are only lit at interchanges. Continuous lighting between interchanges is only provided in a number of specific circumstances, usually as a means of addressing night time road safety concerns.

The TEM references the following documents for design of road lighting:

- VicRoads document TCG006 - Guidelines for Street Lighting; and

With respect to light spillage, TCG006 requires that all reasonable steps are taken to minimise light spillage. Cut off luminaires or lower mounting heights may be required where light spillage is an issue.

AS1158.1.1:2005 "Guide to design, installation, operation and maintenance", recognises light spillage onto adjacent properties as a design consideration and suggests measures to alleviate the problem, such as placement of lighting points and use of shields in the house-side of the luminaire visor.

It is noted that Australian Standard AS4282-1997 "The Control of the Obtrusive Effects of Outdoor Light" provides specific criteria in respect of the control of light spill. That standard does not apply, however, to public lighting "due to the high levels of lighting necessary and because the lighting provides the community at large with an effective night crash counter measure". It should not accordingly be applied as a design measure in this instance.

Past Projects

Measurable criteria have not been specified for other LMA projects, such as Peninsula Link or EastLink.

For Peninsula Link there were particular concerns regarding the Pines Flora and Fauna Reserve as well as recognition of the potential impacts on neighbouring communities.

To minimise impact on the Pines Flora and Fauna Reserve, the specification required the design of public lighting to minimise light spill into the Reserve, and the installation of light attenuation walls to prevent light spill from the freeway into the Reserve.
To minimise impact of light emissions on neighbouring communities, the designer of Peninsula Link was required to “investigate and addresses light spillage” so that adjacent land use would “not be adversely affected by spillage of light from Peninsula Link and local roads”.

For EastLink, the contract specified “mitigation of light from the freeway during operation” to protect biodiversity values.

**Performance Requirements**

For East West Link, performance requirements L1 and L2 require development and implementation of measures, including application of the Urban Design Framework, to minimise light spill and protect the amenity of adjacent land uses. The standards referenced within the TEM, as described above, provide guidance concerning how this might be achieved without compromising the safety of road users.
7 Air Quality

7.1 Tunnel ventilation

45. The LMA should provide information on what other tunnel ventilation systems and discharge stack locations for East West Link might be considered other than that presented in the CIS, including an analysis of:

a. features;
b. feasibility;
c. external visual impacts;
d. external noise; and
e. air quality.

Tunnel ventilation system

Tunnel ventilation systems are designed to collect and disperse emissions that would otherwise occur at the surface, with the following objectives:

- Control of in-tunnel air quality and visibility to provide a safe environment for vehicle occupants;
- Smoke extraction in case of an in-tunnel incident; and
- Minimisation of the adverse impacts of tunnel emissions on external air quality.

There are four basic options for tunnel ventilation, as follows:

- **Passive** ventilation, which relies on the piston effect of moving vehicles - this is only appropriate for short tunnels;
- **Longitudinal** ventilation, where the piston effect is boosted by fans increasing the ventilation rate;
- **Transverse** ventilation, which delivers fresh air and removes contaminated air at points along the full length of the tunnel; and
- **Semi-transverse** ventilation, where the ventilation either only provides fresh air (the more common option) or only removes contaminated air.

As discussed under item 7(b) of this document, the CIS provides performance requirements for the design and operation of the ventilation system, rather than specifying the type of ventilation system required.

For the purposes of the air quality assessment undertaken for the Air Quality Assessment contained in Appendix I of the CIS, an assumed longitudinal ventilation system is presented, with ventilation outlet structures at either end. This was considered the most logical solution, taking into account the following:

- the length of the tunnels;
- the absence of exit and entry ramps (except at Elliott Avenue);
- a preliminary analysis of vehicle emissions;
- PIARC standards for in-tunnel air quality (Performance Requirement AQ2);
- SEPP (AQM) design standards for external air quality (performance requirements AQ1 & AQ3); and
- a maximum in tunnel ventilation air speed of 10 m/s (Performance Requirement AQ2).

The provision of intermediate air intakes to improve in-tunnel air quality was considered, but the analysis of emissions indicated that this would not be necessary. As reported in the Air Quality Assessment, contained in Appendix I of the CIS, even with worst-case conditions of 2,000 vehicles per lane per hour, in-tunnel air quality could be maintained at acceptable levels using air flow from the ventilation system.

**Ventilation outlet structures**

For the purposes of assessing the Reference Project, it was assumed that tunnel ventilation outlet structures would be located between the two tunnels at each portal end, and within 100 metres of the portals to allow for air flow reversal (using jet fans) to minimise portal emissions.

The ventilation system presented in the CIS would require a 20m high ventilation outlet at the western portal serving the westbound tunnel, and a 30m high ventilation outlet at the eastern portal serving the eastbound tunnel.

As reported in the Air Quality Assessment and the Works Approval Application, even with worst-case conditions of 2,000 vehicles per lane per hour, ground level concentrations from the ventilation outlets would comply with SEPP(AQM) policy levels.

**Alternative designs**

The final design is not specified in the CIS and the designer may consider alternatives to the system assumed for the CIS, subject to compliance with the performance requirements. The ventilation structures could be located further away from the tunnel portals, but the increased duct length and energy required to operate the ventilation system would increase greenhouse gas emissions.

Of all the long road tunnels in Australia that require forced ventilation, there is only one that does not use longitudinal ventilation. That is the M5 East tunnel in Sydney which has:

- a mid-point fresh air intake and foul air extraction;
- fresh air flows from the middle of each bored tunnel toward the respective portals;
- before each portal there is a cross-over tunnel connecting to the other (entry portal) opposite-direction tunnel;
- that air then continues to the mid-point; and
- a lateral tunnel of some 500 metres that takes the air to a ‘remote’ ventilation structure.

The primary reason for this non-standard configuration was due to the portal locations effectively having residential (suburban) housing literally directly above each portal meaning compliance with applicable standards was not possible. The ventilation structure is ‘off-site’ at the nearest non-residential land to the portal entry (hence the 500 metre lateral tunnel length in the heavily built-up area of Sydney). This arrangement has significant energy consumption penalties due to the non-standard vent arrangement and has led to problems with air quality in the tunnel. Vehicles entering each portal are confronted with ‘dirty’ air immediately, as the road is non-
tollled and carries a high percentage of heavy vehicles, there are associated visibility impacts causing safety issues.

