

TECHNICAL NOTEProject: **EFW CHP, NORTH YARD, DEVONPORT**

Job No: PCC018

SUBJECT: **Audit of LinSig Traffic Modelling Work**

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1. Introduction

This note has been prepared to briefly summarise the findings of a technical audit of the LinSig traffic modelling work included within the Transport Assessment (TA) report submitted by URS Scott Wilson to Plymouth City Council (PCC) in May 2011. This audit relates to the junctions located on the Local Highway Network only.

2. Flow Input to LinSig models

The models have been cross-checked against the flow diagrams included in the TA. The model flows match those given in the TA report (allowing for conversion of vehicles to PCU values).

3. Calibration / Validation of models

Paragraph 5.1.7 in the TA states that signal timings for each junction were output from the junction controllers. However, the latest note submitted to PCC from URS Scott Wilson (*in response to PCC's request to amend the observed baseline model cycle time of the A3064 Weston Mill Drive / Wolseley Rd Junction to 100 seconds in the AM peak and 96 seconds in the PM peak*) establishes that the PRC optimiser in LinSig was used instead to generate signal timings for the observed baseline models.

The method of control at Weston Mill Drive / Wolseley Rd Junction is understood to be SCOOT-UTC, but due to operational issues with the adjacent Carlton Terrace junction, it is generally operated on fixed time plans. Therefore, as there is timing information available, it is recommended that, for validation purposes and following best practice, the baseline observed model should use the plan data for the time of the survey, or at least provide a cross-check that the LinSig optimised timings correlate well to the observed timings.

The summary tables contained in the note from URS Scott Wilson illustrate that the modelled queues are generally of same order to the observed queues, albeit slightly overestimated.

It is typical for queue surveys to record the 'end of red' queues which are not the same as the 'mean maximum queues' reported by LinSig and this may be the reason why the modelled queues are generally more than the observed queues. If the queue survey recorded end of red queues then the equivalent data should be extracted from the model output for comparative purposes rather than quoting the mean maximum queues.

There are a few queue anomalies (e.g. on Weston Mill Drive approach) and it is recommended to consider the reasons for their occurrence in case the model is in error. This is especially important as the queue survey was undertaken concurrently with the manual classified count and therefore the model should match quite well. For example, on the Weston Mill Drive Ahead/Right approach the model predicts 6.4 PCU queue versus 2.5 PCU as surveyed. Likewise, in the PM peak the model predicts 2.5 PCU modelled versus 3.7 PCU observed.

Possibly a typo, but the performance summary tables illustrate maximum Degree of Saturation rather than the junction Practical Reserve Capacity (PRC) values.

4. Commentary on LinSig model for B3396 Saltash Rd / A3064 Wolseley Rd Junction

The LinSig v.3 model has been reviewed and the model detail seems broadly reasonable in terms of structure. **The model has been cross-checked to the PCC controller specification and is correct.** However, there are a few comments relating to model detail which are as follows:

- a. The saturation flows used in the model are estimated and are based on geometry – the values generated by the model seem quite high with some values over 2000 pcu/hr per lane. This includes several turning movements such as the right turn from Saltash Road. The values should be justified and it is recommended that measured values are used wherever possible as this is an existing junction.
- b. The lane markings on Saltash Road are such that the offside left turn lane (Arm 3 Lane 2) is fed from the right turning lane (Arm 3 Lane 3) and not the nearside left turn lane (Arm 3 Lane 1). This is likely to lead to a slight overestimate of junction capacity.
- c. The left turn give way on Wolseley Road South (Arm 7 lane 1) is set to 1400 pcu/hr which is considered high for a single left turn lane on give way. Suggest 1000 pcu/hr and a lower coefficient of 0.5. This lane is not critical in terms of capacity however.

- d. The capacity results in the TA are showing an overall improvement in junction PRC between the 2011 Baseline and the 2014 Do Minimum scenario, even with the addition of traffic growth. Similarly, this improvement occurs between the 2014 Do Minimum and 2014 'with development' scenario in the PM peak? Please confirm.

5. Commentary on LinSig model for A3064 Weston Mill Drive / Wolseley Rd Junction

The LinSig v.3 model has been reviewed and the model detail seems broadly reasonable in terms of structure. **The model has been cross-checked to the PCC controller specification and is correct.** However, there are a few comments relating to model detail which are as follows:

