

SYDNEY INTERNATIONAL CONVENTION, EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP)

TRAFFIC AND TRANSPORT ASSESSMENT ADDENDUM REPORT – SSD 5752



Hyder Consulting Pty Ltd
ABN 76 104 485 289
Level 5, 141 Walker Street
Locked Bag 6503
North Sydney NSW 2060
Australia
Tel: +61 2 8907 9000
Fax: +61 2 8907 9001
www.hyderconsulting.com



LEND LEASE PTY LTD

DARLING HARBOUR LIVE

Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP)

Traffic and Transport Assessment Addendum Report

Author	Sally Manahan	
Checker	Joe Heydon/Mukit Rahman	
Approver	Greg Ives	

Report No

Date 27 June 2013

This report has been prepared for Lend Lease Pty Ltd in accordance with the terms and conditions of appointment for Darling Harbour Live dated . Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

CONTENTS

1	Introduction	1
1.1	Purpose of This Report.....	1
1.2	Scope of this report	1
2	Schedule of Comments	1
2.1	Comments from Department of Planning and Infrastructure.....	1
2.2	Transport for NSW.....	8
3	Traffic Issues	22
3.1	Darling Drive.....	22
3.2	AimSun Modelling Results.....	23
3.3	Bus Service Provisions for the SICEEP	23
3.4	Road Safety Issues	24
3.5	Pedestrian Crossing Warrants.....	25
3.6	Construction Traffic Impacts.....	26
4	Revised Theatre Scheme	32
5	Summary	32
5.1	DA Comment Responses	32
5.2	VISSIM Modelling of Darling Drive	33
5.3	AIMSUM Modelling results	34
5.4	Bus Service Provisions for SICEEP.....	34
5.5	Road Safety Issues	34
5.6	Construction Traffic Impacts.....	35
5.7	Theatre Re-Design	35
6	Conclusion	35

1 INTRODUCTION

This Report is being prepared as an Addendum to the Traffic and Transport Assessment Report (Hyder Consulting, March 2013) submitted to support the Development Application for the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) Project. The Application seeks approval for construction and use of the Public Private Partnership (PPP) component of the Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP) Project at Darling Harbour.

1.1 PURPOSE OF THIS REPORT

The purpose of this report is two-fold:

- 1) To provide a response to comments received from the Department of Planning and Infrastructure (DoPI) and submissions from the Transport for New South Wales (TfNSW) and the Roads and Maritime Services (RMS) on the Traffic and Transport Assessment Report prepared in support of a State Significant Development Application (SSD 12_5752) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act); and,
- 2) To detail the results of further traffic investigations undertaken for the proposed new theatre access scheme.

1.2 SCOPE OF THIS REPORT

This Addendum Report addresses the issues raised in the comments relevant to the Traffic and Transport Assessment Report and is supported with detailed technical notes (attached herewith as Appendix A, B, C, D and E) pertinent to specific issues and concerns. The appendices are as follows:

- Appendix A: Technical Note 1 – AIMSUN Model Calibration and Validation as per RMS Guidelines
- Appendix B: Technical Note 2 – Darling Drive Traffic Assessment
- Appendix C: Technical Note 3 – Modelling Results for Post Development Conditions Based on AIMSUN
- Appendix D: Technical Note 4 – Road Safety Audit of Darling Drive
- Appendix E: Technical Note 5 – Designer's Response to the Road Safety Audit

2 SCHEDULE OF COMMENTS

2.1 COMMENTS FROM DEPARTMENT OF PLANNING AND INFRASTRUCTURE

In reference to the letter from the Department of Planning and Infrastructure, signed 29 May 2013 with Reference Number SSD 5752-2012, a summary of the selected key issues (Issue 1 to 15), specific to Hyder Consulting and relevant to the Traffic and Transport Assessment Report is outlined in Table 1. Other issues will be addressed by other consultants outside of this Report.

Table 1 Schedule of Comments from Department of Planning and Infrastructure

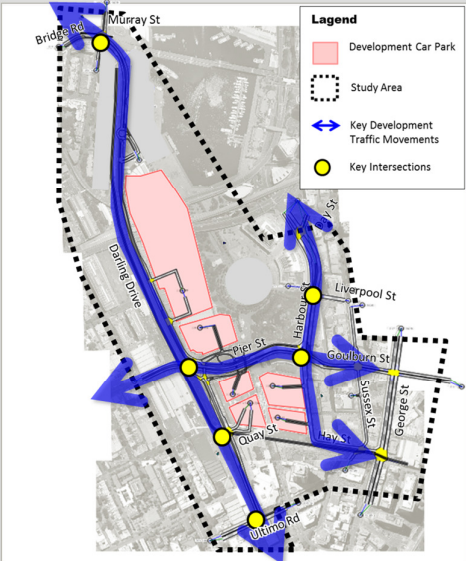
Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Traffic Impacts	1	<p>The geographic coverage of the model is insufficient to demonstrate that the critical intersections assessed in the model will operate at a satisfactory level. It is therefore recommended that all upstream intersections are modelled to ensure the traffic approach profiles are correctly represented at the critical intersections.</p>	<p>Originally the geographic coverage of the AIMSUN Micro-simulation model was determined by Mott MacDonald as part of assessing the SICEEP development proposal. Hyder carried forward the AIMSUN model and updated it to support the environmental assessment of the SICEEP project. Hyder has re-assessed the geographic coverage of the SICEEP for modelling purpose and found that the modelling study area coverage is fit for the study purpose.</p> <p>Figure 1 below shows key SICEEP development footprint and modelling study area coverage.</p>  <p>Legend</p> <ul style="list-style-type: none"> Development Car Park Study Area Key Development Traffic Movements Key Intersections

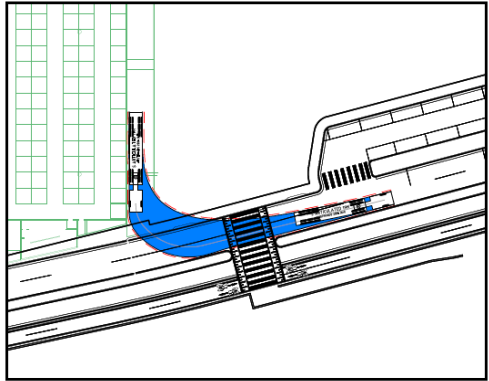
Figure 1

Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
			<p>The following factors were considered in determining the adequacy of the geographic coverage:</p> <ol style="list-style-type: none"> 1. Future Traffic distribution to and from SICEEP i.e., <ul style="list-style-type: none"> • North-south movement to and from the development has been captured by Darling Drive/Murray Street and Darling Drive/Ultimo Road intersections. • East-west movement to and from the development has been captured by Darling Drive/Pier Street and Harbour Street/Goulburn Street/Pier Street intersections. • North-south movement to and from the development has been captured by Harbour Street and Hay Street. 2. Potential impact locations. <p>In general road network impact from the SICEEP will decline with greater distance from the site. Additional traffic impact from SICEEP will be largely confined within the boundary of the modelling study area (see Figure 1)</p>
Traffic Impacts	2	<p>Concern is raised as to whether the proposed single lane Darling Drive has the capacity to accommodate peak hour flows as identified in Table 5-15 of the Transport and Traffic Assessment due to the introduction of multiple access points and two at grade crossings. In this regard clarify whether the site's entry/exit points and the pedestrian crossings off Darling Drive have been included in the traffic model.</p>	<p>A detailed micro-simulation model was undertaken for Darling Drive to further investigate the likely impacts that the multiple access points and pedestrian crossing impacts may have on through traffic.</p> <p>In the southbound direction, the scheme includes minor changes (from existing) in the access and pedestrian crossing locations. The modelling suggests that there will be a minimal impact in average travel speeds during the (critical) Saturday PM peak:</p> <ul style="list-style-type: none"> • Under existing conditions, with <i>minimal</i> development traffic, the average model speed is approx. 35 km/h; • Under future conditions, with peak "event traffic", the average observed speed is forecast to be approx. 31.5 km/h <p>This information is outlined in more detail in the attached Technical Note 3 in Appendix C.</p>

Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Traffic Impacts	3	Provide details in relation to vehicle queuing arrangements along Darling Drive, in particular the number of vehicles to queue at any one time and how this aligns with the expected demand, the location of boom gates and measures to prevent queuing onto Darling Drive.	<p>Exhibition Car Park Access</p> <p>In the northbound direction, a dedicated right turn lane is provided, with similar storage to existing conditions.</p> <p>In the southbound direction, a deceleration lane has not been provided. To avoid queuing on the southbound carriageway, the design will incorporate provision for cars to queue “on-site”, prior to arriving at the barrier gates. The proposal will provide 4 boom gates on entry to the car park, in a layout similar to existing. The proposed car park will provide a reduction in parking bays from 753 spaces to 686.</p> <p>Theatre Car park access</p> <p>The Theatre is accessed from the southbound direction. In the southbound direction a deceleration lane has not be provided. To avoid queuing on the southbound carriageway, the design will incorporate provision for cars to queue “on-site”, prior to arriving at the barrier gates. The proposal will provide 2 boom gates on entry to the car park, in a layout similar to existing. The proposed car park will provide 196 spaces.</p>
Traffic Impacts	4	Demonstrate how the traffic model has been suitably calibrated and validated against all agreed criteria within the RMS's Traffic Modelling Guidelines - RMS 13.184.	Hyder previously calibrated AIMSUN traffic model using the October 2012 counts. Further model calibration and validation was undertaken using new traffic data collected in June 2013. The June 2013 traffic data included travel time, intersection turning movement counts and queue length at key intersections. The AIMSUN model has been calibrated and validated according to the RMS's Traffic Modelling Guidelines (RMS 13.184). Detailed model calibration and validation results are documented in Technical Note 1 and included as Appendix A in this report.

Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Traffic Impacts	5	Demonstrate that strategic modelling approach adopted is a suitable methodology to determine the distribution of traffic at a local level.	<p>In assessing the proposed SICEEP development, Hyder has made the following traffic distribution assumptions:</p> <ol style="list-style-type: none"> 1. Trip distribution within the PPP component of the SICEEP was based on actual traffic counts. 2. Trip distribution in the Haymarket Precinct (Mix-use Development) was based on combined actual traffic counts and census journey-to-work (JTW) distribution obtained from Bureau of Transport Statistic (BTS). <p>Strategic traffic model was not used for traffic distribution in this study. A reference was only made regarding the JTW distribution.</p>
Traffic Impacts	6	Provide a plan showing the proposed construction vehicle routes to the site from surrounding areas and assess the cumulative traffic impact for other major construction projects (e.g. Barangaroo and CBD Light Rail).	<p>A preliminary Construction Transport Management Plan was attached in the DA submission. It will be reviewed and updated in consultation with TfNSW prior to commencement of construction.</p> <p>Section 3.6 in this Addendum Report outlines truck routes and cumulative construction traffic impacts.</p>
Traffic Impacts	7	Provide justification for the proposed northernmost pedestrian crossing on Darling Drive along with details demonstrating that warrants can be met.	<p>We believe the comment should refer to the southern pedestrian crossing near Tumbalong Place.</p> <p>An existing pedestrian crossing connects the eastern side of Darling Drive to the light rail stop and crosses two lanes of traffic.</p> <p>The crossing will be moved slightly north. DHL propose to convert this to a signalised crossing to comply with RMS standards as outlined in the attached Addendum to the DA Traffic Report.</p> <p>There is also a proposal for another pedestrian crossing located along Darling Drive, in the northern end of the site. This is an existing crossing.</p>
Public Transport	8	Clarify the wider directional signage strategy following closure of the Entertainment car park and the greater use of Darling Quarter car park during events at Darling Harbour.	<p>Variable messaging signs utilising dynamic carparking information will be provided to drivers similar to that adopted for the Star Casino.</p> <p>The improvement of pedestrian access to and from existing and/or upgraded public transport nodes will be provided through interactive wayfinding and signage systems located throughout the Precinct.</p> <p>The detail designs of the wayfinding and signage systems are currently under development and will be completed in accordance with the SICEEP Wayfinding and Signage guidelines.</p>

Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Public Transport	9	Clarify the provision for future public bus transport to service the precinct in consultation with Transport for NSW.	<p>DHL has consulted with Transport for NSW (City Transport Planning) on potential provisions for future bus transport service to the precinct. TfNSW confirmed a study is underway to investigate a Bus Servicing Strategy for the CBD. TfNSW is unable to provide any further information until an announcement is made by government as to a preferred CBD Bus Plan in conjunction with the proposal for the George St Light Rail system.</p> <p>Section 3.4 of this Addendum Report provides preliminary information on new bus routes in the CBD.</p> <p>DHL commit to undertake further consultation with NSW Bus and Coach Association to ensure any future requirements are considered.</p>
Public Transport	10	Provide details of proposed future consultation with various transport providers including coach and taxi operators to ensure efficient movement of vehicles to and from the precinct.	Initial consultation meetings have been held with the NSW Bus and Coach Association and the NSW Taxi Council. DHL commit to undertake further consultation during design development stage to ensure any future requirements are considered.
Public Transport	11	Demonstrate that the taxi storage is sufficient to meet the future needs of the site during event mode.	We are providing taxi storage in line with the INSW Brief which requires a dedicated taxi zone of at least 20 spaces. We believe that the Government taxi storage requirement is sufficient. However, we will continue consultation with the NSW taxi council and investigate further during design development if additional taxi storage can be provided.
Public Transport	12	Provide a plan showing sufficient patron storage areas around the taxi zones which do not impede pedestrian flows.	We will provide sufficient patron storage around taxi zones and re-assess this during design development
Public Transport	13	Investigate the opportunities for alternative transport solutions to assist with reducing car use to and from the site.	DHL commit to undertake consultation with TfNSW regarding the potential for the provision of future and or improved bus services to the SICEEP

Category	Item	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Vehicular Access	14	The turning path for 19m articulated trucks exiting the Exhibition Centre loading dock onto Darling Drive crosses over two lanes of traffic and the footpath. Demonstrate how safe truck access can be achieved by either reconfiguring the dock or the angle of access or providing an acceleration/merge lane. In this regard a revised turning path is required to demonstrate how trucks will safely enter and exit the Exhibition Centre loading dock.	<p>Trucks entering the Exhibition Centre lower and upper level loading docks are provided with a dedicated slip lane along Darling Drive. Trucks leaving the upper level loading dock will egress in the same direction of traffic as southbound traffic on Darling Drive, via a dedicated exit lane. Trucks exiting the lower level loading dock have to exit using both southbound lanes of Darling Drive. However, the majority of truck movements into and out of the Exhibition Centre loading dock facilities will be made in off-peak times, during the night or very early morning.</p> <p>Swept path analysis of trucks leaving the lower Exhibition loading dock will be undertaken during the detailed design stage, to look at the finer turning movement of this swept path and to ensure adequate protection to pedestrians in the vicinity of this loading dock egress location.</p> <p>Please see preliminary swept path movement below:</p>  <p>AUSTRoads 2006 19.0m SEMI - 01 OUT TO DARLING DRIVE @ 5km/hr 1:500</p>
Vehicular Access	15	Provide details of any truck marshalling area in terms of capacity, waiting periods and location.	An off-site marshalling yard is not contemplated.
Pedestrian Network	26	Confirm the type of operation of the two proposed at-grade crossings on Darling Drive. In particular clarification is sought in terms of whether they are signalised scramble crossings or zebra crossings.	The existing northern on grade crossing near the Convention stop will be moved slightly south to align with Harbourside place north and will be a zebra crossing. The existing southern crossing will be moved north and converted to a signalised crossing.
Pedestrian Network	27	Consider whether the pedestrian crossing located between the proposed Exhibition Centre and the Entertainment Centre over multiple lanes of traffic along Darling Drive should be signalised to improve pedestrian safety	The crossing will be moved slightly north. DHL propose to convert this to a signalised crossing to comply with RMS standards as outlined in the attached Addendum to the DA Traffic Report.

2.2 TRANSPORT FOR NSW

In reference to the letter from transport for New South Wales, with Reference Number CD13/05724, a summary of the selected key issues relevant to the Traffic and Transport Assessment Report is outlined in Table 2.

Table 2 Schedule of Comments from Transport for NSW

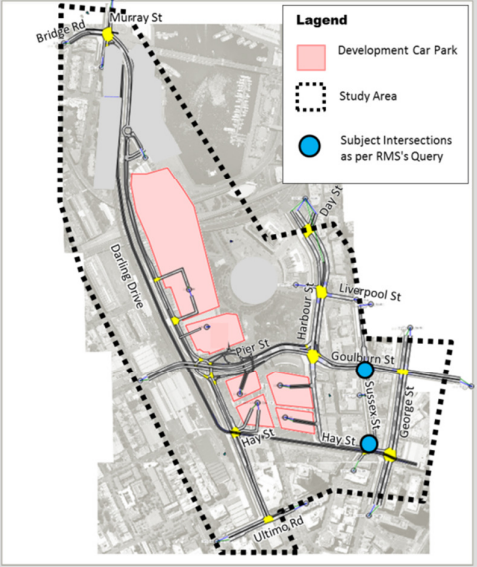
Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Parking	1	<p>The proposal contains no specific provision for car share spaces within allocated parking that would assist in achieving the proposal's objective in reducing private vehicle dependency. There is one small mention of this including "preferential parking" (p.100) but no specific mention of actual number of spaces allocated to car share for either workers and/or residents.</p> <p>***Provide details to measures to encourage sustainable transport measures</p>	<p>DHL committed to providing up to 55 third-party operated Car Share spaces distributed through the precinct (including the Public Realm) for use by residents, the public and exhibitors</p>
	2	<p>The Traffic and Transport Assessment makes general reference (p.100) to way-finding and signage. Given the scale of change in the site, significant investment of new way-finding and signage is required, on and off-site. It is noted that variable message signs would be used to provide information to drivers (p.103) but no commitment has been made to use such signs for pedestrians, which would be the dominant mode of arrival to the site.</p>	<p>Variable messaging signs utilising dynamic carparking information will be provided to drivers similar to that adopted for the Star Casino</p> <p>The improvement of pedestrian access to and from existing and/or upgraded public transport nodes will be provided through interactive wayfinding and signage systems located throughout the Precinct.</p> <p>The detail design of the wayfinding and signage systems are currently under development and will be completed in accordance with the SICEEP Wayfinding and Signage guidelines that are being prepared by INSW. All on-site way finding signage is to be delivered as part of the project, subject to final approval of detailed design by Sydney Harbour Foreshore Authority in accordance with the SICEEP Wayfinding and Signage Guidelines. Off-site way finding signage will be the responsibility of the Sydney Harbour Foreshore Authority (within the Darling Harbour Precinct).</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	3	The Traffic and Transport Assessment recommends improvements to existing pedestrian facilities through "coordination and pedestrian priority at signals and pathway enhancements." The proposal contains no such provision for such items that would provide benefit to pedestrians.	<p>The existing staggered pedestrian crossing located to the north of Darling Drive and Pier Street roundabout, is proposed to be up-graded to a signalised crossing.</p> <p>Pathway enhancements have been proposed via:</p> <ul style="list-style-type: none"> relocated pedestrian crossings on Darling Drive linking to enhanced east-west connections to the Exhibition and Convention light rail stops provision of the Boulevard catering for the north-south pedestrian movements a new bridge linking Quarry St to the new facilities retention and upgrading of Harris St Bridge connection through improvement of interactive wayfinding and signage
	4	The proposal does not make specific provision for future public bus services that may directly serve the SICEEP. Provision has only been made for private bus zones (p.105). The proponent is requested to contact Transport for NSW regarding provision of future bus services to the SICEEP, especially as Transport for NSW is currently planning for changes to the CBD bus network post light rail completion.	<p>DHL has consulted with Transport for NSW (City Transport Planning) on potential provisions for future bus transport service to the Precinct. TfNSW confirmed a study is underway to investigate a Bus Servicing Strategy for the CBD. TfNSW is unable to provide any further information until an announcement is made by government as to a preferred CBD Bus Plan in conjunction with the proposal for the George St Light Rail system.</p> <p>DHL commit to undertake further consultation with NSW Bus and Coach Association to ensure any future requirements are considered.</p>
	5	The Traffic and Transport Assessment (p.103) refers to "provision of new cycling facilities" yet the proposal only commits to a new cycle path. There needs to be a firmer commitment to bicycle parking for visitor, employee and resident use, as well as end of trip facilities for employees and residents.	<p>Proposed cycleways are shown on the Cycle Strategy Plan.</p> <p>The architectural drawings provided with the submission outline the locations for proposed bike parking within the Exhibition Centre carpark and Public Realm. Lockers and end-of-trip facilities will also be provided in the Exhibition Carpark.</p> <p>Darling Harbour Live proposes to explore the viability of a bike hub within the Precinct. This community infrastructure may offer service for bicycle riders and those interested in learning more about cycling and cycle ways in Sydney. It will provide end-of-trip facilities to cyclists, including secure bike storage and amenities and create a community place for cycling commuters and visitors in Sydney</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Construction Phase	6	The Traffic and Transport Assessment (p.96) states "Through consultation with relevant bus and taxi representatives procedures shall be established to ensure harmony of vehicle movements within the area." Whilst this is a procedure that forms part of a detailed construction management plan, it is unclear how such consultation would be facilitated as there are multiple taxi and coach operators. Transport for NSW recommends direct consultation with the NSW Taxi Council and the NSW Bus and Coach Association.	Initial consultation meetings have been held with the NSW Bus and Coach Association and the NSW Taxi Council. DHL commit to undertake further consultation during design development stage to ensure any future requirements are considered prior to construction commencement to ensure coordination with our Construction Transport Management Plan
	9	A Construction Transport Management Plan should be prepared in consultation with Transport for NSW prior to the commencement of construction to address transport and access issues.	A preliminary Construction Transport Management Plan was attached in the DA submission. It will be reviewed and updated in consultation with TfNSW prior to commencement of construction. Section 3.6 in this Addendum Report outlines truck routes and cumulative construction traffic impacts.
Mixed Use Development at Haymarket	11	The road safety assessment should have included an assessment of cycling conditions including cyclist crash history.	An assessment of existing cycling conditions and cyclist crash history is detailed in Section 3.4 of this Addendum Report. A Road Safety Audit was undertaken and is presented in Technical Note 4 attached as Appendix D.
Light Rail Infrastructure Interfaces	14	An assessment of the potential impacts on transport and access to the Light Rail stops will be required. This should take into account any opportunities to improve transport and access for current and future users during both construction and operation. Access to the stops during construction and operation for people with disabilities should also comply with the <i>Disability Discrimination Act 1992 (Cth)</i> and other applicable/relevant guidelines	Following discussion with TfNSW it has been agreed that planning consent for amendments to the Light Rail Stops, as a result of the SICEEP project will be obtained by TfNSW. As such, DHL will no longer seek approval for these works in this application.