Further, treatment of air emissions prior to discharge could theoretically be considered, but is not widely used nor considered best practice and is unlikely to be necessary for compliance with performance requirements AQ1, AQ2 and AQ3. Current technology to treat tunnel emissions requires significant energy usage which would lead to an associated increase in greenhouse gas emissions. It would furthermore, result in a very limited improvement to ground-level ambient air quality. Neither the existing tunnel ventilation structures for the CityLink and East Link tunnels, or any other tunnel in Australia, treat emissions prior to discharge and a number of studies confirm that the tunnel vents have not had an adverse impact on local air quality.

The visual impacts of the ventilation structures are addressed through compliance with performance requirements LV1 to LV3 and application of the Urban Design Framework.

External noise impacts from the ventilation system are addressed specifically by performance requirements NV2 and NV5.

LMA should advise whether appropriate planning controls have been drafted to protect the dispersion performance of the ventilation stacks (e.g. overlay height controls for surrounding buildings).

Amendment GC2 does not propose to introduce an overlay control directed specifically toward the protection of the dispersion performance of the ventilation structures. There is scope to introduce a control of this type upon the precise location of each tunnel ventilation outlet being determined following the resolution of the ultimate design of the project.

Rather than being a control that imposes mandatory height controls, however, it is envisaged that a preferable control would require that relevant public agencies be notified of any permit application for development that may have the potential to impact the dispersion performance of the tunnel ventilation outlet. A control drafted on these terms presently applies in respect of the CityLink ventilation structures.

An example of such a control, contained within Schedule 5 to the Design and Development Overlay of the Yarra Planning Scheme, contains the following design objectives:

To ensure that the development of land around the CityLink exhaust stack is not adversely affected by the operation of the stack.

To ensure that development of land around the CityLink exhaust stack does not adversely affect the operation of the stack.

To ensure that the relevant authorities are informed of development within close proximity of the CityLink exhaust stack and to facilitate comment by those authorities on any specific requirements relating to the design and built form of new development in the area which might be desirable having regard to the proximity of the stack.

The operative provision of the schedule requires that:

32 Comparable provisions are contained within the Stonnington and Melbourne Planning Schemes.
Where a permit is required to use land or for the construction of a building or the construction or carrying out of works under another provision in this scheme, notice must be given under section 52(1)(c) of the Planning and Environment Act 1987 to the person or body specified as a person or body to be notified in Clause 66.06 or a schedule to that clause.

The relevant persons specified under clause 66.06 in respect of CityLink are the Environment Protection Authority, Transurban CityLink Limited, and the Roads Corporation. These authorities, having been notified of a permit application, are able to assess the extent to which the proposed development will impact the dispersion performance of the ventilation structures, and make submissions to the Responsible Authority as to whether a permit should be granted (and / or subject to what conditions). These entities would also be entitled to commence review proceedings in the VCAT in the event that they sought to contest any decision made by the Responsible Authority in granting a planning permit.

It is open to this Committee to recommend that a comparable control be introduced into the affected planning schemes upon the ultimate design of the Project (and precise location of the ventilation structures) being determined.

7.2 Clifton Hill Primary School and Alexandra Parade

The LMA should provide contour plots and time series plots of PM$_{10}$, PM$_{2.5}$ and NO$_2$ for the emissions from the ventilation stack at the eastern end showing the impact (if any) on the Clifton Hill Primary School.

The response to this question provides technical detail in relation to air quality modelling undertaken for Clifton Hill Primary School. Overall, the modelling results indicate that the emissions from the East West Link are unlikely to exceed the intervention levels in Part B of Schedule C of the State Environment Protection Policy (Air Quality Management) (SEPP (AQM)). Further, the modelling indicates that in comparison to existing background levels, the emissions from East West Link (Eastern Section) are very low.

In accordance with SEPP(AQM), a grid spacing for the modelling domain was chosen to ensure that “…the predicted maximum concentration is not significantly underestimated.” A 20 metre by 20 metre grid was selected and extended out to 1 km to the north, south, east and west of the indicative vent location.

The SEPP (AQM) states that “[d]iscrete receptors must be included in the assessment in order to assess the impact at any nearby sensitive locations such as hospitals, schools or residences”. The Clifton Hill Primary School was considered a sensitive receptor as were the many residences nearby. The area of the Clifton Hill Primary School is extensive at greater than 400 m$^2$ and is covered by several grid points. There are literally thousands of grid points that cover residential locations. The modelling process demonstrated that 479 grid points had a higher predicted impact (99.9 percentile of 1-hour ground level concentration) than the most impacted grid point at the Clifton Hill Primary School location.

Contour plots of NO$_2$, PM$_{10}$ and PM$_{2.5}$, with emphasis on highest impact locations and the Clifton Hill Primary School, are provided in Figures 15-17 of Appendix I of this document. These are enhancements to the plots contained in Appendix E of the Air Quality Assessment found in Appendix I of the CIS.

The modelling does show an impact at the Clifton Hill Primary School, albeit lower than the highest impacted areas, and this is put in further context, as requested, by the time series plots in Figures 18-22 at Appendix I of this document.
Predicted NO2 levels at Clifton Hill Primary School

Air quality modelling has shown that in comparison to existing background levels, the contribution of emissions from East West Link will be extremely low, and is far lower than the prescribed intervention levels.

For the NO2 1-hour time series plot (Figure 18) the 70th percentile for background is 24.4 µg/m³ (Table 7, Air Quality Assessment, contained in Appendix I of the CIS) while the highest, peak 1-hour incremental impact from the tunnel ventilation outlet at the Clifton Hill Primary School is 3 µg/m³. That peak incremental impact occurred at 11am on a mid-January day. The hourly time series of incremental impact compared to background is displayed in the Figure 10 below for that particular modelled day. Here the ambient NO2 levels are relatively high overnight (blue shaded columns in Figure 10 below) while the tunnel ventilation outlet has no ground level impact. With the onset of atmospheric mixing, coincident with the start of the school day near 9 am, the ambient levels decrease to below 5 µg/m³. A south-to-south-east wind is bringing some plume impact (red shaded columns in Figure 10 below) to the Clifton Hill Primary School but with most often a lesser contribution than the ambient concentration (which is very low compared to the NEPM 1-hour goal of 226 µg/m³). Note that the south-to-south-east wind continues to bring minor plume impacts well into the evening after the school day would have finished. The winds remained moderate, to keep a well-mixed atmosphere, and give a plume strike at ground level. However, this also caused low ambient levels (almost an order of magnitude lower than the previous evening) so that the cumulative impact is almost two orders of magnitude below the NEPM goal.

