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Project: Summer Hill Transyt Model

Audit Report

Reference: 227688

Prepared for: Arup Pty Ltd

Revision: 1

30 March 2012

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Document Control Record

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Report Title		Audit Report				
Document ID			**Project Number**		227688	
File Path		Y:\Jobs\227688 Summer Hill Transyt Audit\audit\Summer Hill Transyt Audit.docx				
Client		Arup Pty Ltd	**Client Contact**		Andrew Hulse	
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
0	14 February 2012	Preliminary report	CM	CM	AM	AM
1	30 March 2012	Final report	CM	CM	AM	AM
Current Revision		**1**				

Contents

1. Introduction

Aurecon New Zealand Limited (Aurecon) have been commissioned by Arup Pty Ltd (Arup) to undertaken an independent audit of their TRANSYT modelling of the Old Canterbury Road corridor, in Summer Hill, Sydney.

It is understood that the purpose of the TRANSYT modelling is to assess the effects of a proposed development on the operation of existing and proposed traffic signals along this corridor.

This audit has been undertaken for the following model scenarios:

- Existing AM Peak
- Existing PM Peak
- 2021 Base AM Peak
- 2021 Base PM Peak
- 2021 Proposed AM Peak
- 2021 Proposed PM Peak

It should be noted that the audit undertaken by Aurecon has been based principally on the models and information provided by Arup, and has not attempted to verify the information provided, nor has it given consideration to the appropriateness of the model extent, growth rates (obtained from RMS), the magnitude and distribution of development traffic or any other issues external to the TRANSYT modelling itself.

2. Background

Aurecon's involvement in this project commenced with a review of TRANSYT model files and associated traffic data sent by Arup on 25 January 2012. The findings of this review were presented in a preliminary report dated 14 February 2012, which is attached to this report in Appendix A.

Following this, Arup made modifications to the models, and then issued revised models on 14 March 2012, along with a response to each audit comment. This audit response is provided in Appendix B of this report.

3. Final audit comments

We have now undertaken a review of the revised models, together with Arup's response to the each of the comments made in the preliminary audit. This review has found that the vast majority of issues and concerns identified by the preliminary audit have been satisfactorily resolved.

In fact, the only comments that were considered to warrant further consideration were in relation to the modelling of pedestrian effects at signalised intersections and the balancing of traffic flows between lanes (discussed respectively in Sections 2.9 and 2.3 of the preliminary audit report). Consequently, both of these issues have been discussed further with Arup, in order to obtain a better understanding of the modelling approach taken for these two matters.

With respect to the modelling of pedestrian effects, our preliminary audit identified a concern that the pedestrian crossings at the signalised intersections had not been included within the modelling. In this regard, Arup have subsequently indicated that the level of pedestrians within the model area is low. Despite this, to address the preliminary audit concern, Arup have adjusted the models to include a 2 seconds lag for selected traffic phases, on the basis that these phases would be affected by pedestrians on average one in every four cycles.

We consider that this approach is satisfactory, provided the assumptions on pedestrian demands are correct, both for the existing model and under the future scenarios.

The model area includes several locations where two adjacent traffic lanes both allow through movements. As identified in the preliminary audit, it would typically be expected that the performance of these lanes would be similar, particularly with respect to queuing, whereas in some instances the modelling suggests differing performance. Arup have subsequently indicated that the modelling reflects current on-street behaviour and provided that this is the case, then this is considered satisfactory, although it should be recognised that some measure of rebalancing may occur in the future scenarios.

The effect of any rebalancing would be to bring the performance of the two lanes closer together, but perhaps more critically, would improve the performance of the worst performing lane. For this reason, together with Arup's comments on existing observed behaviour as mentioned above, this issue is not considered significant.

On balance, neither of the two issues identified above are considered to be significant in this instance. Consequently, it is therefore concluded that the revised models are fit for purpose.