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Cumulative Impacts	20	<p>Further detailed assessment is required in relation to the potential cumulative construction impacts of the following major transport infrastructure projects:</p> <ul style="list-style-type: none"> • CBD & South East Light Rail Project • Inner West Light Rail Extension • Monorail Removal Project • Wynyard Walk Project <p>The cumulative construction impacts should be addressed as part of a Construction Environmental Management Plan to be developed in consultation with Transport for NSW. The potential operational impacts with regards to current and future light rail infrastructure requirements should be addressed through a collaborative design process between the proponent, Transport for NSW (as operator of Light Rail) and RailCorp (as the land owner).</p>	<p>Construction works for these projects are not anticipated to coincide with construction works in the associated area.</p> <p>DHL has prepared a brief outline report describing construction routes for the SICEEP development and programme on the concurrent projects including:</p> <ul style="list-style-type: none"> • Global Switch (First Stage); • UTS Chau Chak; and • Wynyard Walk. <p>It is noted no information is currently available on the CBD & South East Light Rail Project.</p> <p>INSW has been liaising with the TfNSW Monorail project team and measures are being undertaken to ensure the timing of the two projects are being coordinated. The current advice indicates removal of the monorail in the associated area will be completed by December 2013.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Traffic Analysis	21	<p>The Aim sun Model Calibration and Validation is only based around GEH criteria. The calibration and validation ignores other criteria (as indicated within RMS's Traffic Modelling Guidelines) such as travel times and queue lengths. In addition, for simulation models, the guideline recommends detailed analysis of critical movements to ensure they do affect modelled outcomes. Therefore, Hyder will be required to demonstrate to the satisfaction of the RMS that the base Aim sun traffic model has been suitably calibrated and validated against all agreed key criteria within RMS's Traffic Modelling Guidelines- RMS 13.184. This document can be downloaded at the following link:</p> <p>http://home.rta.nsw.gov.au/doingbusinesswith/downloads/technicalmanuals/technicalmanuals_dl1.html</p> <p>For one of the GEH criteria (Links with difference in flow within 15% for flows between 700 and 1700vph) -The target required is 85%. Yet on the Friday PM peak they only reach 64%. The report then explains the following: "Large traffic flow difference is observed at Goulburn Street/ Sussex Street and Sussex Street/Hay Street due to upstream and downstream congestion. However, it does not impact on the study area". This would be acceptable to RMS on the proviso that Hyder can clearly demonstrate that their model reflects conditions outside the study area, if such impacts are felt within the study area.</p>	<p>Hyder previously calibrated AIMSUN traffic model using the October 2012 counts. Further model calibration and validation has now been undertaken using new traffic data collected in June 2013. The June 2013 traffic data included travel time, intersection turning movement counts and queue length at key intersections. The AIMSUN model has been calibrated and validated according to the RMS's Traffic Modelling Guidelines (RMS 13.184). Detailed model calibration and validation results were documented in Technical Note 1 and included as an Appendix A with this submission.</p> <p>The traffic model has been further refined considering additional traffic data collected in June 2013. At RMS request, Darling Drive /Ultimo Road intersection has been added to existing model. Further calibration improvements are achieved to roads and intersections within the model study area particularly at Harbour St/Day St, Harbour St/Liverpool St and Goulburn St/George St intersections. The additional traffic data (travel time, intersection movements, queue length) in conjunction with further calibration refinements have improved overall model performance particularly in the GEH statistics.</p> <p>Regarding GEH criteria, Table 3-1 in Technical Note 1 showed that Friday PM peak model achieved 88%. This meets the targets of 85%. With GEH of 88% determined from Technical Note 1, the model satisfies targets.</p> <p>In previous traffic model a reference was made to Goulburn Street/Sussex Street and Sussex Street/Hay Street intersections. Both intersections are located within the study area boundary (see Figure 3 below for subject two intersections).</p> <p>The left turn out of Sussex Street (southbound) into Goulburn St is being obstructed by existing congestion observed at downstream intersection at George St /Goulburn St. Similarly the right turn traffic out of Sussex (southbound) does not clear up in each cycle time due to congestion from upstream intersection at Harbour St/Goulburn St.</p> <p>The revised June 2013 model reflects existing traffic conditions of road and intersections contained within the model boundary showed by dotted line in Figure 3.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
			<p>In general, traffic model does not reflect conditions outside the study area except to those roads and intersections shown in Figure 3. Goulburn Street/Sussex Street and Sussex Street/Hay Street intersections have always been included in the study area boundary. Traffic impact at these two intersections is not influenced by any other nearby intersections located outside the study area.</p>  <p>Figure 3</p>
	22	<p>The proposal will now force vehicles leaving both the proposed Haymarket carpark (400 spaces) and Theatre carpark (107 spaces) to travel southbound towards Ultimo Road. Yet, there is no traffic analysis (either Aim sun or SIDRA) conducted for the intersection of Darling Drive and Ultimo Road. However, the report concludes in the section titled (Next Steps) that "Detailed assessment of the Darling Drive/Ultimo Road intersection is to be carried out as part of the relevant DA submissions". This should be done now as the changes caused by this current application would affect this intersection.</p>	<p>Hyder has extended the AIMSUN model to incorporate the full length of Darling Drive. The model was extended from Quay Street to the Ultimo Road intersection.</p> <p>The Darling Drive/Ultimo Road intersection has been assessed for existing traffic condition. The model shows a Level of Service (LoS) B for 2013 traffic condition.</p> <p>With the proposed SICEEP development traffic, the model predicted LoS C for Darling Drive/Ultimo Road intersection.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	23	<p>Traffic distribution is as follows: 60% arrive/depart from the north via Darling Drive north; 10% arrive/depart from the east via Goulburn Street and George Street; 15% arrive from south via Darling Drive south; 25% depart to south via Darling Drive south; 10% arrive from north via Harbour Street north; 15% depart to the north via Harbour Street north; 5% arrive from east via George Street/Hay Street. The report states: "This traffic distribution follows the observed directional flows taken from Hyder's Sydney Strategic Model". Strategic models are for strategic modelling, not detailed distribution at a very local level. Therefore, Traffic distribution should be determined through survey data of patrons attending functions at this precinct or other observations.</p>	<p>In assessing the proposed SICEEP development, Hyder has made the following traffic distribution assumptions:</p> <p>Trip distribution within the PPP component of the SICEEP was based on actual traffic counts Trip distribution in the Haymarket Precinct (Mix-use Development) was based on combined actual traffic counts and census journey-to-work (JTW) distribution obtained from Bureau of Transport Statistic (BTS). Strategic traffic model was not used for traffic distribution within study. The reference to the strategic model was only made regarding the JTW distribution.</p>
	24	<p>In Appendix C, detailed SIDRA outputs for the "<i>Future Intersection Performance</i>" have not been included within the report. RMS would appreciate receiving such information for review.</p>	<p>The previous SIDRA modelling has been superseded by the AIMSUN modelling results presented in Technical Note 3 attached as Appendix C in this Addendum Report</p>
	25	<p>The Aim sun intersection analysis identifies intersection operational issues at a number of intersections yet no clear recommendations (re: feasible road infrastructure improvements) are provided on how to minimise the problem at the key intersection of Harbour Street I Liverpool Street. This shall be satisfactorily examined and addressed by the proponent.</p>	<p>Traffic model suggested currently there is a capacity problem at the Harbour Street/Liverpool Street. The existing AIMSUN model showed poor level of service (LoS F and E) for left turn movement out of Liverpool Street southbound to Harbour Street. The poor level of service was forecast for both Friday and Saturday PM peak hour. With the addition of the proposed development traffic, the existing capacity problem would remain particularly for this left turn movement.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	26	<p>With regard to the sensitivity analysis undertaken for George Street Light Rail the report states that <i>"An indicative model run was carried out using Hyder's Sydney Strategic Model to determine the likely impact on traffic flow on the surrounding network. The model indicated the shift of vehicle movements onto Harbour Street and increasing Harbour Street traffic volume by 10%".</i> The analysis was conducted for the following two intersections using SIDRA:</p> <ul style="list-style-type: none"> • Harbour Street / Pier Street / Goulburn Street • Harbour Street / Liverpool Street <p>This should have been done using Aim sun as the above intersections are affected by queue spillback and the SIDRA analysis would not have taken this into account. In addition, the sensitivity analysis should also model and consider other nearby potential closures/changes to the local street system, which include changed traffic conditions in Thomas Street between Hay Street and Ultimo Road (i.e. reduction from two lanes to one lane southbound). Details of these changes can be obtained from City of Sydney Council.</p>	<p>A sensitivity analysis was not required by the DGRs. A baseline assessment allowing for 10% growth was undertaken following a request by Transport for NSW. This assessment was undertaken using the available information regarding this proposal.</p> <p>Due to the limited information available on the George Street Light Rail, SIDRA was adopted as a guide only to develop the sensitivity analysis presented in the DA Traffic Report.</p> <p>However, Aimsun modelling has since been undertaken for the revised scheme with the modified access arrangements for the proposed Theatre on Darling Drive. The results of the modelling are detailed in Technical Note 3 attached as Appendix C in this Addendum Report.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Other traffic and Road Safety Issues	27	<p>The proposal intends to reduce parts of Darling Drive (southbound) to one lane per direction. The plans highlight a number of changes which will add to the traffic delays for southbound vehicles which include the following:</p> <ul style="list-style-type: none"> ▪ Currently if the entry capacity into the Exhibition Centre car park is temporarily exceeded, there is the opportunity for vehicles to queue out into the kerbside lane along Darling Drive. However, under the proposed changes, such a scenario will result in the full blockage of southbound traffic along Darling Drive. ▪ Pedestrian demands to cross the proposed marked foot crossing across Darling Drive (located between the Exhibition Centre and the Theatre) will increase significantly. The increased pedestrian crossing volumes will further delay southbound traffic. 	<p>Micro-simulation modelling has been undertaken for Darling Drive.</p> <p>A detailed micro-simulation model was undertaken for Darling Drive to further investigate the likely impacts that the multiple access points and pedestrian crossing impacts may have on through traffic.</p> <p>In the southbound direction, the scheme includes minor changes (from existing) in the access and pedestrian crossing locations. The modelling suggests that there will be a minimal impact in average travel speeds during the (critical) Saturday PM peak:</p> <ul style="list-style-type: none"> ▪ The modelling suggests a minor decrease in average speed, from 35 km/h (existing) to 31.2 km/h in the southbound direction. The northbound average speed on Darling Drive (20.2 km/h) is within the range of speed being observed for existing condition (between 14 km/h and 35 km/h). ▪ The northbound traffic performance on Darling Drive is influenced by the “southern zebra crossing”, located around 100 metres to the north of Pier Street (see previous Figure 2-1). The modelling analysis has found that a two staged zebra crossing on Darling Drive would work for up to 250 pedestrian volumes in one hour. The model does not suggest queue on Darling Drive with Pier Street roundabout. Should pedestrian volumes at “southern zebra crossing” exceeds above 250, the modelling has identified the need for signalisation of this crossing. ▪ The relocation of Theatre car park access off Darling Drive would increase northbound traffic on Darling Drive by 10% compared to the DA scheme. This would have potential to marginally impact the northbound travel speed on Darling Drive. Model forecasts average travel speed at 17 km/h in the northbound direction. The northbound average speed on Darling Drive with revised Theatre access (17 km/h) is still within the range of speed being observed for existing condition (between 14 km/h and 35 km/h). <p>This information is outlined in more detail in Technical Note 2 attached as Appendix B in this Addendum Report.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	28	<p>In addition, concerns are raised in relation to traffic growth along Darling Drive (i.e. 5-10 years post development) and mid-block flows associated with Friday and Saturday PM peak hours plus concurrent Theatre event/concert traffic conditions. The proponent must demonstrate to the satisfaction of RMS/Council that the mid-block capacity of Darling Drive (within the areas of the proposed reduction to one lane) will not be exceeded, and that Darling Drive will not become blocked as a result of the issues raised above.</p>	<p>Hyder have undertaken previous traffic studies within and around Darling Drive over recent years which indicate traffic levels have not significantly grown. As a result they consider that there will be minimal growth within the next 5-10 years and this view has been supported by the City Of Sydney.</p> <p>The results outlined above relate to the previous DA Scheme. Further modelling was undertaken for the revised Theatre access scheme. The Theatre access scheme has assumed signalisation of the southern pedestrian crossing on Darling Drive.</p> <p>Under the revised Theatre access scheme, the traffic model shows instances where traffic queue extends to the nearby roundabout with Pier Street for a brief period of time. However, the queue dissipates quickly and does not obstruct Darling Drive with Pier Street roundabout.</p>
	29	<p>The report states: <i>"North of the Darling Drive/Pier Street roundabout the dual lane two-way segregated cycle-way will be provided along the western side of Darling Drive, until it meets the proposed scramble crossing in the northern sector by the ICC and Hotel"</i>. Before RMS will consider this matter further, the proponent will need to submit detailed information to RMS for review which details the need for this crossing along with details demonstrating that warrants can be met.</p>	<p>Cyclists travelling southbound on the one-way cycle way north of the SICEEP development boundary are required to cross Darling Drive at the crossing to join the dual lane segregated cycle-way on the western side of Darling Drive.</p> <p>The dual cycleway cannot be extended further north due to the grade and width changes of Darling Drive as it approaches the Murray St intersection. The road also separates to provide loading dock access to the Harbourside Shopping Centre.</p> <p>The crossing cannot be relocated north of the Convention roundabout due space limitations for a safe crossing.</p> <p>We consider cyclists crossing at the designated crossing opposite Harbourside Place to be the most appropriate solution. Appropriate signage will be considered to guide cyclists during the detailed design stage of this crossing.</p>
	30	<p>The proposed marked foot crossing across Darling Drive (located between the Exhibition Centre and the Theatre) crosses multiple lanes of traffic along Darling Drive. To address pedestrian safety and to comply with RMS requirements, consideration shall be given to providing signals at this crossing location.</p>	<p>An existing pedestrian crossing connects the eastern side of Darling Drive to the light rail stop and crosses two lanes of traffic.</p> <p>The existing crossing is proposed to be moved slightly north. DHL propose to convert the existing pedestrian crossing to a signalised crossing in order to comply with RMS standards as outlined Section 3.6 of this Addendum Report.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	31	RMS also requires further information relating to the at-grade pedestrian/cyclist crossings along Darling Drive and whether grade separation of such movements was investigated for feasibility.	Connectivity within and surrounding the site at-grade is the deliberate intent of the proposal. There are significant amenity advantages provided by ensuring active streets and footpaths through the provision of at-grade pedestrian/cyclist crossing. Furthermore at grade access reduces issues relating to CPTED within the public realm. Grade separated movements are not proposed for these reasons.
	32	With regard to the cumulative impacts from surrounding construction sites the report states: <i>"It is noted that construction at the Barangaroo site has the option to transport by sea transport via Darling Harbour"</i> . Hyder is advised that sea transport for construction at the Barangaroo site is no longer feasible, which will therefore result in increased road based construction traffic impacts. The report should be mindful of this change and suitably demonstrate to the satisfaction of Council/RMS that cumulative traffic impacts from surrounding construction sites will not detrimentally impact key roads within and around the Sydney CBD.	Section 3.6 of this report provides a description and diagram of the proposed construction traffic routes and a programme outlining key construction projects in the vicinity of SICEEP. We note comments regarding sea transport for Barangaroo and advise that this was provided as an option only and was not part of the formal traffic analysis which included road use for construction impacts.
	33	The report does pick up on the fact that there are quite a number of crashes at the Darling Drive, Pier Street roundabout. No mention is made in the report about how to improve or address this. However, the report does mention the need for a more detailed road safety audit to determine future measures (with regard to pedestrian safety on Darling Drive and also pedestrian safety along Harbour Street). Therefore, it is recommended that the proposed road safety audit will also need to examine this intersection in more detail and recommend any suitable ameliorative measures to improve road safety.	We have sought information from RMS on this matter and carried out a road safety audit. A Road Safety Audit was undertaken for the proposed design and the findings are outlined in Technical Note 4, attached as Appendix D in this Addendum Report. The Designer's responses to the Audit to address the issues are outlined in Technical Note 5, attached as Appendix E to this Addendum Report.