![Figure 10: Impacts of NO2 at Clifton Hill Primary School. Note that background levels are shown in blue and East West Link impacts are shown in red.](image)

Predicted PM10 levels at Clifton Hill Primary School

For the PM10 1-hour time series plot (Figure 19 in Appendix I of this document) the 70th percentile for background is 21 µg/m³ (Table 7, Air Quality Assessment, contained in Appendix I of the CIS) while the highest, peak 1-hour incremental impact from the tunnel ventilation outlet at the Clifton Hill Primary School is one order of magnitude lower at 1.5 µg/m³. At least 86% of the hourly predicted data are zero as the plume is blowing away from the Clifton Hill Primary School, to the south for example. The peak incremental impact occurred at the same time as the NO2 modelled day with the hourly time series of incremental impact compared to
background displayed in the figure below. The daily average, 15.7 µg/m³, is below the NEPM goal and WHO guideline of 50 µg/m³, with the incremental impact from the tunnel ventilation outlet being significantly lower at 0.23 µg/m³ as a daily averaged contribution.

![Modelled Day 16 January](image)

**Figure 11:** Impacts of PM10 at Clifton Hill Primary School. Note that background levels are shown in blue and East West Link impacts are shown in red.

A daily averaged time series plot of ambient and incremental impact of PM10 from the tunnel ventilation outlet is also provided in Figure 20 of Appendix I of this document. Three days of the modelled year have the ambient concentration already above the NEPM standard (but not above the goal of 5 or less days in a year) and WHO Guideline. However, the increment provided by the tunnel ventilation outlet plume is modelled to be mostly zero at the Clifton Hill Primary School (half the days in the year with winds placing the School upwind) and never going above 0.31 µg/m³ as a daily incremental contribution.

**PM2.5 Predictions at Primary School**

Not surprisingly, the time series plot of hourly PM2.5 also shows that the incremental impact of the tunnel ventilation outlet at the Clifton Hill Primary School is low compared to the prevailing ambient fine particulate concentrations in the inner-east of Melbourne. Note that for hourly PM2.5 there are no NEPM or WHO levels to consider, just the design criterion from SEPP(AQM). For the time series plot in Figure 21 in Appendix I of this document, the addition of the hourly background (blue shaded columns – as measured in 2008) to the predicted school impact due to the tunnel ventilation outlet (red shaded columns – as modelled for 2021 but with 2008 dispersion meteorology) is always below the PM2.5 design criterion of 36 µg/m³.

Daily PM2.5 does have NEPM (advisory reporting standard) and WHO guidance at 25 µg/m³ – which is lower than the SEPP(AQM) Schedule B Intervention Level at 36 µg/m³. The time series plot of daily PM2.5 in Figure 22 in Appendix I of this document shows that the modelled impact from the tunnel ventilation outlet (used to assess against SEPP(AQM) Schedule A design criterion) will only contribute a small proportion to the fine particulate load already being measured in inner-east Melbourne (representative of levels at the Clifton Hill Primary School).
The LMA should provide an assessment of the emissions from traffic using the temporary road running parallel to Alexandra Parade on local residents and the Clifton Hill Primary School. This should include PM\(_{10}\), PM\(_{2.5}\) and NO\(_2\). This should include any measures that can be implemented to reduce potential impacts on sensitive receptors.

The temporary Alexandra Parade diversion will occur between the commencement of the Project and the expected Project opening in 2019. Current traffic levels (2010) and expected emission levels (2015) have been used in a ‘before and after’ modelling exercise. Contour plots for peak 1-hour NO\(_2\) are presented for these two scenarios in Figures 23 and 24 in Appendix J of this document. Near-road impacts are simply moved, as expected, in response to the diversion on the north side while far-field (say beyond a few hundred metres) changes only slightly. This is due to the diversion creating some separation from the two line sources but with the total emissions unaltered.

To investigate this further, especially adjacent to Alexandra Parade and out to the primary school, transect plots (contained in Figures 25-26 in Appendix J of this document) have been constructed along Wellington Street and Gold Street. The shading indicates the distance of the Clifton Hill Primary School.

The short-term peaks, represented by maximum peaks of hourly NO\(_2\), show that at any given distance south of Alexandra Parade the impact levels during the construction phase decrease slightly. On the north side, peak levels are slightly higher at any given distance away from the road but the difference reduces to be negligible at increasing distance. Moreover, receptors immediately adjacent to the temporary side-track will have higher levels than experienced now but these will be lower than the current kerb-side impacts. A very similar pattern can be seen in the daily PM10 transect plots with incremental impacts being well short of the NEPM standard and WHO guideline of 50 µg/m\(^3\). Traffic sourced PM2.5 is at least 92.8% of PM10 and follows the same impact pattern.

Emissions from general traffic during construction, just as on every other road in Victoria, will not be controlled by the construction contractor. However, the particulate matter may be increased during some construction activities from the current levels at some locations, mostly due to construction dust. This is to be controlled as part of an Environmental Management Framework (EMF) involving a Construction Dust Environment Management Plan (CEMP) – Performance requirement AQ7. With the side-track being proximate to a residential area, alarming real-time dust monitors, for example, will be used which will have trigger levels that will react to all particulate matter (combination of ambient, traffic and construction). Auditing of the CEMP will also involve dust deposition gauges – most likely requiring a rather dense network in this area. The use of such mitigation measures and management plans is best-practice for major construction sites.

This Project can be considered ‘major’ and the application of an EMF and CEMP is in response to the performance requirement which was identified by the risk assessment process (see Risk A003 of Table 12 of the Air Quality Assessment contained in Appendix I of the CIS). In fact, off-site construction dust impacts have the highest residual risk rating after application of such mitigation as would be required for the Project – including in and around the Alexandra Parade diversion. Projects including the Geelong By-pass, the Sugarloaf Pipeline, EastLink and the Victorian Desalination Project linear corridors have all required extensive and comprehensive construction dust controls. The Eildon Dam upgrade project and the Geelong bypass construction in particular involved the first instances of reactive dust control using DustTrak alarming dust monitors. All latest models of DustTrak (and now other monitoring instruments makers employing a range of sensor technologies) have built in alarming...
capabilities via instrument alarms (usually to a central server) that provide real-time SMS alerts to operational personnel.

7.3 Ormond Road exit

The LMA provide an assessment of the emissions from traffic estimated to use the Ormond Road exit on the residents of Ormond Road. This should include \( \text{PM}_{10} \), \( \text{PM}_{2.5} \) and \( \text{NO}_2 \) and extend to the intersection of Mount Alexander Road.