4. Summary and conclusions

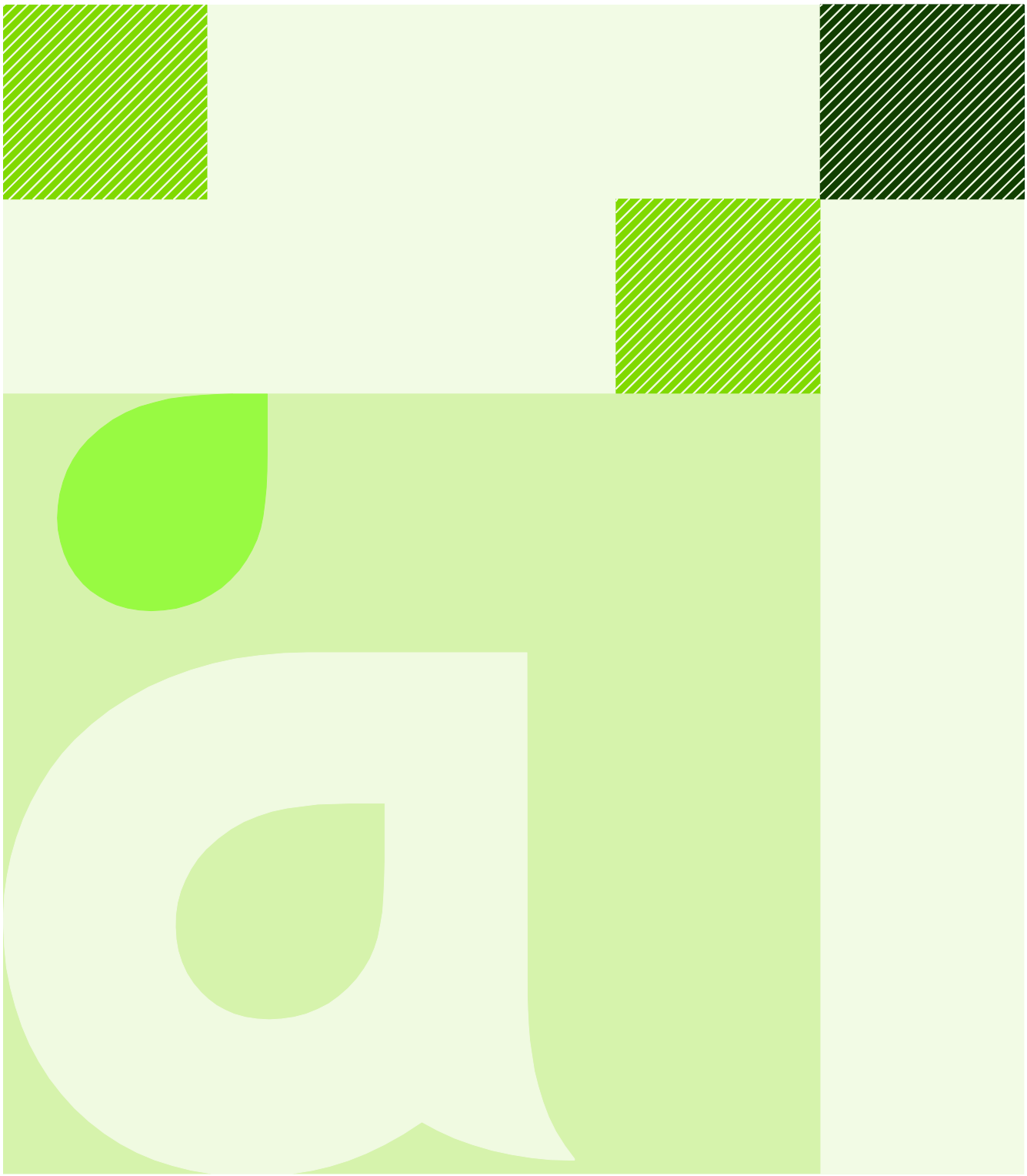
This report provides a summary of the audit process and findings from an audit of TRANSYT modelling for the Old Canterbury Road corridor in Summer Hill, Sydney.

As identified above, the preliminary audit identified a number of issues and concerns with the modelling. Subsequently, Arup have revised these models and also provided further discussion and justification of the modelling approach adopted.

Our review of these revised models has found that the vast majority of the issues and concerns identified within the preliminary report have been satisfactorily resolved. Two issues were considered to warrant further consideration, and have been discussed further with Arup, and it has consequently been concluded that neither issue is significant.

Overall, it is therefore our conclusion that the Summer Hill TRANSYT models are now considered to be satisfactory and fit for purpose.