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
	34	<p>The report recommends road infrastructure improvements at Goulburn Street incorporating a westbound right turning bay extension at the intersection with Harbour Street. However, the proponent will need to have a closer look at this proposed improvement as there appears to be difficulties in lengthening this bay. There might be scope to provide a triple right turn from Goulburn Street into Harbour Street northbound. This should be examined further in consultation with the RMS.</p>	<p>The development does not exacerbate any already existing operational issues and therefore no remedial works are proposed as part of the development.</p>
	35	<p>The previous Mott MacDonald report prepared for Infrastructure NSW (which is Appendicised to the Hyder Report) makes the following key statements with regard to Goulburn/Pier Street/Harbour Street:</p> <p><i>"This intersection is currently underperforming during major events and is in need of an ameliorative treatment. There are currently three turning lanes from Pier Street into Harbour Street... Three lanes are insufficient to provide an acceptable level of service or saturation level for this movement. However, relocation of the Sydney Entertainment Centre which would redirect a significant pedestrian travel path across this intersection. In turn, this will further deteriorate the intersection's performance. The intersection will need to be redesigned with a view to increase the capacity of the left turn from Pier Street into Harbour Street as well as increasing the storage capacity of the islands (for pedestrians)".</i></p> <p>The Hyder report does not make any clear comments about this matter and/or how to address these issues. This issue must be addressed by the proponent.</p>	<p>The Mott MacDonald Report outlined the "base line" traffic conditions that have been modified by Hyder to suit the proposed masterplan.</p> <p>The Mott MacDonald modelling was premised on a different future traffic demand and their results cannot be compared with the Hyder modelling which is based on the proposed masterplan as lodged with the DA. The one way loop road at Exhibition Place directs traffic southbound and away from the Pier Street/Goulburn St/Harbour Street intersection.</p> <p>Pedestrian travel is not expected to be redirected to this intersection because of the provision of the Boulevard. It is anticipated that the major pedestrian flows are associated with the movements between the precinct and Central Station or Town Hall.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Construction Traffic Management Plan	37	<p>Individual Traffic Management Plans (TMP) shall be prepared for each construction site in consultation with RMS, Transport Management Centre (TMC), Council and other agencies, prior to the commencement of substantial construction on each site. The TMPs would be forwarded to RMS/TMC for review and approval. Where Council is the Roads Authority approval of the TMP shall be sought from Council, in consultation with the RMS/TMC.</p> <p>All TMPs shall be certified by the Contractor's Traffic Manager and subject to road safety audits by the Contractor.</p> <p>The TMPs must include, but not be limited to the following:</p> <ol style="list-style-type: none"> a. An introduction to the construction phasing and brief narrative on proposed work b. A description of the Construction Activities for all areas affected by the Plan and integration with the adjacent work areas c. A description of existing traffic conditions, including length, direction and type of road (regional, local road function etc.), important access points, brief description of current AM, business and PM peak traffic volumes, a description of number and type of lanes applying to both weekdays and weekends and a description of parking/loading zones applying to both weekdays and weekends d. Details of Construction Program e. Constraints affecting construction, including: Working hours impact on utilities such as traffic signal controllers, TCS posts, smart poles, traffic signal roadway duct, stormwater and other utilities f. Results of traffic modelling, results of bus travel time surveys etc. as required g. Traffic Construction Impacts, including <ul style="list-style-type: none"> • Any restriction of access and any intermittent stoppage to traffic • Any effects on specific road users, in particular buses. • Impact on pedestrians and cyclists and access to properties and use of barricades and advisory signs, as necessary, to warn and guide pedestrians around the construction site, and redirection to alternative pedestrian crossing points 	<p>We will continue to engage with TMC, RMS, Council and other relevant agencies in developing these plans. The plans will be developed prior to construction commencement and issued to the relevant consent authority.</p>

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
		<ul style="list-style-type: none"> • Impact on pedestrians and cyclists and access to properties and use of barricades and advisory signs, as necessary, to warn and guide pedestrians around the construction site, and redirection to alternative pedestrian crossing points • Traffic impacts, including changes to traffic signal phasing • Construction site traffic generation and access, including spoil access routes, type of truck to be used, consideration of geometry and manoeuvring requirements on the route, separate routes for contaminated spoil removal. In principle priority will be given to the use of State or Council roads (may require separate Haulage Management Plan) • Impact on bus operations • Impact on other public transport <p>h. Traffic control construction program, including:</p> <ul style="list-style-type: none"> • Provision of traffic barriers • Alteration to lane lines • Minimum lane widths • Alterations to pedestrian crossings • Security fencing • Night time delineation such as flashing lanterns, line marking incorporating glass beads, raised reflective pavement markers, lighting • Provision of signposting - directional, advisory, regulatory <p>i. Details of advertising and communication, including radio, newspaper and letterbox distribution.</p> <p>j. Use of Variable Message Signs under TMC control</p> <p>k. Request to use any VMS under TMC control</p> <p>l. Notification of Authorities, including Police, STA and Council</p> <p>The applicant must meet all costs in regards to the provision of any supplementary staff or technical services provided by Transport Management Centre (TMC).</p>	

Issue Group Category	Item Number	Issue Description	Response and Relevant Section of Addendum Report (where applicable)
Construction Traffic Management Plan		<p>Transport for NSW supports and recommends that the proponent implement the following Travel Behaviour Change initiatives, as mentioned within the Transport and Traffic Assessment report:</p> <ul style="list-style-type: none"> • Tickets with subsidised public transport. • Preferential parking for car share operations reduced parking fees. • Way-finding, signage and infrastructure providing real time information on travel operations. End trip facilities (i.e. bicycle facilities, lockers, showers, change rooms, etc.). • Green Travel Plan implementation. Incentives for public transport users. • Car park design Dynamic Parking signage (VMS) - illustrating parking availability <p>In addition, to further facilitate the effective management of traffic around the Precinct, the proponent (in consultation with RMS, TMC and Council) will also be required to install VMS on key roads streets in approach to the site along with CCTV at agreed locations. This must be implemented prior to any occupation certificate.</p>	<p>Variable messaging signs utilising dynamic carparking information will be provided to drivers similar to that adopted for the Star Casino.</p> <p>Signage and interactive wayfinding signs shall be designed and installed in accordance with SICEEP Wayfinding and Signage guidelines. These details are currently being developed.</p> <p>DHL will investigate extension of these systems to incorporate ticketing and public transport initiatives.</p>

3 TRAFFIC ISSUES

3.1 DARLING DRIVE

Technical Note 2 has been prepared to address concerns on the performance of Darling Drive raised by Transport for NSW (TfNSW) and Roads and Maritime Services (RMS). A detailed traffic modelling on Darling Drive was undertaken using micro-simulation software VISSIM. The detailed model of Darling Drive has considered interactions from pedestrians, cyclists, coaches, taxis, cars and trucks.

The modelling results in Technical Note 2 demonstrate that impact from SICEEP would not adversely impact the traffic performance of Darling Drive.

3.2 AIMSUN MODELLING RESULTS

Technical Note 3 has been prepared to present the Aimsun modelling results following the update on the validation of the model and the extension of the model to include Darling Drive intersection.

Technical Note 3 also presents the outcomes of the investigations on the proposed new theatre access proposed on Darling Drive.

3.3 BUS SERVICE PROVISIONS FOR THE SICEEP

A consultation process was initiated with Transport for NSW (TfNSW) to investigate future plans for the provision of public bus transport service for the SICEEP. TfNSW had advised that TfNSW is currently undertaking a study investigating options for a new CBD Bus Plan in conjunction with the George Street Light Rail project. The study is aimed at redesigning the bus network to create simpler, faster and better bus services in the CBD. More information cannot be provided until an announcement is made by government as to a preferred CBD Bus Plan. However, TfNSW advised that the most current information on potential routes is publicised in *'Sydney's Light Rail Future', TfNSW, December 2012.*

Figure 1 shows the initial bus network concept for the CBD suggests a western CBD bus corridor closer to the SICEEP site. The main north south bus route will be on Elizabeth Street and the main east-west bus routes will be on Park Street and Druiitt Street. However, this bus route plan is deemed to be preliminary and the preferred bus plan will only be confirmed after the completion of the ongoing investigations. Nevertheless, TfNSW have indicated that Harbour Street and Darling Drive are flagged as potential future bus service routes and provisions for future bus facilities can be considered. The current Darling Drive realignment proposal considers a bus stop in the south adjacent to the Theatre and in the north adjacent to the Convention Centre, and proposed hotel.

Darling Harbour Live are committed to continue consultations with TfNSW as design development for the SICEEP progresses.