The Air Quality Assessment at Appendix I of the CIS, at page 83, states that Figure 22 shows that:

“…the total traffic count for Ormond Road is approximately 13,500 vehicles per hour in morning peak and approximately 15,000 vehicles per hour in the afternoon peak.”

As a means of clarification, however, it is noted that the preceding sentence and Figure 22 demonstrate that the 15,000 vehicles per hour in the afternoon peak refer to the Ormond Road (overpass) area. The CityLink freeway lanes dominate this traffic count and form the major contribution to the 15,000 vehicles per hour value. The Ormond Road outbound traffic (heading west after off-ramp merge) in the afternoon peaks at just 1,702 vehicles per hour (Figure 22) and the off-ramp itself has an afternoon peak of just 1,098 vehicles per hour (in comparison, CityLink at this time is dominant at 6,229 vehicles per hour north-bound and 5,342 vehicles per hour southbound).

The contour plots in Figures 27-29 in Appendix K of this document for the Ormond Road area include both areas east and west of Ormond Road, specifically at CityLink interchanges with Ormond Road and Flemington Road / Mount Alexander Road respectively. As AUSROADS is a near-road model and as the required modelling domain extends beyond the validated 500 metre range of the AUSROADS model, it was necessary to combine three model runs (where each model run covers a sub-area). These combined results show that the highest predicted pollutant levels are adjacent to the CityLink lanes (an expected result as these lanes have by far the highest traffic flows). Along Ormond Road the traffic levels are significantly lower and concentrations are consequently lower, and further diminished rapidly with distance from the road. The Mount Alexander Road intersection with Ormond Road has elevated traffic flow numbers but concentrations here, albeit higher than the majority length of Ormond Road, are still lower than those at the CityLink interchange area.

From these plots it is possible to construct traffic impact transects – by using the traffic emission tracer \( \text{NO}_2 \). Figure 24 from Appendix I of the CIS, has been reproduced in Figure 30 in Appendix K of this document to show the same transects in the Ormond Road area with delineation of the contributions from the entire CityLink interchange and just the contribution from the off-ramp and additional East West Link lanes (plotted as ‘with’ and ‘without’ East West Link additional lanes / ramps / traffic to show the difference). For the transects:

- With East West Link – the modelling includes East West Link lanes coming from the south and the Ormond Road off-ramp
- Without East West Link – the modelling includes CityLink and Ormond Road, along with on and off ramp to CityLink.

A similar additional transect has been constructed to show the diminishing impact, when moving west away from the Community Garden, along Brisbane Street, Ascot Vale – with and without the off-ramp contributions, and is also contained in Figure 31 of Appendix K of this document. An additional transect along Myrnong Crescent, Ascot Vale which runs north-south on the south side of Ormond Road has also been included in Figure 31 of Appendix K.
From all the transect plots in Appendix K it can be seen that the contribution of emissions from East West Link is barely detectable in comparison to those from CityLink traffic.

When considering the extension to the Mount Alexander Road intersection, representative transects (NW, NE, SW and SE) have been calculated for the highest impacted area as indicated by the contour plot in Figure 32 of Appendix K of this document.

7.4 Elevated receptors

The LMA should provide contour plots for PM$_{10}$ and PM$_{2.5}$ for surface roads including the impact on elevated receptors in particular the Debney Park Estate and the Evo Apartments. Time series plots should also be included for the most affected receptors.

The Debneys Park Estate and Evo Apartments are located in Precinct 3 and the contour plot for NO2 is given in Figure 20 of the Air Quality Assessment, in Appendix I of the CIS. Similar contour plots for this area have been calculated for daily PM10 and PM2.5 and are contained in Figures 33-34 in Appendix L of this document. The same pattern is evident as for NO2 in that concentrations levels are well below assessment criteria levels and diminish rapidly away from the near-road environment.

Elevated (so called ‘flagpole’) receptors have been assessed by consideration of the highest impact (from the contour plot) for each of the following sensitive receptor locations:

- Evo Apartments;
- ALT Tower next to CityLink;
- Flemington Estate (Debneys Park Estate);
- apartments on Lennon Street; and
- Elderly Chinese Nursing Home.

‘Flagpole’ receptors extend from ground level to the maximum height of the buildings of concern at a geographic receptor which corresponds to the part of the building envelope most exposed to the traffic emissions. The ALT tower for example extends to 78 metres above ground while the Elderly Chinese Nursing Home is in part a double storey complex, with CityLink viaduct structure in both locations 10 metres above ground. In all cases, the vertical concentration profiles show a maximum at ground level with the concentration of NO2 decreasing with an increase in elevation above ground. This is as expected as the vehicle emission sources are at or near local ground level.

The vertical concentration profile plots contained in Figures 35 - 37 in Appendix L of this document clearly show that of the five affected building envelopes, it is the ground level concentration at the base of Debneys Park Estate that is “the most affected receptor” – with a peak concentration of ~62 µg/m3. A time series plot of the predicted NO2 concentration (assuming 30% of NOx is NO2) for this location is also provided in Figure 38 of Appendix L.

7.5 Road gradient effects on air quality

The LMA should provide an assessment of the impact of the inclusion of grade for the relevant roads for PM$_{10}$, PM$_{2.5}$ and NO2. The assessment should include consideration of the Hoddle Street interchange and the CityLink and Port connections and the impact on existing elevated receptors.

The additional consideration of road gradients in the modelled intersection for Hoddle Street for NO2 specifically alters the emission factors of each road segment used in
the line source Gaussian Plume model AUSROADS (V1.0). Emission factors originally used in the model in Figure 17 of the Air Quality Assessment contained in Technical Appendix I of the CIS were based on values obtained in PIARC (2012) for emissions factors in Australia on a road of 0% gradient (flat). This was considered a reasonable approach because:

- on balance there are just as many up-slope as down-slope road links;
- whenever any road gradients are involved there is naturally vertical separation of the line sources which introduces an additional degree of dilution/dispersion at the eventual ground level receptor; and
- any gradients that are present are not at the extreme +/- 6% grades.

Re-modelling to account for road gradient

Consideration of road elevations and gradients allows for factoring in vehicular emissions based on the slope of the road and is possible using PIARC (2012) emissions factors for gradients up to a magnitude of 6% - but at 2% increments. Gradients were rounded to the nearest whole number and through interpolation were input into the same AUSROADS model (CIS at 0% grades for surface roads) to determine if there was any significant difference in concentrations at nearby sensitive receivers (residences).