Appendix A
Preliminary audit report



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0	14 February 2012	Preliminary report	CM	CM	AM	AM
Current Revision		**0**				

Contents

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1. Introduction

1.1 Overview

Aurecon New Zealand Limited (Aurecon) have been commissioned by Arup Pty Ltd (Arup) to undertaken an independent audit of their TRANSYT modelling of the Old Canterbury Road corridor, in Summer Hill, Sydney.

It is understood that the purpose of the TRANSYT modelling is to assess the effects of a proposed development on the operation of existing and proposed traffic signals along this corridor.

This report summarises the findings of the model audit, and in particular identifies any errors, deficiencies or other issues with the modelling. In each instance, the report also provides suggestions for addressing these comments.

This audit has been undertaken for the following model scenarios:

- Existing AM Peak
- Existing PM Peak
- 2021 Base AM Peak
- 2021 Base PM Peak
- 2021 Proposed AM Peak
- 2021 Proposed PM Peak

In addition to model files for each of the above scenarios, Arup has also provided further information relating to the development of the models, including traffic volumes, signal timings and phase arrangements, and model results. The audit undertaken by Aurecon has been based principally on the models and information provided by Arup, and has not attempted to verify the information provided, nor has it given consideration to the appropriateness of the model extent, growth rates (obtained from RMS), the magnitude and distribution of development traffic or any other issues external to the TRANSYT modelling itself.

Finally, it should be recognised that the following report only highlights issues which are considered to potentially warrant alterations to the modelling. As such it does not specifically comment on the aspects of the modelling which were reviewed and found to be correct and appropriate.

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1.2 Audit report convention

Throughout the report, paragraph formatting has been used to assist in reading the review. There are four levels of formatting, each colour coded provided to indicate the significant of the suggested model changes. This colour coding is as follows:

Low: This style of paragraph is a suggested "good practice" tip and is not critical to the model operation or results

Median: This style of paragraph suggests a desirable alteration that may improve the model operation or results, it is however not essential.

High: This style of paragraph is a strong recommendation to correct or amend the discussed element or provide further justification for not changing the element.

Critical: This style of paragraph identifies an element that is critical to the model that effects model operation and the results and requires alteration.

1.3 Audit report structure

This report is subdivided into the following chapters:

- Chapter 2 identifies any issues or concerns with the existing models
- Chapter 3 identifies any issues or concerns with the 2021 base models that have not already been discussed for the existing models
- Chapter 4 identifies any issues or concerns with the 2021 proposed models that have not already been discussed for either the existing or 2021 base models
- Finally, Chapter 5 summarises the findings and conclusions of this model audit.

DRAFT

2. Existing Models

2.1 Model setup

Comments

It is noted that the Platoon Dispersion Model (PDM) has been applied to the PM existing model, while the Cell Transmission Model (CTM) is applied to the AM existing model.

Given the characteristics of the model area, it is considered that there are some advantages to using each of the above modelling methods. The distance between signalised intersections means that some platooning could be expected (this effect only being modelled using PDM), while some blocking back also occurs (which is only modelled using CTM).

Presumably, as the modelling indicated queuing back as only occurring during the AM peak, this was the justification for using CTM for the AM model, while PDM was retained for the PM model to enable allowance for platooning. While for each model in itself this is considered to be an acceptable approach, these is a potential concern that comparisons between the two time periods would not be entirely consistent given the alternative model methods used.

This issue of consistency is perhaps more significant when comparing scenarios, and in this regard, further comments on this issue are provided in Section 4.1 of this report.

Suggestions

Median: Consider whether the same model method (suggest CTM) should be used for both time periods to ensure consistent results.

2.2 Link and node structure

Comments

Generally, the link and node structure for the existing models is considered to be reasonable. The exception to this is the modelling of Links 121 and 122, which have been modelled as giveway and bottleneck links respectively, but should be modelled as signalised links. This would reflect their on-street operation and would also allow pedestrians to be taken into account (this topic is discussed further in Section 2.9).