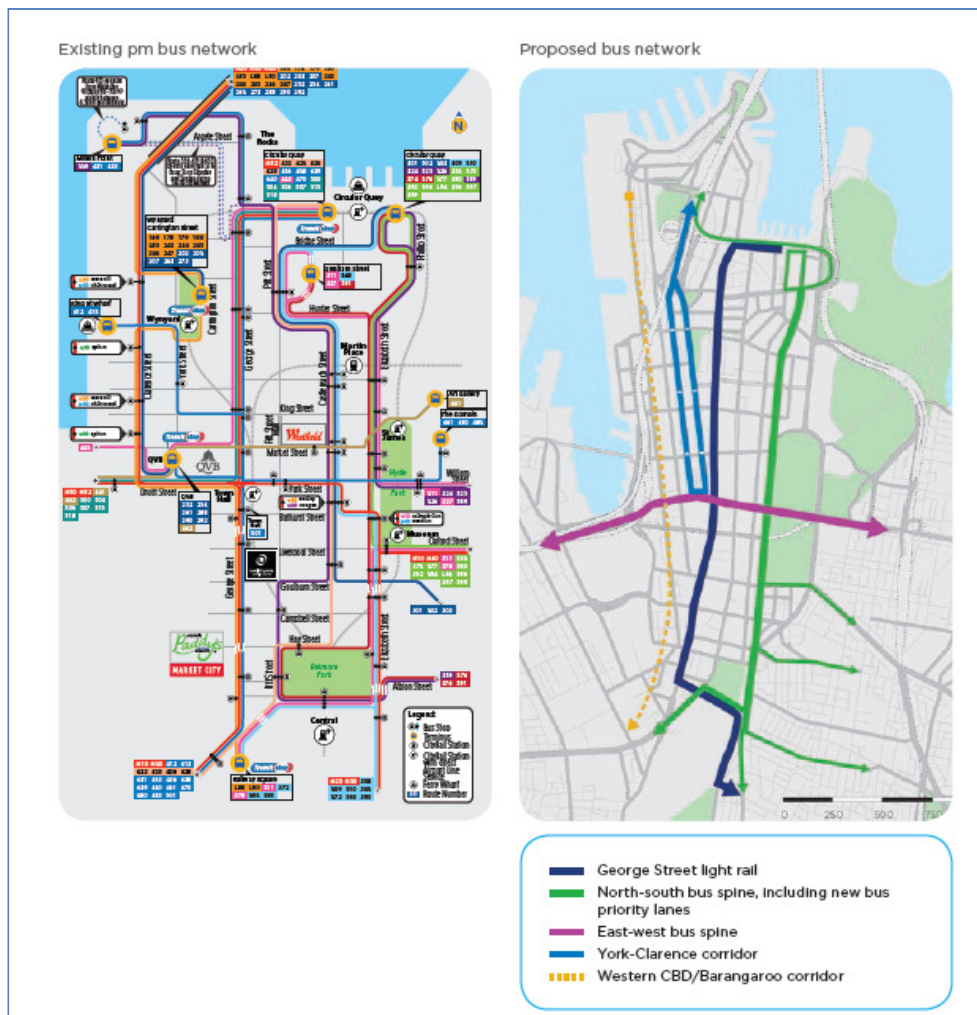


Figure 1 Existing and Proposed Bus Network

Source: Sydney's Light Rail Future, TfNSW, December 2012

3.4 ROAD SAFETY ISSUES

3.4.1 ROAD SAFETY AUDIT FOR DARLING DRIVE

Following the submission of the DA, a Road Safety Audit was undertaken on Darling Drive for the concept design of Darling Drive and is attached in this Addendum as Technical Note 4. Parallel to the commissioning of the Road Safety Audit, modifications to the design of Darling Drive have also been undertaken and hence have already addressed some of the issues identified.

To address the Audit findings, a Designer's response has been drafted and is attached in Technical Note 5.

3.4.2 CYCLING CONDITIONS AND CYCLIST CRASH HISTORY

Crash data was obtained from the RMS for Darling Drive from the intersection with Ultimo Road to the south to the intersection with Murray Street to the north, including 10 m at all

intersections. Crash data for five years from July 2007 to June 2012 was provided. An analysis was undertaken on the data and the findings are summarised as follow:

- A total of 78 crashes has been recorded over the five year period;
- Twenty-three crashes (23) or 29.4 % involved a cyclist;
- Seventeen (17) of the crashes involving a cyclist occurred in the vicinity of the Pier Street roundabout;
- Sixteen of the crashes at the Pier Street roundabout involved a cyclist travelling in the southbound cycle lane and a vehicle travelling west from Pier Street;
- One crash involved a cyclist travelling in the southbound lane and a vehicle making a u-turn at the roundabout.

The above crash history indicate that there is a high risk for cycling crashes to occur at the Pier Street roundabout, particularly at the point where vehicles travelling west from Pier Street cross the path of the existing southbound cycle lane.

The proposed cycle lane design on Darling Drive will significantly improve the conditions for cyclists via the dual lane two-way segregated cycle path. The proposed cycle way will be segregated to improve the safety of cyclists along Darling Drive and will run along the western side of Darling Drive.

3.5 PEDESTRIAN CROSSING WARRANTS

Modifications to the design of Darling Drive include signalised mid-block marked pedestrian crossings across Darling Drive between Hay Street and Pier Street and between Pier Street and Harbourside roundabout. There are advantages of signalised midblock crossing over a zebra crossing:

- Provides clear, unambiguous advice/ control regarding which road user has right of way. The signal is undisputable regarding who has right of way. Also, there is less "creeping" by vehicles i.e. when vehicles creep forward so that they can pass through the crossing as soon as the pedestrian moves out of the way. This is a behaviour that commonly happens at zebra crossings.
- Can be linked to the upstream and downstream signals via SCATS. Therefore, phasing can be controlled to minimise risks of queue spillback from one facility to the other.
- Handles high volumes of pedestrians better which arrive in "chunks" (platoons). This may be applicable here because pedestrians from the western side will tend to arrive in groups following the arrival of a tram.

The RMS provides warrants as a guide in the consideration of a signalised mid-block marked crossing. Guidance on the locational requirements has been noted but it is argued that the proposed locations can be justified on the merits of safety and anticipated pedestrian desire lines.

Furthermore, as a guide, a signalised mid-block marked pedestrian crossing may be considered if following warrant is met:

For each four one-hour periods of an average day (for example two hours in the morning peak and two hours in the evening peak):

- The pedestrian flow crossing the road exceeds 250 persons/hour; and

- The vehicular flow exceeds 600 vehicles/hour in each direction or, where there is a central median of at least 1.2 m wide, 1,000 vehicles/hour in each direction.

For Darling Drive, the above conditions are met.

3.6 CONSTRUCTION TRAFFIC IMPACTS

An initial assessment has been undertaken for the cumulative effects of construction traffic on Darling Drive. Construction work for the SICEEP is anticipated to commence in February 2014 to be completed in August 2016. The commencement of construction works for the PPP and the Haymarket is on February 2014 while the commencement of constructions works for the Haymarket is scheduled to be July 2014. The construction works are likely to be carried out concurrently.

Construction works for other planned developments in the vicinity of the SICEEP site are likely to coincide with the development. Table 3 provides a list of known projects within and around the SICEEP site.

Table 3 Construction Projects in the vicinity of the SICEEP Site

Project Work	Start	Finish
SICEEP PPP	February 2014	August 2016
SICEEP Haymarket	February 2014	August 2016– 2019 (Staged)*
SICEEP North Hotel	July 2014	August 2016
Global Switch (First Stage)	December 2013	April 2014
UTS Chau Chak	December 2013	December 2014
Wynyard Walk	December 2013	October 2015

* Works are staged and are subject to change

3.6.1 CONSTRUCTION SITE ACCESS

Site access for construction vehicles associated with the works for the SICEEP will access from Darling Drive from the North using Pyrmont Bridge Road, Pyrmont and vehicles accessing Darling Drive from the South using Ultimo Road and Harris Street, Ultimo. The main entry and exit for construction materials and vehicles for the PPP works shall be from the west, off Darling Drive, and from the south utilizing the current roadway access to the SHFA maintenance compound located under the Pier Street overpass.

For the construction works associated with the Haymarket, there are different locations off Darling Drive as follows:

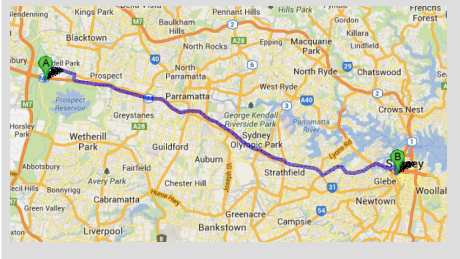
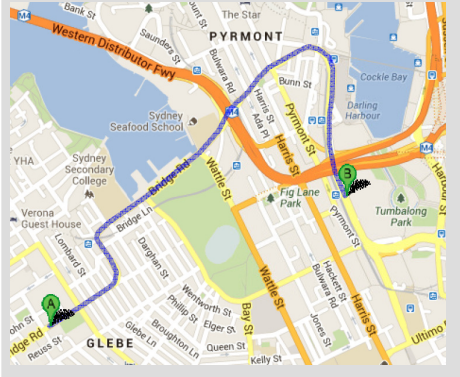
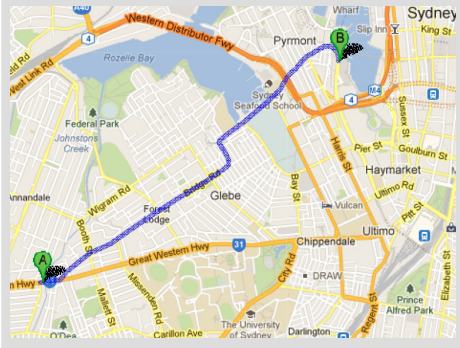
- The Darling Drive plot will be accessed from vehicles travelling north along Darling Drive and pulling into the newly created parking bay on the western side of Darling Drive;
- Demolition of the SEC Car Park will be serviced from south bound trucks using the existing mini coach parking area on the east side of Darling Drive;

- The NW plot will be accessed from the north along the new loop road via the Darling Drive roundabout beneath Pier Street; and
- The SW plot will be accessed from vehicles travelling north and south along Darling Drive turning into a loading area within the Hay Street corridor.

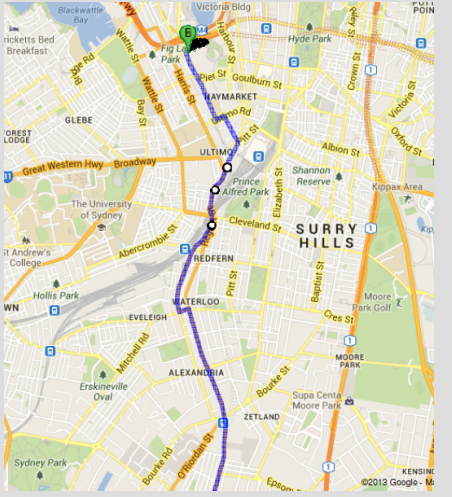
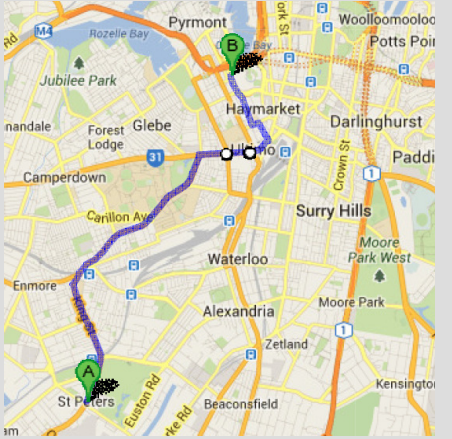
Construction vehicles for the North Hotel shall also mainly access from the west, off Darling Drive.

The main entry and exit access for construction vehicles to the SICEEP construction sites will be on Darling Drive. The general construction routes are shown in Table 4. Construction vehicles to and from Eastern Creek, Glebe, Parramatta and Victoria Road will access Darling Drive from the north while construction vehicles to and from Botany Bay, Moorebank, St George and St Peters will access Darling Drive from the south.

Table 4 General Construction Routes

Route	Description	Route map
Eastern Creek	Via Great Western Highway – M4 Motorway – Parramatta Road - Wattle Street – City West Link – Western Distributor – Pyrmont Bridge Road – Darling Drive north	
Glebe	Via Bridge Road – Darling Drive north	
Parramatta	Via Great Western Highway – Bridge Road – Darling Drive north	

Route	Description	Route map
Victoria Road	Via Victoria Road – Western Distributor – Pyrmont Bridge Road – Darling Drive north	
Botany Bay	Via Foreshore Road - Botany Road - Gibbons Street – Regent Street – Lee Street – Quay Street – Ultimo Road – Darling Drive south	
Moorebank	Via Junction Road – Heathcote Road - M5 Motorway – Princes Highway - King Street City Road – Parramatta Road – Ultimo Road – Darling Drive south	
St George	Via Stoney Creek Road – Forrest Road – Princes Highway - King Street City Road – Parramatta Road – Ultimo Road – Darling Drive south	

Route	Description	Route map
St Peters	Via Botany Road - Gibbons Street – Regent Street – Lee Street – Quay Street – Ultimo Road – Darling Drive south	
St Peters	Via King Street City Road – Parramatta Road – Ultimo Road – Darling Drive south	

3.6.2 CONSTRUCTION TRAFFIC FOR THE SICEEP

Table 5 provides an indicative estimate of truck movements through each component of the PPP, PDA Haymarket, and the North Hotel projects through their early works and structure phases where it is expected that peak traffic loads shall occur. It can be seen that estimated peak construction traffic will be evident in the months between July 2014 to February 2015, and shall drop off significantly following this period.