Vehicular emissions increase for gradients above 0% (driving uphill requires more power from the engine) and decrease for gradients below 0% (driving downhill requires less power from the engine). In areas where opposite directions of the same road have equal but opposite gradients, the altered emissions factors have roughly similar but opposite effects and a relatively even net result to using a 0% gradient. However, sections of roads that are one-way (such as on ramps and off ramps) with an uphill slope that do not have a similar down slope in the nearby vicinity would have higher concentrations of indicator pollutants.

Contour plots of NO2 are shown in Figures 39 - 40 Appendix M of this document comparing the original model output as used in the CIS (Figure 17 of the Air Quality Assessment contained in Technical Appendix I of the CIS) with the output when considering road gradients and their effect on vehicular emissions (Figure 17b). These figures show a small increase in the concentrations to the north-west of the intersection immediately north of Alexandra Parade. This area lies next to the off ramp from Alexandra Parade to Hoddle Street, where the positive gradient increases vehicular emissions and thus concentration levels of NO2. This increase in concentration is observed here because the corresponding down slope road from Hoddle Street to Alexandra Parade westbound (where the negative slope would result in a decrease in vehicular emissions and thus lower concentration of NO2) is separated by over 50 metres (and 12 lanes of traffic where the East West Link connects with the Eastern Freeway). This separation then provides some dilution when returning to ground level.

For areas along the centreline of the road (where concentrations are highest) concentrations are also slightly higher for the modelled output using road gradients. This demonstrates that the effect on increasing vehicular emissions on an uphill slope is slightly stronger than the opposite effect of a downhill slope on decreasing vehicular emissions. However, this only has a net effect of slightly increasing predicted 99th percentile concentrations further from the road (where the nearest sensitive receptors are located) by no more than 13% and even a decrease in one location (south side) as shown in Table 1. Some locations as close as 10 metres from the nearest road link have a percentage difference of just over 10%, whereas the biggest difference reporting in Table 1 of 13% is 80 metres from the nearest road.
This increase in concentration at receptors by factoring in the gradient of the roads is also demonstrated in the transects contained in Figures 41a - 41b in Appendix M of this document (reproduced from the CIS Technical Report Appendix I). North-south transects were modelled as distance from the nearest road segment in the Hoddle Street intersection on all corners of the intersection. In all cases, the model considering the gradients of the roads (concentrations shown in red) gave only slightly higher concentrations at the points of the nearest sensitive receivers (residences, shown in green). These higher concentrations are still well within SEPP (AQM) limits (NO2 1-hour Intervention Level of 263 µg/m3).

The most pronounced difference between the concentration occurs in the north-west transect, at distances closer than 50 metres to the roadside. This is due to the up-gradient of Alexandra Parade to Hoddle Street, as discussed earlier. The effect is also evident for the south-west transect, where the up-gradient of the Hoddle Street flyover has a more significant effect than the down-gradient of the Hoddle Street off ramp to Alexandra Parade. The flyover would also be responsible for the south-east transect increased levels in the near-field, due to any prevailing winds from the north-east. No change is observed on the north-east transect in concentration levels.

It is only in the near-field at close range to up-gradient road links that increased ground level concentrations are found. Within 50 metres the concentration levels are of comparable levels with or without the changed emissions due to slope corrected emission factors.

Gradients on the Port Connection and CityLink were also considered for an analysis of vehicular emissions based on road gradients.

South of Racecourse Road heading to the tunnel portal, the gradient of the road reaches a maximum of +4% for a distance of just over 250 metres, but then quickly evens out and then decreases to a negative gradient as the tunnel portal is approached. The Reference Project includes features to minimise the uphill gradients that would slow heavy vehicles in a ‘freeway’ environment. The overwhelming proportion of emission segments in this elevated section of CityLink are at such low gradients that they would be modelled at 0% for the purposes of calculating the emissions. Therefore changing a single small link to a higher emission, reflecting a positive gradient produces an insignificant increase in overall emissions. As demonstrated by the Hoddle Street interchange modelling, at the distance of the sensitive receptors in the area there will be a barely discernable difference in any two modelling scenarios involving emission correction for gradients.
This is demonstrated by the transect plots in Figures 41a and 41b of Appendix M of this document showing a recalculation of Figure 28 from the Air Quality Assessment contained in Technical Appendix I of the CIS. The horizontal green line is the SEPP(AQM) intervention level. On the east side the impact is indiscernible. The west side transect shows an increase due to the up-slope road section but the difference has diminished to negligible within 50 m.

No other significant sections of road with gradients greater than 2% are evident along the Port Connection and CityLink around the modelled hotspots. However, further south near Macaulay Road there is a small section involving a 3% gradient – both up and down – but the dominant traffic volume of the CityLink section has a flat gradient. This can be seen in the diurnal plot of vehicle counts provided in Figure 41c in Appendix M of this document. These have been converted into Vehicle Kilometres Travelled (VKT) for each road segment to arrive at relative contributions to total vehicle emissions, shown in Figure 41d of Appendix M of this document. The Port Connection south-bound has lower emissions due to the down slope while the Port Connection north-bound has an up-slope. Overall, these are small contributors to total vehicle emissions compared to the north and south bound sections of CityLink.

7.6 Emission factors

52. **The LMA should provide the implications of using the PIARC emission factors, which is a surrogate for PM$_{10}$ emissions, on the predicted PM$_{10}$ concentrations from vehicles on East West Link.**

Tunnel ventilation predominantly directed toward controlling in-tunnel concentrations rather than ‘controlling’ ambient (external) environmental impacts. The issue with particles in tunnels is the effect on visibility (the assumption being that vehicle occupants are less exposed to in-tunnel air within the vehicle cabin and the relatively quick transit time in the tunnel. As a consequence, the ventilation design is concerned with in-tunnel air particulate matter concentrations affecting local visual distance. Hence, emission factors are expressed in terms of opacity rather than particulate matter (PM).

However the PIARC report “…provides the emission factors for exhaust pollutants such as CO, NOx and PM, as well as the appropriate factors for non-exhaust particulate emissions for passenger cars, light vehicle, and heavy goods vehicles”. 33 Fleet emission factors were derived by PIARC with the consideration of the various Euro-standard emission controls. These define PM emission factors. Therefore, the opacity is a surrogate of PM as mandated by Euro-standards (fleet mix of same).