It is also noted that a number of priority intersections along Old Canterbury Road (within the model extent) have not been included within the modelling, although additional traffic flow has been added and removed (via Links Dumm1 and b1) to account for traffic from these intersections. Assuming that the key purpose of this modelling is to evaluation the operation of the existing and proposed signalised intersections, these minor priority intersections are not likely be significant, and therefore their exclusion is not considered to be an issue in this instance.

Suggestions

High: Alter Links 121 and 122 to signalised links.

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2.3 Traffic flows

Comments

The traffic flows developed for the existing models (as shown in the provided information) are based on traffic surveys undertaken primarily in June 2010, with some minor modifications to ensure flows are balanced through the network. This balancing generally appears reasonable, with one exception in the PM period, where significant additional traffic flow (469 pcu's) has been added to the left turn on the Old Canterbury east approach to the intersection with Nowraine Street/ Junction Road (Link 122). The scale of additional traffic required to achieve balanced flows suggests a more fundamental issue with the traffic data, for example either the date of the survey for this intersection (February 2011) was inappropriate or that the added traffic is actually using Windsor Road rather than heading further west to Link 122. The scale of this additional traffic is significant in terms of the effect on model results and requires further consideration.

Notwithstanding the comment above, the modelled traffic flows are considered to correctly match the balanced traffic flows as presented in the information provided. However there are several instances where two separate links accommodate a common traffic movement, which requires the traffic flow to be manually split between each link. In a number of such instances the modelled performance of these two links (in terms of DOS and queues) is substantially different, indicating that the allocation of traffic to each link is not correct. In practice, where multiple lane options are available, vehicles will typically use the best performing lane, which results in more equal lane performance.

Examples of links where this appears to be an issue as listed as follows:

- Links 341 and 342
- Links 431 and 432
- Links 441 and 442

Suggestions

High: Give further consideration to whether it is appropriate to add 469 pcu's to Link 122 to achieve balanced flows.

Adjust flow allocation to achieved balanced performance for each pair of links identified in the list above.

2.4 Link lengths

Comments

There are two instances where pairs of links are not the same lengths, listed as follows:

- Links 41ex and 41ex2, which are modelled as 40m and 100m respectively
- Links 42ex and 42ex2 (or named Links 422 and 423 in the AM model), which are modelled as 40m and 100m respectively

Other than the issues identified above, we have reviewed the lengths of the modelled links against available aerial images, and confirm that they appear reasonable.

Suggestions

High: Ensure that the length of the link pairs identified is correctly modelled.

DRAFT

2.5 Cruise speeds

Comments

Ideally cruise times should be surveyed and used within the modelling, however it is common industry practice for cruise speeds to be used, as has been done in the models provided.

It is noted that cruise speeds have been uniformly set at 50km/h, which is considered appropriate given the characteristics of the modelled area. However the cruise speed for Link Connector ex22 has been set at 30km/h, presumably because of the tighter turn for this movement. While this is not a concern in itself, it has been noted that the 30km/h speed parameter has not been applied across all model time periods and scenarios which is inconsistent.

Suggestions

Low: Either adjust Link Connector ex22 cruise speeds to 50km/h or ensure that the 30km/h speed for this connector is applied consistently across all model periods and options.

2.6 Saturation flows

Comments

The method used to Arup to derivate the modelled saturation flows has not been included within the information provided for this audit, however it appears that the modelled saturation flows reflect recommended saturation flows as provided by Austroads guidelines. While measured values would generally be preferable, the use of Austroads based values is considered to be an appropriate and reasonable alternative.

Assuming that the AUSTROADS guidelines have been used, the modelled links appear to have saturation flows reflecting a 'Class A' environment (ideal or nearly ideal conditions), although a number of links have been modelled with what is equivalent to lower (average conditions) 'Class B' saturation flows. Again, the justification for using Class B saturation rates is not provided, although it is assumed that it may be a result of the tighter intersection geometry.

While the above assumptions do not appear unreasonable, given the significant influence that saturation flows have on modelling results, it is considered that it would be appropriate for additional information be provided to justify the methodology and values used, to ensure that they are reasonable and reflect observed conditions.

In addition to the above comments it is also noted that an inconsistent saturation flow has been applied to Link 12ex (3700 and 1850pcu/hr for AM and PM models respectively).