Table 5 Indicative Construction Duration and Associated Truck Movements by Construction Component

Description	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16		
PPP SITE																																			
Incoming Services			2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3			
Demolition			12	12	12	12	12	12	12																										
Darling Drive			5	5	5	5	5	5																											
Excavation			8	8	8	8	8																												
Piling			5	5	5	5	5																												
Formwork					3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Concrete					10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
Rebar					1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Structural Steel						8	8	12	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	
High Voltage										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Public Realm Excavation																	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Landscaping																																			
PDA SOUTH																																			
High Voltage			5	5	5	5																													
Incoming Services			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Darling Drive			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Demolition					12	12	12	12																											
Excavation								8	8	8	8																								
Piling								5	5	5	5																								
Formwork								3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Concrete								5	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Rebar										1	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Façade																																			
Landscaping																																			
PDA NORTH																																			
Demolition								10	10																										
Incoming Services										2																									
Piling										2	2																								
Excavation										5	5	5																							
Formwork																																			
Concrete																																			
Rebar																																			
Façade																																			
Total Trucks			28	58	72	73	76	97	97	99	99	104	104	106	107	86	87	70	66	66	63	65	66	67	35	36	26	26	22	22	21	9	6		

From Table 5, it is estimated that the truck movements associated with the construction of the SICEEP development (PPP, Haymarket and the North Hotel) will be approximately 107 truck movements per day in the busiest month of February 2015.

Traffic surveys undertaken in October 2012 suggests there are approximately 550 truck movements recorded on a Friday and 200 truck movements recorded on a Saturday along Darling Drive. It is estimated that approximately 10 truck movements per hour or 100 truck movements per day (over a 10-hour period) are associated with the existing Exhibition and Convention Centre on Darling Drive, north of the Pier Street roundabout. During construction, the Exhibition and Convention Centre will not be operational. Hence, these 100 truck movements can be discounted from the total truck volume on Darling Drive.

With 107 movements per day for the construction works, this equates to at least 1 additional truck movement per hour when compared to existing truck movements. It should be noted that this increase is marginal and that during construction, the Exhibition Centre and Convention Centre will not be operating and construction traffic is not likely to exceed current levels of existing truck traffic on Darling Drive.

3.6.3 CONSTRUCTION TRAFFIC FOR OTHER KNOWN DEVELOPMENTS

A review of active construction projects near to the SICEEP development has also been undertaken, taking into consideration programme durations in comparison to SICEEP.

- Global Switch – It is understood the first stage of the Global Switch ‘Sydney East’ Data Centre project is due for completion in the first quarter of 2014. This new data centre is an expansion of the current Global Switch Sydney campus located in Pymont Street, Ultimo.

The project in its completion phase shall coincide with the first 3 months of SICEEP, however it is not expected that this will impact on peak traffic associated with the SICEEP development. Construction has commenced and will finish in April 2014. The truck movements for the SICEEP during this period are estimated at a maximum of 72 truck movements per day to occur in April 2014. This equates to 35 truck movements less than the expected SICEEP peak of 107 in February 2015.

- UTS Chau Chak – The Dr Chau Chak Faculty of Business project at UTS is currently in its structure phase of construction, where peak vehicle loads are expected to occur. Construction has commenced and it will finish in August 2014. The completion of structural works is anticipated at the end of 2013, and as such peak traffic will begin to drop off prior to the commencement of SICEEP.

It is expected that following structural works the most significant traffic into the project will come from the delivery of façade materials, which is expected to continue until June 2014. Again this is not expected to affect SICEEP peak truck movements, as a maximum of 76 truck movements per day is observed in June 2014.

- Wynyard Walk – This staged project will create a pedestrian link between the existing Wynyard Station, CBD western corridor and Barangaroo development. Previous information compiled as part of the Barangaroo Traffic Management Plan suggest that at peak, there will be up to 72 construction vehicles per day associated with the Wynyard Walk project up until the end of 2013 and will drop off significantly following this.

As a result, it is not expected that this project will have a significant effect on the SICEEP development due not only to its location but also in that its peak traffic loads occur well before SICEEP construction activities begin to ramp up.

3.6.4 CUMULATIVE TRAFFIC IMPACTS

It is anticipated that access routes to construction works of other developments are likely to differ from that of SICEEP. However, where the routes coincide the increase in heavy vehicles will be temporary only for the duration of the construction and will be managed through the preparation of a Construction Traffic Management and Access Plan. This plan will be prepared prior to commencement of construction works and in consultation with the relevant stakeholders and affected parties.

This diversity of construction access points will largely mitigate any significant construction traffic impacts on Darling Drive.

Analysis of the frequency and type of expected construction vehicles suggests:

- The truck movements anticipated will be spread throughout the construction programme
- The distribution will alleviate potential for congestion at any single access point;
- Potential conflict points can be monitored and managed through the preparation of detailed construction traffic management plans;
- The specific plans will be regularly updated in accordance with any changes required to proposed route and movements as identified through constant monitoring as the works progress, and,
- Any possible impact would be marginal and temporary.

Construction traffic to and from the development site will be subject to constraints imposed by the current traffic network. Advice received from the RMS at various meetings is that increased traffic to Darling Drive and surrounding road network would be best suited to non-peak hour times as such we will ensure that our bulk deliveries will be coordinated to these times.

It is noted, however, that the construction vehicle movements will not exceed the current vehicular movements that have been monitored, from the existing convention centre, exhibition centre, multi deck carpark and entertainment centre into the surrounding road network.

4 REVISED THEATRE SCHEME

The revised theatre scheme is a slight modification to the original DA scheme with the relocation of the Theatre car park access off Darling Drive and the increase of parking from 107 to 196 spaces. The access will be a left-in, left-out arrangement. This arrangement has been reviewed as from a Road Safety Audit perspective and the findings are noted as follows:

This scheme is regarded to be a similar set of circumstances as the previously proposed taxi rank as the taxi rank is essentially a left-in-left-out arrangement. As per the audit report there was no issue with the taxi rank. As such, there is no issue with the current proposal to have a left-in-left-out arrangement for the Theatre car park.

The revised theatre scheme has also been assessed from a traffic analysis perspective. AIMSUN modelling was undertaken to investigate the likely impacts of the revised scheme. The results of the analysis are provided in Technical Note 3, attached as Appendix C in this report.

5 SUMMARY

This Addendum Report was prepared for the purpose of providing a response to the issues raised on the submission of the Traffic and Transport Assessment in support of the development application for the Sydney International Conventional, Exhibition and Entertainment Precinct (SICEEP) Project and to present the results of additional analysis and investigations carried out for the Revised Theatre Scheme.

The traffic and transport assessment focussed on access and the connectivity of the precinct with the external network for all modes of transport and cites the key features of the whole precinct that will contribute to this. This Section summarises the conclusions from the additional investigations undertaken as part of the Addendum.

5.1 DA COMMENT RESPONSES

This Report provides a response to comments received from the Department of Planning and Infrastructure (DoPI) and submissions from the Transport for New South Wales (TfNSW) and the Roads and Maritime Services (RMS) on the Traffic and Transport Assessment Report prepared in support of a State Significant Development Application (SSD 12_5752) submitted to the Minister for Planning and Infrastructure pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act); and addresses the comments raised on issues such as:

- Traffic impacts;
- Public transport;
- Vehicular access;

- Parking;
- Construction traffic;
- Mixed use development at Haymarket;
- Cumulative impacts; and
- Road safety.

5.2 VISSIM MODELLING OF DARLING DRIVE

Technical Note 2 addresses the request that a micro-simulation model be undertaken to demonstrate that Darling Drive will operate satisfactorily following the SICEEP development. The model includes the extent of Darling Drive between the Pier Street roundabout and the Convention Centre roundabout, as requested by the RMS.

The modelling results in Technical Note 2 demonstrate that the SICEEP development would not adversely impact the traffic performance of Darling Drive.

This technical report documents Hyder's findings on the traffic performance of Darling Drive particularly the section between Pier Street and Harbour side roundabouts for post development condition. The detailed micro-simulation model of Darling Drive has considered interactions from pedestrians, cyclists, coaches, taxis, cars and trucks. Two development schemes for Darling Drive were modelled as follows:

- "DA scheme", as presented as part of the original Development Application. In original DA scheme, the Theatre car park access is proposed off Exhibition Place Loop Road.
- "Revised Theatre Access Scheme" – a slight modification to the original DA, with the relocation of the Theatre car park access off Darling Drive, the provision of a signalised pedestrian crossing linking the light rail with Tumbalong Place, and the increase to 196 carpark spaces from 107.

In general, the travel lanes on Darling Drive for post development condition would be similar to existing condition.

Both schemes were modelled for worst case traffic volumes for "Saturday PM peak hour", with "peak event" traffic demand.

The 2013 Saturday PM peak traffic data shows that existing travel speed on Darling Drive north of Pier Street varies between 14 km/h and 35 km/h in the northbound direction. The travel speed varies between 21 km/h and 36km/h in the southbound direction.

The traffic modelling study has found that:

- The DA scheme is expected to perform well for southbound travel along Darling Drive. The northbound traffic performance on Darling Drive is influenced by the southern zebra crossing. The modelling analysis has found that two staged zebra crossing on Darling Drive would work for up to 250 pedestrian volumes in one hour. The model does not suggest traffic queuing back onto the Darling Drive with Pier Street roundabout. Should pedestrian volumes at the "southern zebra crossing" exceed 250, the modelling has identified the need for signalisation of this crossing.
- The relocation of the Theatre car park access off Darling Drive would increase northbound traffic on Darling Drive by 10% compared to the DA scheme. This would have potential to marginally reduce the northbound travel speed on Darling Drive. Model forecasts average travel speed at 17 km/h in the northbound direction. The northbound

average speed on Darling Drive with revised Theatre access (17 km/h) is within the range of speed being observed for existing condition (between 14 km/h and 35 km/h).

- Under revised Theatre access scheme, the traffic model shows instances where queue extends to the nearby roundabout with Pier Street for a brief period of time. However, the queue dissipates quickly and does not obstruct Darling Drive with Pier Street roundabout.
- Further data analysis on Darling Drive for seven days period (Monday to Sunday) shows that on average, Friday traffic is about 18% lower than Saturday traffic. Traffic on Darling Drive in weekday (Monday to Thursday) reduces significantly between 23% and 40% compared to Saturday traffic.

The revised Theatre access scheme on Darling Drive would work for both weekday and weekend traffic conditions.

5.3 AIMSUN MODELLING RESULTS

Technical Note 3 has been prepared to present the Aimsun modelling results following the update on the validation of the model and the extension of the model to include Darling Drive intersection. The key findings of the modelling are summarised as follows

- The Theatre access car park off Darling Drive would not adversely impact the operation of roundabout with Pier Street. Model forecasts LoS B at this roundabout
- The results based on revised AIMSUN modelling in Technical Note 3 do not change the conclusion drawn in March 2013 Traffic and Transport Assessment Report.

5.4 BUS SERVICE PROVISIONS FOR SICEEP

The initial bus network concept for the CBD suggests a western CBD bus corridor closer to the SICEEP site. The main north south bus route will be on Elizabeth Street and the main east-west bus routes will be on Park Street and Druiitt Street. However, this bus route plan is deemed to be preliminary and the preferred bus plan will only be confirmed after the completion of the ongoing investigations. Nevertheless, TfNSW have indicated that Harbour Street and Darling Drive are flagged as potential future bus service routes and provisions for future bus facilities can be considered.

Darling Harbour Live are committed to continue consultations with TfNSW as design development for the SICEEP progresses.

5.5 ROAD SAFETY ISSUES

A road safety audit (Technical Note 4) of the concept Darling Drive design, which is located between Hay St and the roundabout at Harbourside was undertaken. No significant safety issues were identified from this safety audit, except for the need of a signalised pedestrian crossing to safely link pedestrians with the light rail stop and Tumbalong Place.

The designer's response (Technical Note 5) report addresses all of the safety issues raised. Any safety issue that is not already addressed since the audit was undertaken or is an existing condition, will be addressed during the detailed design stage of Darling Drive.

The revised Theatre layout results in the need for a signalised pedestrian crossing to link the light rail stop and Tumbalong Place.

5.6 CONSTRUCTION TRAFFIC IMPACTS

With 107 movements per day for the construction works, this equates to at least 1 additional truck movement per hour when compared to existing truck movements. It should be noted that this increase is marginal and that during construction, the Exhibition Centre and Convention Centre will not be operating and construction traffic is not likely to exceed current levels of existing truck traffic on Darling Drive.