53. **The LMA should provide the implications of not including particle emissions from passenger vehicles in the modelling of PM$_{10}$.**

PIARC (2012) gives particulate matter (PM) emission factors for all the various EURO-standard classes. 34 These include passenger vehicle diesel particulate matter as well as for the other vehicle types of Light-Duty vehicles (gross weight < 3.5 t) and Heavy Goods vehicles (gross weight > 3.5 t). A particulate matter emission factor is not given for non-diesel passenger vehicles, implying that the contribution from petrol passenger vehicles is negligible in comparison to the emissions from all diesel vehicle classes.

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34 PIARC, section 3, pages 63-88.
In the ‘Emission Factors for Australia’ section of PIARC (2012)\textsuperscript{35} opacity emission factors adopt the EURO-standard tables, where passenger vehicle non-diesel PM is negligible. However, the Australian passenger car fleet consists of approximately seven per cent diesel fuelled vehicles (as reported in Appendix C of the Air Quality Assessment included at Appendix I of the CIS).

The air quality modelling included 7% of the passenger fleet as diesel-fuelled, and therefore included the particulate matter from these vehicles as well as road dust.

54. \textit{The LMA should provide information on how the opacity factors in m²/h have been converted to a mass emission rate to use in the modelling of PM\textsubscript{10}.}

PIARC (2012, pages 13-14) provides a commentary on particle emissions and visibility / extinction factor:

\textit{In road tunnels, the two source types of emission, “exhaust” and “non-exhaust”, are relevant. Although both fractions have different extinction behaviour and therefore should be treated differently, the following correlation between exhaust and non-exhaust PM\textsubscript{2.5} mass concentration (\(\mu\) in mg/m\textsuperscript{3}) and light extinction (\(K\) in m\textsuperscript{-1}) can be applied for diluted exhaust gases \[1\]:}

\begin{equation}
K = 0.0047 \mu
\end{equation}

All of the PM\textsubscript{2.5} fraction was included in the PM\textsubscript{10} emission factors.

\textit{“A large uncertainty is related to the quantification of non-exhaust particulate matter (PM) emissions (re-suspension of road dust, abrasion). PIARC, 2012, page 7.}

55. \textit{The LMA should provide an assessment on the use of alternative emission factors, e.g. NPI or EPA emissions factors on the predicted PM\textsubscript{10} concentrations.}

The PIARC (2012) data is publically available and is the result of an extensive review process through Working Group 4 of the Technical Committee C4 of the World Road Association. Moreover, the data is presented so as to:

- provide country-specific vehicle emission information – Australia, Algeria and China being the non-European countries considered;
- provide corrections for road gradient and traffic speed (NPI and EPA are fleet-wide emission factors for ‘airshed’ studies and do not allow for the sometimes steep gradients in tunnels);

It is further noted that the PIARC dataset “…is intended for ventilation design purposes and differs from emission data used for environmental assessments, as a safety margin is added to take a certain proportion of high emitting vehicles into account.”\textsuperscript{36}

Accordingly the data relied on is recent, including estimates out to year 2020, with an Australian-specific anticipated vehicle fleet mix (inclusive of EURO-standard classes). PIARC also err on the high side so as to safeguard against the under-design of tunnel ventilation. For these reasons the adoption of this dataset was considered highly

\textsuperscript{35} PIARC 2012, pages 38-46.

\textsuperscript{36} PIARC, 2012, page 6.
appropriate in the context of the in-tunnel calculations and thus also the emissions reporting to the vent structures. Due to the ventilation requirements of PIARC, these emission factors have to be used and so it is logical and appropriate to then use the same factors and methodologies to define the emission rates used in the dispersion modelling.

A further consideration was whether there was any better data available, particularly in the context of the near-road modelling undertaken for the surface road assessment in the CIS (addressing the known risks of impacts on the external air environment). Alternative choices considered, notwithstanding their 'disconnect' with the mandatory PIARC data, were the National Pollutant Inventory (NPI) emission estimation manual for combustion engines and data from EPA Victoria (which has previously been supplied for other road project assessments and which is continually updated for use in 'airshed' studies). The NPI factors do include passenger vehicles (both petrol and diesel – and even LNG) and heavy vehicles (diesel only – but this is overwhelmingly dominant). However, the data for petrol fuelled cars are based on fleet averaged fuel consumption (m3 of fuel - an unknown for highly variable speeds, gradients and drive cycles related to road type across the entire study area) or an assumed, fixed fuel consumption rate – “based on fuel consumption of 11.06 L/100km” used for petrol road transport ‘cars’. EPA Victoria fleet emission factors used in the past (PenLink and WestLink studies) do have speed correction factors with differentiation between vehicle types. However, the data used in the above-mentioned studies is no longer current and the PIARC data used for the ventilation emission calculations has accounted for all of the required variables.

The near-road modelling involved speed dependencies and so the emission factors from PIARC were utilised with diurnally and road link / type speed and vehicle mix considerations.

7.7 In-tunnel and background air quality

56. The LMA should provide an assessment of whether the Reference Design for the project tunnels would be able to meet the standards applied to the CityLink and EastLink tunnels if they were applied to this project.

Proposed draft licence conditions have been derived by consideration of vehicle emissions into the tunnel environment and the ventilation options available via the Reference Project. The impacts of emissions were calculated to confirm compliance with SEPP(AQM) requirements through the use of the dispersion model AUSPLUME V6.0 and a screening-level meteorological data file from EPAV representing worst case conditions. The test being “what level of emissions are expected (reasonable upper bound) and will this comply with SEPP(AQM)”?

Table 5: Bubble Limit Licence

<table>
<thead>
<tr>
<th>Indicator limit (tonnes per annum)</th>
<th>Calculated</th>
<th>Existing Licence Precedents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>128</td>
<td>5273</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>10.3</td>
<td>129</td>
</tr>
<tr>
<td>Particles (as PM₁₀)</td>
<td>5.0</td>
<td>32.44</td>
</tr>
<tr>
<td>Particles (as PM₂.₅)</td>
<td>4.5</td>
<td>25.88</td>
</tr>
</tbody>
</table>
The above values are considered reasonable upper bounds for expected total emissions, as would be consistent with a National Pollutant Inventory (NPI) annual report. This includes a ‘safety factor’ increase for the East West Link by assuming all days of the year are weekday emissions (i.e. weekend emissions are over-estimated). Note that benzene is included but is expected to be significantly lower by the time of tunnel opening (compared to the existing operating tunnels) due to the fuel standard controls that now apply in Australia (CityLink predates, for example, the Fuel Quality Standards Act 2000, Act No. 153 of 2000 as amended).