Suggestions

High: Confirmation should be provided of the method used to derive the modelled saturation flows, and justification of the 'class environments' applied if the AUSTROADS guidelines have been adopted.

Apply a consistent saturation flow to Link 12ex.

DRAFT

2.7 Bus modelling

Comments

Buses have not been explicitly modelled with the existing models, however given the level of bus activity along this route, and the model purpose it is our opinion that separate links are not necessary in this instance.

Suggestions

No modifications required.

2.8 Giveway data

Comments

There are a small number of instances where the giveway parameters do not appear to match values recommended by TRL. These instances are listed below:

- Modelled Link 211 giveway max flow is 700 (rather than recommended value of 715 for a left turn from a minor road)
- Modelled Links 231 and 211b giveway max flow is 700 (rather than recommended value of 600 for a right turn from a minor road)
- Modelled Link 231b giveway coefficient is 0.29 (rather than recommended value of 0.22 for a left turn from a minor road)
- Modelled Link 211b has no slope coefficient for opposed movement 221 (AM model only)

It is considered that this issue is unlikely to have a significant impact on the operation of the model, particularly given the primary concern of the modelling is the operation of the traffic signals, however these parameters are easy enough to adjust and could be done for completeness.

Suggestions

Low: Reconsider the giveway parameters identified in the list above.

2.9 Phase structure and sequences

Comments

The phase structure applied to the modelling does not appear to make any allowance for pedestrian crossings at the signals. Unless the pedestrian demands at this location are insignificant, then time should be allocated to pedestrian movements, otherwise it could be considered that the traffic capacity is overestimated.

As this could have a significant impact on model results, it is considered that further consideration of pedestrian modelling is warranted.

Other than issues relating to pedestrian movements, the modelled phasing structure is considered to reflect observed phasing (as presented in the provided information).

Suggestions

Critical: Ensure that pedestrians are appropriately accounted for within the modelling.

DRAFT

2.10 Green times

Comments

The allocated green times within the existing models do not appear to match the green times observed on-site (as presented in the provided information). The green times for the existing models should reflect the existing operation, and the modelling should be amended to match on-street observations or operational signal data.

Suggestions

Critical: Ensure that the modelled green times reflect observed on-street operation.

2.11 Calibration and validation data

Comments

While the modelling parameters adopted are generally reflective of standard industry values, we are concerned that little on-site data has been obtained and reviewed to assess whether the models are actually representative of the specific location being modelled. Such measured on-site data would enable greater confidence to be placed on the model operation and confirm that the model is sufficiently calibrated.

For example, no saturation flows and cruise speeds have not been measured, while comparison of modelled and surveyed queues or journey times has also not been undertaken.

Suggestions

High: Consider the modelled performance of the network against observed behaviour on-site, and provide further justification or calibration data as considered appropriate.

2.12 Results

Comments

The information provided by Arup includes a summary of results from the modelling. This summary includes the key model outputs that would typically be expected from TRANSYT modelling, although it may be helpful to also provide results for Links 431 and 442.

It is noted that there are several links which are shown as operating with a Degree of Saturation (DOS) of over 90% under the existing modelling, primarily at the Old Canterbury Road/ Railway Terrace intersection and also Link 341 during the AM peak. Such results suggest that key inputs for these links may not be correct (most likely either the saturation flow and/or phase time). Additional consideration of the key inputs for these links may therefore be warranted.

Suggestions

High: Give further consideration to key parameters for links with DOS greater than 90%.

Low: Consider providing results for Links 431 and 442, in addition to results previously presented.

DRAFT

3. 2021 Base Models

This chapter of the report summarises issues which have been identified with the 2021 base models. In this regard, it should be noted that it does not include issues which relate to both the existing and base models, and which have been identified in the previous section of this report, although whether appropriate it would be anticipated that corrections be carried through both model scenarios.

3.1 Model setup

Comments

It is noted that the Platoon Dispersion Model (PDM) has been applied to the PM 2021 base model, while the Cell Transmission Model (CTM) is applied to the AM 2021 base model. As identified in Section 2.1, there is a concern that the use of alternative model methods may have implications when comparing results across the two model periods.

Suggestions

Median: Consider whether the same model method (suggest CTM) should be used for both time periods to ensure consistent results.