An assessment of construction traffic associated with adjacent development sites was undertaken. It is not expected that these projects will have a significant effect on the SICEEP development due not only to its location but also in that its peak traffic loads occur well before SICEEP construction activities begin to ramp up.

5.7 THEATRE RE-DESIGN

The main traffic findings from the redesign of the Theatre include:

- The Theatre access car park off Darling Drive would not adversely impact the operation of roundabout with Pier Street. Model forecasts LoS B at this roundabout
- The results based on revised AIMSUN modelling in Technical Note 3 do not change the conclusion drawn in March 2013 Traffic and Transport Assessment Report.
- Driver's leaving the revised Theatre will now have more options of getting to their destination, as they can now travel south or north at the Darling Drive and Pier Street roundabout or travel via Pier Street;
- Access to both PPP car parks will now be off Darling Drive;
- The redesign of the Theatre supports the need for the existing pedestrian crossing to be changed to a signalised crossing, which addresses safety concerns identified in the road safety audit; and
- Traffic related to the Theatre redesign would have potential to marginally reduce the northbound travel speed on Darling Drive.

6 CONCLUSION

This Addendum Report was prepared for the purpose of providing a response to the issues raised on the submission of the Traffic and Transport Assessment in support of the development application for the Sydney International Conventional, Exhibition and Entertainment Precinct (SICEEP) Project and to present the results of additional analysis and investigations carried out for the Revised Theatre Scheme.

The key design change to the SICEEP Project is the change of the access and egress location to the proposed Theatre building. The previous scheme provided access and egress to and from the Theatre from Exhibition Place, which is the proposed one way loop road. The revised design will now provide access and egress to and from the Theatre from Darling Drive.

The changes to the access and egress location for the Theatre results in:

- Driver's leaving the revised Theatre will now have more options for getting to their destination, as they can now travel south or north at the Darling Drive and Pier Street roundabout or travel via Pier Street. Previously, they were required to travel south and could not directly access Pier Street or Darling Drive northbound;

- Vehicles wanting to enter the Theatre car park from the south will be required to travel north along Darling Drive, prior to entering the car park. However, vehicles coming from the south will still have the option of parking at the public car park, located in the NW plot of the proposed Haymarket development, with access provided from the Pier Street and Darling Drive roundabout.
- There will be no impact on vehicles coming from the north who wish to park at the Theatre car park, relative to the previous scheme.

In terms of overall traffic and transport impacts the results of the traffic modelling and safety audit outlined in this Addendum, demonstrate that:

- The impact from the SICEEP development would not adversely impact the traffic performance of Darling Drive;
- The Theatre access car park off Darling Drive would not adversely impact the operation of roundabout with Pier Street. Model forecasts LoS B at this roundabout;
- The results based on revised AIMSUN modelling do not change the conclusion drawn in March 2013 Traffic and Transport Assessment Report; and
- The redesign of the Theatre supports the need for the existing pedestrian crossing to be changed to a signalised crossing, which addresses safety concerns identified in the road safety audit.

On this basis, this report concludes that the revised Theatre car park access and egress design provides benefit to the users, does not adversely impact the traffic performance of Darling Drive and addresses pedestrian safety at the proposed pedestrian crossing at Tumbalong Place.

SYDNEY INTERNATIONAL CONVENTION, EXHIBITION AND ENTERTAINMENT PRECINCT (SICEEP)

TRANSPORT AND TRAFFIC ASSESSMENT

Technical Note 1 – AIMSUN Model Calibration and Validation as per RMS
Guidelines



Hyder Consulting Pty Ltd
ABN 76 104 485 289
Level 5, 141 Walker Street
Locked Bag 6503
North Sydney NSW 2060
Australia
Tel: +61 2 8907 9000
Fax: +61 2 8907 9001
www.hyderconsulting.com

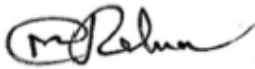




LEND LEASE PTY LTD

DARLIN HARBOUR LIVE

Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP)

Technical Note 1 – AIMSUN Model Calibration and Validation as per RMS Guidelines

Author	Mukit Rahman, Kung N.	
Checker	Joe Heydon	
Approver	Greg Ives	
Report No	AA004399_TN1	
Date	June 2013	

This report has been prepared for LEND LEASE PTY LTD in accordance with the terms and conditions of appointment for Darling Harbour Live. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

REVISIONS

Revision	Date	Description	Prepared By	Approved By
A	17 June 13	Internal Review	MR, KN	MR
B	18 June 13	Draft for Client's Review	MR	MR
C	21 June 13	Final Report	MR	MR



CONTENTS

1	Introduction	1
1.1	Report Purpose	1
1.2	New Data Collection	1
1.3	Model Augmentation.....	3
2	Model Calibration and Validation Criteria	5
3	Friday PM Peak Model	6
3.1	Calibration Results	6
3.2	Model Validation	8
3.3	Summary of Friday PM Calibration and Validation	13
4	Saturday PM Peak Model.....	14
4.1	Calibration Results	14
4.2	Model Validation	16
4.3	Summary of Saturday PM Calibration and Validation.....	21

1 Introduction

1.1 Report Purpose

This technical report is an extension to the Traffic and Transport Assessment Report, March 2013, prepared by Hyder Consulting for the Sydney International Conventional, Exhibition and Entertainment Precinct (SICEEP) Project. This technical report has been prepared to address AIMSUN model calibration and validation raised by Transport for NSW (TfNSW) and Roads and Maritime Services (RMS).

This technical report documents Hyder's findings on AIMSUN model calibration and validation based on RMS Guidelines.

The modelling results in Technical Note 1 demonstrate that existing models have been calibrated and validated according to the RMS's Traffic Modelling Guidelines. The models are fit for the study purpose.

1.2 New Data Collection

Hyder undertook new traffic survey required for AIMSUN model calibration and validation.

A new traffic survey was undertaken on Friday 31st May 2013 and Saturday 1st June 2013. The traffic survey was undertaken by Autraffic.

Three types of data were collected as follows:

- Travel time data on five key travel routes within the model study area;
- Intersection turning movement counts for Friday and Saturday PM peak period at five intersections. and
- Queue length surveys for Friday and Saturday PM peak period at five intersections.

Travel Time Survey

Travel speed and time data was collected during 2 hours PM (5:00-7:00pm) on Friday 31st May 2013 and 2 hours PM (5:30-7:30pm) Saturday 1st June 2013 for the following five key travel routes including:

- Route 1 on Darling Drive southbound from Murray Street to Ultimo Road;
- Route 2 on Darling Drive northbound from Ultimo Road to Murray Street;
- Route 3 on Goulburn Street / Pier Street / Darling Drive westbound from George Street to Ultimo Road;
- Route 4 on Darling Drive / Pier Street / Harbour Street northbound; and
- Route 5 on Harbour Street / Pier Street and Darling Drive southbound.

Travel speed and time data was collected using a GPS instrument. Figure 1-1 shows the surveyed travel time routes.

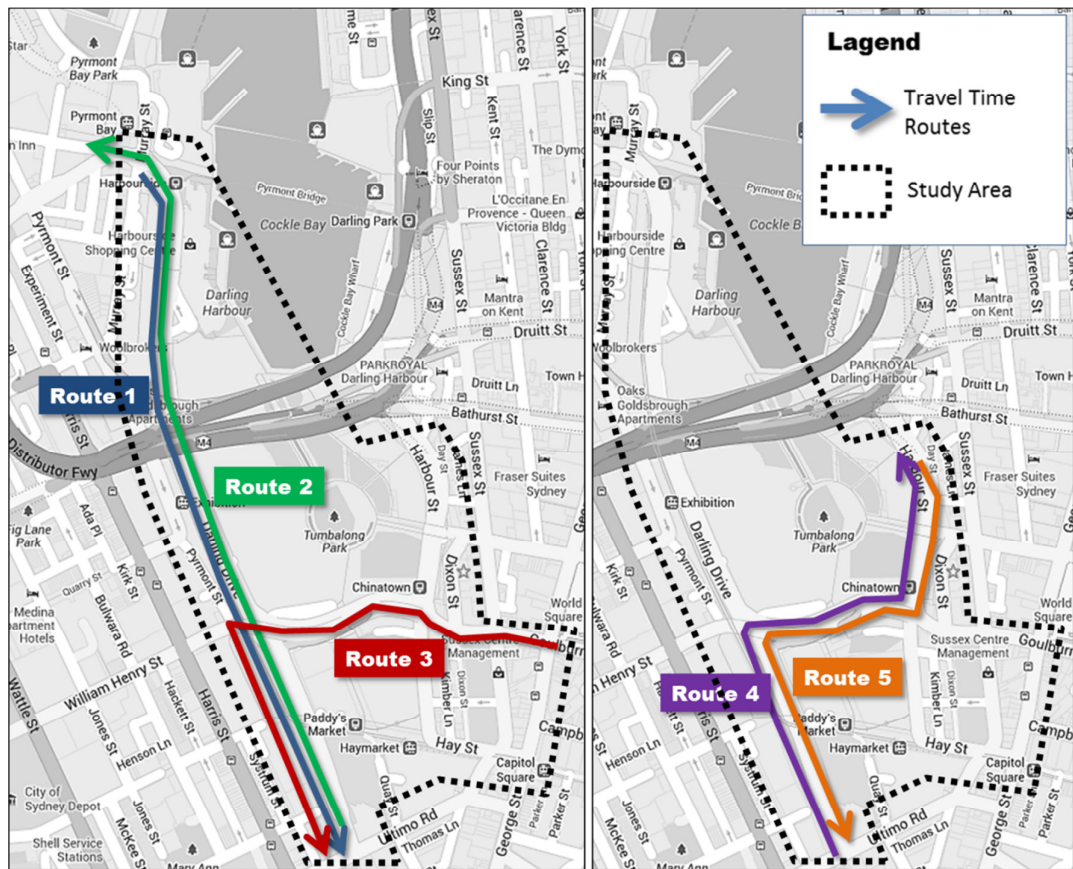


Figure 1-1 Travel Time Routes

Intersection Counts and Queue Length Surveys

The intersection turning movement counts and queue length surveys were undertaken for 2 hours PM (5:00-7:00pm) on Friday and 2 hours PM (5:30-7:30pm) on Saturday using the video survey method for five intersections within the study area on Friday 31st May 2013 and Saturday 1st June 2013. The five intersections were:

- Darling Drive / Pymont Bridge Road / Murrumbidgee Street;
- Darling Drive / Pier Street;
- Darling Drive / Ultimo Road;
- Harbour Street / Pier Street / Goulburn Street; and
- Harbour Street / Liverpool Street.

Figure 1-2 show location of intersection counts and queue length surveys.

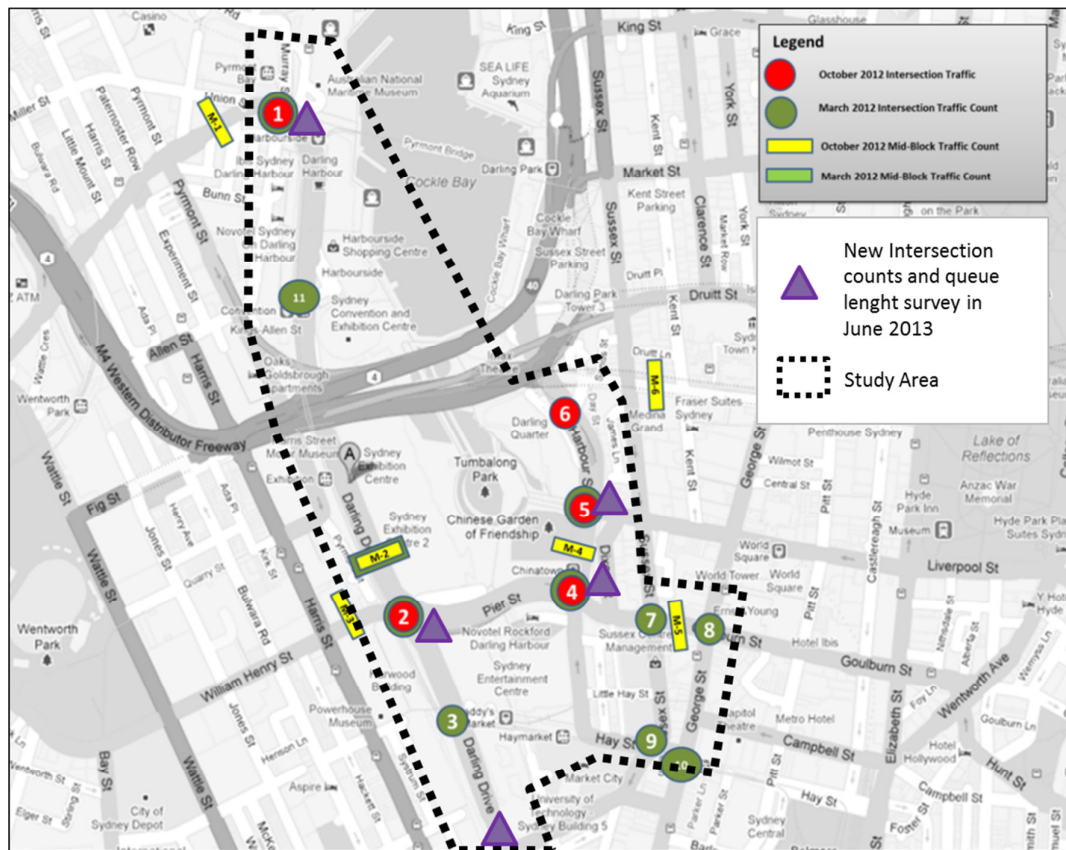


Figure 1-2 New Intersection Counts and Queue Lengths Survey Location

1.3 Model Augmentation

Hyder extended the AIMSUN model incorporating the full length of Darling Drive. The AIMSUN model was extended from Hay Street to Ultimo Road intersection. Figure 1-3 below shows the AIMSUN model study area.