**Draft proposed licence conditions**

**Air Conditions**

LI_DA1 Discharge of waste to air must be in accordance with the 'Discharge to Air' Table below.

<table>
<thead>
<tr>
<th>Discharge Point No</th>
<th>Description of Discharge Points</th>
<th>Indicator</th>
<th>Limit Type</th>
<th>Unit</th>
<th>Discharge Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>All Air Discharge Points</td>
<td>Benzene</td>
<td>Bubble</td>
<td>to/yr</td>
<td>0.542</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carbon monoxide</td>
<td>Bubble</td>
<td>to/yr</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrogen dioxide</td>
<td>Bubble</td>
<td>to/yr</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Particles (as PM_{10})</td>
<td>Bubble</td>
<td>to/yr</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Particles (as PM_{2.5})</td>
<td>Bubble</td>
<td>to/yr</td>
<td>4.5</td>
</tr>
</tbody>
</table>

to/yr = tonnes/year

LI_DA1.13 Air emissions of: (a) carbon monoxide must not exceed 1535 grams per minute from DP1 or DP2; (b) nitrogen dioxide must not exceed 113 grams per minute from DP1 or DP2; (c) particles (as PM_{10}) must not exceed 43 grams per minute from DP1 or DP2; (d) particles (as PM_{2.5}) must not exceed 42.5 grams per minute from DP1 or DP2; and (e) benzene must not exceed 5.5 grams per minute from DP1 or DP2.

LI_DA1.6 The concentration of carbon monoxide in the tunnel must not exceed (a) a maximum of 150 ppm, (b) a 15 minute average of 50 ppm, and (c) a two hour average of 25 ppm.

LI_DA1.7.4 Discharge of waste to air is only permitted from the tunnel exit portals: (a) at any time during maintenance, training or testing of the smoke extraction system; (b) at any time during an emergency event to prevent danger to life or limb in the tunnel; (c) for the east-bound (Clifton Hill) tunnel: Monday to Friday - before 5am and after 8pm; Saturday - before 7am and after 8pm; Sunday and Public Holiday - before 8am and after 8pm; and (d) for the west-bound (Royal Park) tunnel: Monday to Friday - before 5am and after 8pm; Saturday - before 7am and after 8pm; Sunday and Public Holiday - before 8am and after 8pm.
LI_DA1.9 Discharge of waste to air may exceed the limits referred to in conditions LI_DA1 and LI_DA1.6 during an emergency to prevent danger to life or limb in the tunnel.

LI_DA2.4 Visible emissions to air other than steam must not be discharged from the premises except in accordance with conditions LA_DA1, LI_DA1.7.4 and LA_DA1.9.

Note that the CO in-tunnel limits (LI_DA1.6) are the same as used in CityLink and EastLink. The air emission discharge limits (LI_DA1.13) are different and project specific – for CO:

- 1535.0 g/min from East West Link both vents;
- 3083.3 g/min from CityLink DP1;
- 6950.0 g/min from CityLink DP2 (longer tunnel); and
- 1870.0 g/min from EastLink both vents (Melba and Mullum Mullum).

The assessment method for devising the licence limits included a safety factor by considering the peak in-tunnel concentrations. PIARC (2012) define a threshold level for carbon monoxide of 200 ppm, which is used to ‘close the tunnel’ (i.e. prevent more vehicles from entering until the ventilation can reduce in-tunnel concentrations). As defined by PIARC:

Threshold values: For safe operation of the tunnel, threshold values are defined that may not be exceeded i.e. if reached an immediate action (e.g. tunnel closure) has to be taken.

Similarly, “Where the tunnel ventilation system is also dimensioned for NO2, it is proposed to permit an average in-tunnel concentration of 1.0 ppm NO2 along the length of the tunnel at any one time as the design value.” Trigger levels (set at sub-threshold values) are used as part of the management regime of the operating tunnel to ensure this extreme value is not reached. But if thresholds are reached, the tunnel is closed (no more vehicle emission sources are added) and the ventilation is then set to maximum (in this instance 1,000 m3/s with a vent exit velocity of 20 m/s).

As discussed elsewhere (revisited in the last paragraph below), NO2 is the constraining pollutant for this project. Thus the 1 ppm NO2 threshold limit, (corresponding to 1,880 µg/m³), was adopted together with the maximum fan capacity (1000 m³/s) to define the peak NO2 tunnel emission rate. Modelling with the screening ‘metsamp’ was then used to determine if the EPA design criterion for NO2 is met. (This value is independent of the 30% NO2 to NOx ratio that is used for assessment based on vehicle emission estimates of NOx). The resultant peak NO2 emission rate is 112.8 g/min and the simulation produces a worst-case GLC of 8.27 µg/m³, well within the 190 µg/m³ design criterion for NO2. If this result is then used as the upper limit with a safety factor of 112.8/76 = 1.48 (ratio of in-tunnel concentrations converted to mass emission rate and the calculated worst-case emissions associated with 2,000 veh/lane/hour), other indicators can be set by the same scaling – including for CO. Thus, the project tunnels would be able to meet the CO in-tunnel concentration standards applied to the CityLink and EastLink tunnels.

The NO2 in-tunnel limit of 1 ppm (1880 µg/m³) can be maintained for the maximum vehicle fleet emissions (2000 veh/lane/hr westbound) with a tunnel airflow rate of 673

37 PIARC, 2012, Table 3 on page 15.
m$^3$/s. At this ventilation rate and coupled with the worst-case CO emission from 2,000 vehicles per lane per hour, the corresponding in-tunnel CO concentration is 22.0 ppm reporting to the vent structure at the tunnel end (after collecting vehicle emissions along the length of the tunnel). This value is within the 2-hour limit set by EPA licencing (25 ppm) and is comfortably within the shorter term peak allowances (50 ppm over 15 minutes and peaks of 150 ppm (EPA) and 200 ppm (PIARC)).

The proposed draft licence conditions are currently being considered by the EPA and will be addressed in its submission to the Committee at the formal public hearing.

57. **The LMA should clarify whether more locally relevant data than air monitoring data from Alphington was available.**

EPA only provided background data from Alphington and Footscray, being the closest to the project area. No other recent data was available.

58. **The LMA should clarify why data from Alphington is considered to be representative of the Clifton Hill / Alexandra Parade area.**

The intent of providing ambient background data in the modelling process is to include a representation of the concentration of a pollutant as the air arrives at the source being assessed.