3.2 Link structure and saturation flows

Comments

Link 44ex has not been connected to the next downstream link in the PM 2021 base model. This link also has an inappropriately high saturation flow.

Suggestions

Critical: Address identified issues with Link 44ex.

3.3 Traffic flows

Comments

The modelled 2021 base flows in most instances match those presented in the information provided (which have been developed by growthing up the surveyed counts based on growth rates we understand are provided by the NSW Roads and Maritime Services).

However a couple of links appear to have incorrect traffic flows for the AM period. These links are identified as follows:

- Link 111 (which should be 924 pcu/hr rather than 945 pcu/hr)
- Link 241, and its link connector from Link 12ex (which should be modelled as 1,318 pcu/hr and 1230pcu/hr respectively)

Suggestions

Suggestions

High: Correct traffic flows identified above.

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3.4 Green times

Comments

The information provided indicates that the existing green times for each phase have also been applied to the 2021 base model. However consideration is warranted as to whether it would be more appropriate to optimise the offsets and green splits as has been done to the proposed models, as this would perhaps allow a more appropriate comparison as to the impact of flow changes resulting from the proposed development.

Suggestions

High: Consider where the modelled 2021 base green times should be optimised as per the proposed models, to ensure appropriate comparison.

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4. 2021 Proposed Models

This chapter of the report summarises issues which have been identified with the 2021 proposed models. In this regard, it should be noted that it does not include issues which also relate to either the existing and base models, and which have been identified previously, although whether appropriate it would be anticipated that corrections be carried through all model scenarios.

4.1 Model setup

Comments

It is noted that the Cell Transmission Model (CTM) has been applied to both time periods for the 2021 proposed models. For the PM time period this is in contrast to the existing and base scenarios, for which the PDM was used.

It is considered that there is risk that this change in model type will have implications when making comparison between each model scenario i.e. differences in results between scenarios may partially be a result of the change in model type rather than actual demand/network changes.

Suggestions

Median: Consider whether the same model method should be used for each time period to ensure consistent results.

4.2 Traffic flows

Comments

The basis for developing the traffic flows associated with the proposed development have either been provided or reviewed. The modelled traffic flows have however been reviewed against the proposed traffic flows presented in the information provided, and have been found to be correct, with the exception of Link 241 during the PM period, which has been incorrectly coded with a flow of 1342 pcu/hr (and should instead be 786 pcu/hr).

This flow difference is significant and will impact on the performance of both this approach, and the intersection generally (since it has been optimised), and should be correctly accordingly.

Suggestions

Critical: Correct the traffic flow on Link 241 during the PM period.

4.3 Link lengths

Comments

A couple of links have been identified as having differing link lengths from previous model scenarios, which cannot be accounted from proposed network changes (as listed in information provided). These particular links are identified as follows:

- Link 122 is modelled as 100m (but was 80m in previous modelling).
- Overall length for Links 22ex and 341 (and 342) is 260m (previously 240m)

Suggestions

High: Adjust intergreens to appropriate values, and add additional phase if required.

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4.4 Intergreens

Comments

It is noted that the intergreens used for the Old Canterbury Road/ Toothill Street intersection are significantly different that those applied to the existing and 2021 base models. In particular there are a number of intergreens, which at 38 to 44 seconds, are significantly in excess of appropriate values. It is possible that this has been done to effectively include an additional phase, however this is not considered an acceptable approach.

Suggestions

High: Adjust intergreens to appropriate values, and add additional phase if required.

DRAFT

5. Summary and conclusions

This report provides a summary of the findings from an audit of TRANSYT modelling for the Old Canterbury Road corridor in Summer Hill, Sydney.

The audit of the existing modelling has identified a number of critical and highly significant issues should be addressed. In particular some fundamental and critical issues relating to the satisfactory operation of these models include the following:

- The existing models do not take into account the pedestrian crossings at the signals.
- The green times for each phase do not appear to appropriate match the timings observed on-site and should be adjusted to reflect actual on-street operation.

In this regard, as a minimum, it is considered that all issues identified as critical (in red) or high (in blue) should be resolved before the existing models are considered fit for purpose.

A number of further issues have also been identified with the base and proposed models, and again we recommend that at least all issues categorised as critical or high should be addressed. In addition, some of the amendments required for the existing models will also need to be carried through to the base and option modelling.