- a. The saturation flows used in the model are estimated and based on geometry - there are some quite high values over 2000 pcu/hr per lane, for example the right turning traffic on Wolseley Road south. The values should be justified and it is recommended that measured values are used wherever possible as this is an existing junction.
- b. The left turn give way capacities on Wolseley Rd south (Arm 3 Lane 1), Wolseley Rd north (Arm 1 Lane 1) and Dockyard approach (Arm 9 Lane 1) are all set to 1400 pcu/hr which is considered high for a left turn lane on give way. Suggest 1000 pcu/hr and a coefficient of 0.5.
- c. In practice, traffic queuing on Wolseley Rd north (Arm 1 Lane 2) will cut off give way Lane 1 before 2 pcu is reached – suggest reducing Lane 1 to 1.5 pcu.
- d. Dockyard approach (Arm 4 Lane 4) is modelled as an infinitely long lane although it is only 16 pcu long. Recommend changing to a short lane for completeness. (minor comment, there is a short green given to this approach so this change is unlikely to affect the results)
- e. The modelling assumes equal use of the right turn lanes on Wolseley Rd south (Arm 3 lane 3 and Arm 3 lane 4) – can this be justified from the classified count data? Table 5.2 in the TA report does not provide the observed queue figure for the offside right turn lane to check against the observed baseline model output.
- f. Based on the flow demands, it is recommended (for completeness) to change Wolseley Road north (Arm 1 Lane 3) to a long lane and Lane 4 the short lane.
- g. Were there **any phase delays in the controller specification** and if so, have they been used in the model?
- h. The model assumes that pedestrian phase J on the Weston Mill Drive exit is not called in either the AM or PM peaks – any evidence to demonstrate that this is the case?
- i. The stage sequence in the AM peak is different to the PM peak – i.e. **stage 4 and 5 are swapped around**. Please confirm.

6. Commentary on LinSig model for A3064 Weston Mill Drive / Carlton Terrace Junction

The LinSig v.3 model has been reviewed and the model detail seems broadly reasonable in terms of structure. **The model has been cross-checked to the PCC controller specification and is correct.** However, there are a few comments relating to model detail which are as follows:

- a. Weston Mill Drive south-west approach (Arm 4) is modelled as two full lanes, however, there is a 2 into 1 lane merge just to the north of the junction, and hence in the PM peak a full two lane saturation flow is unlikely to be maintained given the long green time. It is recommended to model Arm 4 lane 2 as a flared lane of 13 pcu to allow for the funnelling effect.
- b. Weston Mill Drive north-east approach (Arm 2) is also modelled as two full lanes, although the second lane is only about 15 pcu in length. It is recommended to check the model to ensure that the flared lane does not empty out, particularly in the AM peak with the long green time.
- c. During the PM peak the modelled queue lengths would suggest interference with the operation of the adjacent Wolseley Rd / Weston Mill Drive junction, which is located 120m away. It is recommended that, although these junctions may not be linked on-street, the interaction of the two junctions is fully considered, ideally combining both into one model. As it stands, the model does not allow for any platooned arrival of traffic.
- d. The stage sequence calls stage 1 twice in the sequence in the PM peak – please confirm the source information.
- e. The capacity results are showing an overall improvement in junction PRC between the 2014 Baseline and the 2014 ‘with development’ scenario, in the PM peak? Please confirm.
- f. The cycle time in the 2014 scenarios has been reduced from 100 seconds to 55 seconds in the AM peak, and increased from 96 seconds to 120 seconds in the PM peak. As per existing arrangements, the cycle time of this junction would need to match the adjacent Wolseley Rd / Weston Mill Drive junction for best co-ordination. This is currently not met by the modelling work.
- g. The reserve capacity in the 2014 PM scenarios is less than zero, even with an increase in cycle time from 96 seconds to 120 seconds. The longer 120 second cycle time would lead to longer queues (as evidenced in the tables), and hence increased interaction with adjacent junctions – this should be addressed.

7. Commentary on LinSig model for A3064 Weston Mill Drive / Wolseley Rd/ Site Access Junction

The LinSig v.3 model has been reviewed and the model detail seems broadly reasonable in terms of structure. However, there are a few comments relating to model detail at the site access junction which are as follows:

- a. The Dockyard approach from the west (Arm 2) is modelled as two full lanes, although there is a roundabout set back about 7 PCU from the junctions, so that full two-lane saturation flow is unlikely to be maintained. Suggest flared lanes on Arm 2.
- b. There are two full lanes for Arm 2 plus a third flare lane input to the model. However Figure 6.5 (or drawing PA19A) shows only two lanes? Please confirm.
- c. The inter-green from phase Q to phase R is 6 seconds, but as the Dockyard approach (Arm 2) is set back some way from the site access, this may not be enough - please check and confirm this meets standard.
- d. The 2014 PM peak with development scenario illustrates that the expected queue on Arm 4 at the main junction would tail back across the site access junction. The model does not take this blocking into account at the site access junction in terms of capacities.

8. Conclusions

The above review has identified that, in general, the submitted LinSig traffic models provide a broadly reasonable interpretation of the current operation and performance of the junctions on the Local Highway Network. There are, however some changes to the model detail required and the validation and calibration should be reviewed especially as the interaction of the junctions with each other is known to influence the method of control operated at these junctions. The issues may materially affect the results as presented.

It is therefore recommended that the TA should accommodate or address the above comments, to include changes and/or further justifications as necessary.