The potential for ‘double accounting’ of emissions by including background data influenced by local sources was discussed briefly in the Air Quality Assessment contained in Appendix I of the CIS (at section 7.4.8, page 60). This is especially important in this instance where the background data for the inner-east and inner-north most often shows higher concentrations of the pollutants being assessed (most dramatically for particulate matter – see Table 7 of the Air Quality Assessment contained in Appendix I of the CIS at page 29). Therefore, data representative of the well-mixed Melbourne airshed at the closest air quality monitoring station sited to be representative of population exposure was used.

In assessing the relative merits of the data sets from the various Melbourne Air Quality Monitoring Stations (AQMS) operated by EPA Victoria for the purposes of selecting representative ambient backgrounds in the East West Link modelling, it is useful to review EPA Victoria commentary when evaluating data from these stations as part of their NEPM reporting obligations. The EPA provided this commentary when assigning Alphington as the population exposure background station for NEPM reporting purposes.

*Inner East Metro: This station is located in Alphington, a high population and traffic area; it is considered neighbourhood in scale. The site is representative of Melbourne’s inner suburban residential areas. Recorded CO concentrations reflect the road traffic as well as residential wood burning open fires. This is the station with the longest data record for CO (since the late 1970s) and the longest-running station for ozone (since 1978). It is not expected to capture peak ozone concentrations.*

*Note that Collingwood, at the time (circa 2001) designated to measure lead-in-air only, was not considered as anything other than a peak monitoring station:*

*CBD North East: This station is located approximately 10 m from a major arterial road that runs through a residential / light industrial area in Collingwood. It is regarded as a peak site for lead.*

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The inner-west was / is to be defined by Footscray:

*Inner West Metro: This station is located at Footscray in a residential / industrial area. It is considered to be upper bound for ozone in the inner west.*

By way of further explanation in the monitoring plan (EPA Victoria, 2001) the Richmond site (more than 3km from the eastern portal area but less than 4 km – as is Alphington) is considered to be representative of the CBD south-east (rather than CBD north-east as is Collingwood or inner north-east as is Alphington). Moreover, Richmond is not considered as a ‘Nominated Performance Station’ whereas Alphington and Footscray are (Appendix C, EPA Victoria, 2001). Richmond measures carbon monoxide and PM10 whereas Alphington measures CO, NO2 and PM10 as a ‘trend’ ‘generally representative upper bound station’ and also ozone and sulphur dioxide as ‘population average’ – the later as a trend station. Alphington (and Footscray) are designated performance stations for trends such that:

*In order to ensure compliance with the NEPM Standards, stations will generally be located so as to monitor the upper bound of the distribution of pollutant concentration likely to be experienced by portions of the population, while avoiding the direct impacts of localised pollutant sources. … to monitor the ambient air across a region, we can be reasonably sure that, if the NEPM standards are met at those sites, then most of the total population of the region will be exposed to air that meets the standards. In this way, the NEPC aim of equivalent environmental protection is assured.*

It is noted that in the latest ‘Air monitoring report for Compliance with the National Environment Protection (Ambient Air Quality) Measure’ of 2012 (EPA Victoria, 2013, Publication 1536), that in relation to particulate matter (as PM10 24-hour average) the Richmond data had a higher maximum day than Alphington (47.4 µg/m3 and 40.7 µg/m3 respectively when a number of stations where affected by airshed-exterior sources of bushfire / control burn smoke). However, for the more robust statistic of the 6th highest PM10 (24-hour average) in a 12 month period, Alphington had the higher value compared to Richmond (30.4 µg/m3 and 29.8 µg/m3 respectively).

LMA supports the recommendation made by EPA in its submission to the Committee that “an ambient air quality monitoring program is implemented for at least one year before and one year after commencement of operation of the tunnel ventilation system, to confirm modelling of the ventilation emissions”.

### 7.8 Western end

59. *The LMA should provide an assessment, including contour plots, of the impact of increased traffic using the Elliot Ave off-ramp, western portal ventilation stack emissions and increased traffic flows on the Royal Children’s Hospital Precinct and the Zoo.*

Contour plots of the impacts of the tunnel ventilation outlets, 99.9 percentile 1-hour average for NO2 and PM10, are provided in Appendix F of the Air Quality Assessment in Technical Appendix I of the CIS. The consideration of cumulative impacts, contributions of point source emissions and line source emissions, requires the addition of differing model runs using the AUSPLUME and AUSROADS models respectively. The corresponding contour plots of the surface road emissions are provided in Figures 42 - 43 in [Appendix N](#) of this document.

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At the most southerly point of the Melbourne Zoo, closest to Elliott Avenue:

- for NO2, 1-hour averages the peak impact from the western vent (contour) is closer to 2 µg/m³ rather than 5 µg/m³ while near-road impacts are predicted to be as high as 12 µg/m³; and
- for PM10, 1-hour averages the point source contour is closer to 1 µg/m³ rather than 2 µg/m³ while near-road impacts are predicted to be up to as 1.3 µg/m³.

At the most exposed receptor point at the Royal Children’s Hospital (north-west corner):

- for NO2, 1-hour averages the peak impact from the western vent (contour) is near to 2 µg/m³ while near-road impacts are predicted to be comparable at 2.1 µg/m³;
- for PM10, 1-hour averages the point source contour is less than 1 µg/m³ while Elliot Avenue impacts are predicted to peak at 12.2 µg/m³.

All of these values are well below their respective assessment criteria.

The cumulative impact can be considered by the use of time series plots showing the relative contributions of each modelled source type. PM10 is easiest to demonstrate by use of a daily averaged value (to compare to various 24-hour assessment criteria). Both time-series are shown for the Melbourne Zoo and the Royal Children’s Hospital in Figures 44-45 in Appendix N of this document. There are many incidences of zero impact when the wind direction places the sources downwind of the receptor location (north to east winds for the Melbourne Zoo and south-west to south-east winds for the Royal Children’s Hospital). At both sites the cumulative incremental impact is always less than 1 µg/m³ for daily average impact – this compares to the SEPP(AAQ) Intervention level of 60 µg/m³ and the NEPM standard and WHO Guideline value of 50 µg/m³.

The time-series of hourly NO2 cumulative impact for the two sensitive receptor locations are also provided in plots contained in Figures 46-47 in Appendix N of this document. The increased density of data points (24 times extra) along the X-axis (8784 hours compared to 366 days) make the plots harder to interpret.

Of course, currently the Royal Children’s Hospital will already be exposed to Flemington Road near-road emissions and occasionally the more distant existing Elliott Avenue traffic will, under some wind conditions, have an impact.