Overall, and as identified elsewhere in this report, there are a number of issues that will need to be resolved before the Summer Hill TRANSYT models can be are considered sufficiently robust and fit for purpose.

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Appendix B
Arup response summary

ARUP	Job No.	Sheet No.	Rev.
	220640-00	1	A
	Member/Location		
Job Title: Summer Hill Flour Mill	Drg. Ref.		
Calculation	Made by: CJ	Date: 14/03/2012	Chd.: CJ

Section	Suggestion	Response
Existing Models		
2.1	Consider whether the same model method (suggest CTM) should be used for both time periods to ensure consistent results	Models changed to CTM for both periods
2.2	Alter links 121 and 122 to signalised links	Both links changed as suggested
2.3	Give further consideration to whether it is appropriate to add 469 pcu's to link 122 to achieve balanced flows. Adjust flow allocation to achieve balanced performance for each pair of links identified in the list above.	Windsor Road is likely to be attracting quite a bit of traffic. It connects through to other key roads and has been traffic calmed indicating it has through traffic. We have remove this balance on this basis so the model inputs reflect surveyed data. Flow allocation has been changed on suggested links to achieve a closer queue between lanes.
2.4	Ensure that the length of the link pairs identfied is correctly modelled.	Link lengths changes as noted.
2.5	Either adjust link connector 22ex cruise speeds to 50km/h or ensure that the 30km/h speed for this connector is applied consistently across all model periods and options.	All link cruise speeds and connectors changed to 50km/h
2.6	Confirmation should be provided of the method used to derive the modelled saturation flows, and justification of the class environments applied if the AUSTROADS guidelines have been adopted. Apply a consistent saturation flow to Link 12ex.	AUSTROADS guidelines have been adopted. All roads have been adopted as class A with limited pedestrians and nearly ideal conditions except for Nowraine Street and Toothill Street which have been allocated class B due to these roads being in a low speed residential area with on street parking with zebra crossings on Toothill Street. Edward Street and Weston Street have also been allocated class B in the proposed signalised scenario due to the same reasons. Link 12ex has been updated to be consistent in all scenarios.
2.8	Reconsider the giveway parameters indentified in the list above.	All links changed as recommended.
2.9	Ensure that pedestrians are appropriately accounted for within the modelling.	A 2s start lag has been applied to turning movements that interface with pedestrian movements for every cycle. This is deemed to be appropriate given that pedestrian numbers were observed to be very low and not observed in every cycle.

2.10	Ensure that the modelled green times reflect observed on street operation.	The green times have been modified to be more similar to the site surveys however given only a few cycles were observed on a different day to when the traffic counts were done - at some locations average green times may be different to what was observed however they were only changed if results produced delays and queues that were not observed and unrealistic. A level of optimisation has been applied at certain intersections as SCATS does hence modelled green times are expected to be within the SCATS possible range of green times in the peak hours.
2.11	Consider the modelled performance of the network against observed behaviour on-site, and provide further justificatin or calibration data as considered appropriate.	The models have been calibrated against observed queues on site and compares well and is deemed fit for purpose. Refer to report for observed queues.
2.12	Give further consideration to key parameters for links with DOS greater than 90%. Consider providing results for links 431 and 442 in addition to results previously presented.	Based on observation, it is expected several links have a DOS greater than 90%. Links 431 and 442 provided in results.
2021 Base Models		
3.1	Consider whether the same model method (suggest CTM) should be used for both time periods to ensure consistent results	Models changed to CTM for both periods
3.2	Address issues identified with Link 44ex	Corrected
3.3	Correct traffic flows identified above	Corrected
3.4	Consider where the modelled 2021 Base green times should be optimised as per the proposed models, to ensure appropriate comparison.	2021 base models have been optimised.
2021 Base Models		
4.1	Consider whether the same model method (suggest CTM) should be used for both time periods to ensure consistent results	Models changed to CTM for both periods
4.2	Correct the traffic flow on link 241 during the PM peak period.	Corrected
4.3	Adjust link lengths above	Corrected
4.4	Adjust intergreens to appropriate values and add additional phase if required.	Intergreens adjusted and additional phases added.

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