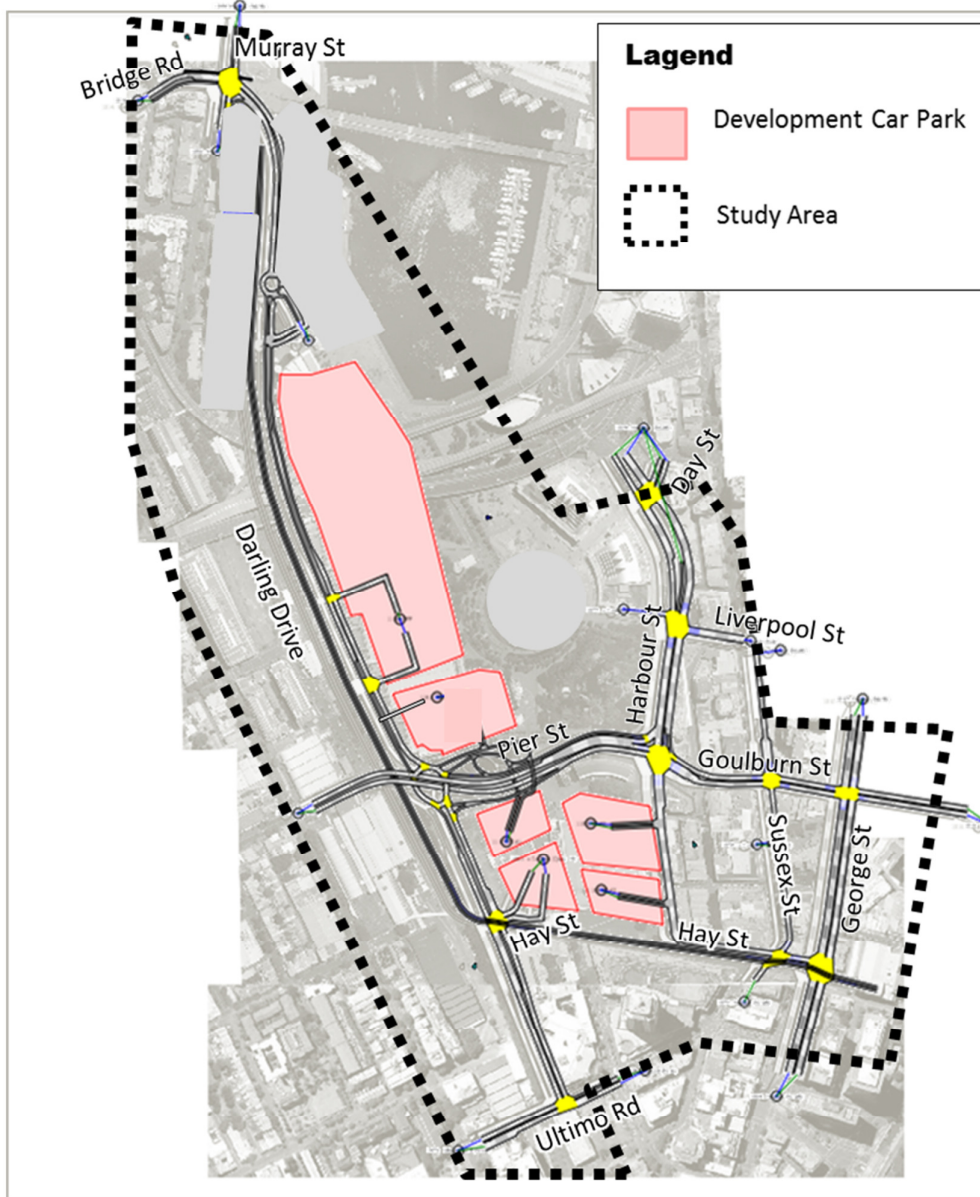


Figure 1-3 AIMSUN Model Study Area

2 Model Calibration and Validation Criteria

The calibration and validation criteria were based on the following sources.

- RMS's Traffic Modelling Guidelines—Version 1.0 issued in February 2013;and
- UK Design Manual for Roads and Bridges (DMRB) issued by the Highways Agency, UK and last amended in November 2009.

Intersection turning volumes and individual link flows were assessed based on the modelling criteria (as per UK DMRB) detailed in Table 2-1.

Table 2-1 Criteria for link flows and intersection turning volumes

Criteria	Target
Difference in flow within 100 vph for flows less than 700 vph	85%
Difference in flow within 15% for flows between 700 and 2700 vph	85%
Difference in flow within 400 vph for flows more than 2700 vph	85%
GEH statistic less than 5	85%
R ² Value (volume comparison)	> 0.95

The following sections provide a summary of the calibration and validation results.

3 Friday PM Peak Model

For the study purpose, Friday PM peak model was developed for weekday condition. The weekday base year model represented 2012/13 traffic conditions.

Traffic demand in AIMSUN model was developed based on intersection turning movement counts data collected in October and March 2012. Hyder previously calibrated AIMSUN model using October and March 2012 intersection counts. Further refinements have been undertaken that improved model calibration.

The June 2013 new counts have been used for model validation purpose.

The following sections document model calibration and validation results.

3.1 Calibration Results

Individual link flows and intersection turning volumes have been assessed based on the criteria adopted for this study. Table 3-1 and Table 3-2 summarise the modelling results for the Friday PM peak (5:30-6:30pm).

The results from Table 3-1 and Table 3-2 demonstrated that Friday PM peak model was calibrated for intersection turn flows and individual link flows as per RMS standards. Figure 3-1 shows a good comparison (R^2 value = 0.97) between observed and modelled intersection turn volumes.

It is therefore concluded that Friday PM peak model has been calibrated as per RMS guidelines. Both intersection turning volumes and link flows in AIMSUN model meet RMS calibration targets.

Table 3-1 Friday PM Peak - Intersection Counts

Model Calibration (intersection turning volumes)			
Total number of turn flows:	65 (11 intersections)		
Number of flows less than 700 vph	49		
Number of flows between 700 and 2700 vph	16		
Number of flows more than 2,700 vph	n/a		
Meet the assessment criteria:	Target	Achieved	Status
Difference in link flow within 100 for flows <700 vph	85%	94%	Pass
Difference in link flow within 15% for flows 700-2,700 vph	85%	88%	Pass
Difference in link flow within 400 for flows >2,700 vph	85%	n/a	Pass
GEH Statistic less than 5 of all individual modelled flow	85%	89%	Pass
R2 Value (volume comparison)	>0.95	0.97	Pass

AIMSUN model code: Hyder SICEEP Aimsun Model_R4_ExistingLink: F:\AA004399\D-Calcs\Traffic Modelling\POST TENDER TRAFFIC STUDY\Modellings\AIMSUN\1-Models\Hyder SICEEP Aimsun Model_R4_Existing

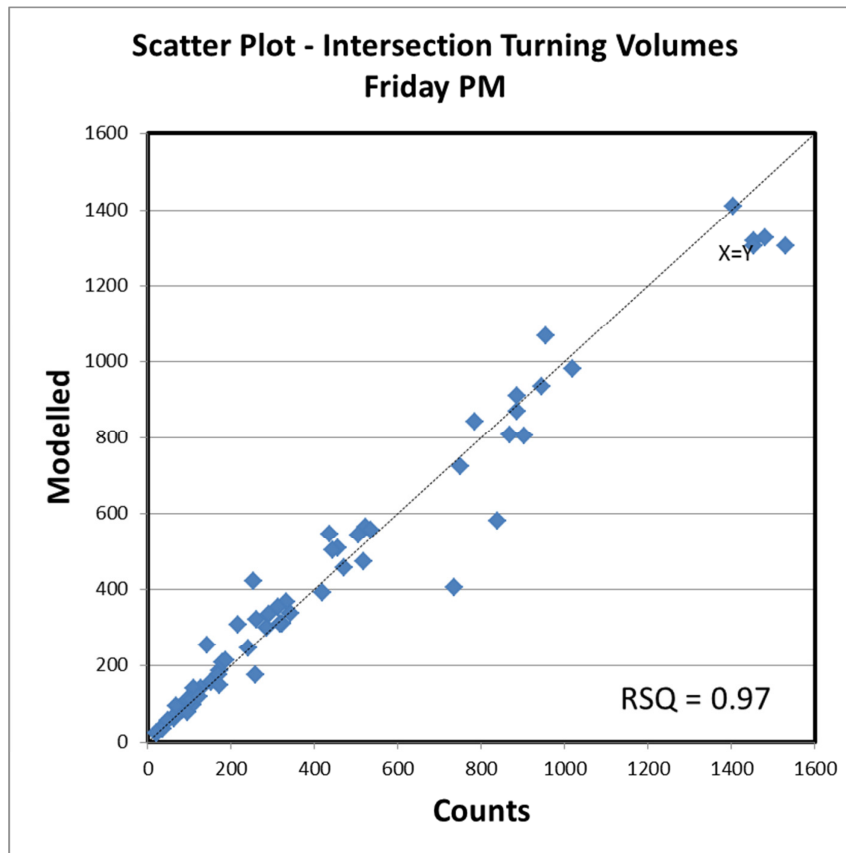


Figure 3-1 Intersection Turning Volume Comparison Saturday PM Peak

Table 3-2 PM Peak - Link Counts

Link Calibration			
Number of individual link flows (by direction):	10		
Number of flows less than 700 vph	3		
Number of flows between 700 and 2700 vph	7		
Number of flows more than 2,700 vph	n/a		
Average link flow	900 veh/h		
Meet the assessment criteria:	Target	Achieved	Status
Difference in link flow within 100 for flows <700 vph	85%	100%	Pass
Difference in link flow within 15% for flows 700-2,700 vph	85%	86%	Pass
Difference in link flow within 400 for flows >2,700 vph	85%	n/a	Pass
GEH Statistic less than 5 of all individual modelled flow	85%	90%	Pass

AIMUSN model code: Hyder SICEEP Aimsun Model_R4_ExistingLink: F:\AA004399\D-Calcs\Traffic Modelling\POST TENDER TRAFFIC STUDY\Modellings\AIMSUN\1-Models\Hyder SICEEP Aimsun Model_R4_Existing

3.2 Model Validation

Model validation has been undertaken using a different set of intersection counts surveyed in June 2013. In conjunction with that model has also been validated for travel time and queue length data collected in June 2013.

Travel Time Comparison

Travel time comparison provides a good indicator that the calibrated modelled accurately reflect delay conditions on major routes in the study area. Friday PM Peak observed and modelled travel times, as cumulative values, were compared for five key travel routes.

Figure 3-2 shows the travel time comparison between modelled and average survey travel time data. In general, the model travel time (shown as red line) followed the same trend with the average survey travel time data.

The comparison results demonstrated that Friday PM peak model was validated adequately against the travel time.

