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Upper Gungate PBA TA Review
Staffordshire

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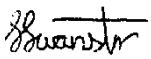
Signature:		

Previous Revisions
None

0.0 Executive Summary

In August 2014 JCT were commissioned to examine a Transport Assessment Addendum (TAA) (Ref : 286-5501) produced by Peter Brett Associates LLP (PBA) on behalf of Barwood Strategic Land II LLP. The TAA asserts that the Upper Gungate corridor will accommodate additional traffic generated by a proposed residential development of land north of Ashby Road. JCT were instructed to examine all elements of the TAA which related to modelling of the junctions and the network, to conduct an audit of the models produced in support of the TAA and to comment on any proposed design changes in respect of the practicality of operation and safety.

JCT identified a number of issues with the proposed design changes which may compromise the operation of some of the junctions and raise safety concerns. These include:

- Changes to the proposed traffic signal stage timings at the Ashby Road / Comberford Road junction which will present a significant number of southbound vehicles with a red signal at the proposed pedestrian facility, increasing the likelihood of vehicular pedestrian conflict and potentially causing block back in the junction.

- Changes to the phase delays at the Upper Gungate / Salters Lane / Offadrive junction which may result in southbound vehicles blocking the junction and cause operational problems.

JCT also identified a number of potential anomalies and possible errors with the models which cast doubt on the validity of the model outputs. These include:

- The use of intergreen timings in the models which do not reflect the existing controller specifications or the intergreens in the JCT proposed models

- The use of the Congested Platoon Dispersion Model on a non-flared lane, which underestimates the effect of blocking

- An assumption of flare usage at the Gungate / Salters Lane / Offadrive junction which are not consistent with site observations

- Assumptions about the frequency of demand dependant stages which are not consistent with site observations

- Modelling of some flare lengths which are not consistent with the current or proposed highway design

- Modelling of a phase and stage structure at the Aldergate / Lichfield junction which does not reflect the existing controller specification or the JCT proposed models

It is the conclusion of this report that with the lack of supporting information on design changes and the significant potential errors identified in the modelling it is not possible to have confidence in the results and the assertions made in the Transport Assessment Addendum.

1.0 Introduction

JCT Consultancy were commissioned by Staffordshire County Council in 2012 to undertake a study of the Upper Gungate/Aldergate Corridor. The area studied consists of sections of the A513 and B5493 from the Ashby Road/Comberford Road/Upper Gungate junction (Fountains junction) to the Lichfield Street/Silver Street/Church Street/Aldergate junction in Tamworth, Staffordshire.

JCT Consultancy were tasked with:

i) Producing calibrated and validated LinSig models that reproduce existing travelling conditions along this corridor at the times of peak demand.

ii) Identifying improvements to maximise the capacity of this corridor at peak times allowing a quantity of development to be delivered whilst still giving an acceptable level of service to all road users.

ii) Testing the model of an improved corridor to establish what level of extra traffic can be accommodated whilst maintaining an acceptable level of service.

JCTs outputs in this respect consisted of two technical notes **TN120028.1** and **TN120028.2** along with LinSig models of the individual junctions and the network.

JCT were subsequently commissioned by Staffordshire County Council to examine a Transport Assessment Addendum (TAA) (Ref: 286-5501) produced by Peter Brett Associates LLP (PBA) on behalf of Barwood Strategic Land ll LLP and submitted to Staffordshire County Council on the 12th August 2014. The PBA Transport Assessment Addendum concludes that the junctions on the Upper Gungate corridor will accommodate additional traffic generated by a proposed residential development of land north of Ashby Road.

2.0 Brief

JCT's brief was:

- To examine all elements of the Transport Assessment Addendum which related to modelling of the junctions and the network
- To conduct an audit of the models produced in support of the Transport Assessment Addendum
- To comment on any proposed design changes in respect to the practicality of operation and safety

Note:

Examination of the trip generation and traffic distributions figures did not form part of the JCT brief. JCT were however requested to extract turning flows from the models and show a comparison between the PBA *2024 Sensitivity Do Something* and *2024 Sensitivity Cumulative* flows.

3.0 Information Used

Staffordshire provided the following information:

3.1 A copy of the: *Land north of Ashby Road Tamworth Transport Assessment Addendum Ref : 28648/55002 August 2014*

3.2 Models comprising:

- Aldergate_Lichfield St with pinchpoint.lsg3x
- Fountain Junction_jct for TA Final.t14
- Upper Gungate_jct for TA peds every other.t14

Note : Drawings of alternative junction designs or material relating to determination of saturation flows or intergreens have not been provided. A telephone conversation with Staffordshire CC suggests that no such material has been submitted by PBA.

4.0 Comments and Audit

4.1 General comments

The key scenarios reported by PBA in their modelling of the Upper Gungate network were "Sensitivity Do Some" and "Sensitivity Cumulative" for the AM and PM peak periods, and these were included within the provided traffic models. Together with any relevant audit comments, this section will also highlight the traffic flows used in the PBA modelling.

4.2 Junction of Ashby Road with Comberford Road

In the original JCT study this junction was identified as being congested under prevailing traffic flows. A key issue was the presence of a school crossing patrol just south of the junction, which resulted in queues blocking back to the junction and underutilised green time, particularly during the AM peak period. JCT recommended the provision of a signal controlled pedestrian crossing in place of the school crossing patrol, and this was modelled as operating within the same stage stream as the junction. The timings were set so that southbound traffic from both Ashby Road and Comberford Road should not be stopped at the internal stopline (i.e. at the pedestrian crossing). This approach was taken to prevent blocking back in the junction when the pedestrian phase is green, and was also taken to remove the risk of drivers accidentally running the red light when the pedestrian phase is green. JCT did not suggest any alterations to the geometry of the junction itself other than some minor kerb realignment, and so the modelling reflected the existing controller specification with changes limited to those required to operate the pedestrian crossing as discussed.

4.2.1 Comments on design changes

The PBA Transport Assessment Addendum paragraph 6.2.5 states *"these junctions have been tested assuming the completion of the Gungate Pinchpoint scheme*". It is JCT's understanding that the Pinchpoint Scheme incorporates the geometric design changes recommended by JCT. Investigation of the PBA Transyt model suggests however that PBA are proposing an alternate design for this junction (see comments in 4.2.2). JCT have not been provided with details of these design changes other than those apparent in the PBA Transyt model, discussions with Staffordshire suggest that no details of the alternate design have been submitted. However, PBA suggest that operating the junction and the pedestrian crossing on separate stage streams will provide additional capacity, and follows guidance in TAL 5/05. This approach was investigated in the original JCT study but rejected in favour of a single stream approach with phase Delays to provide certainty of linking.

4.2.2 Comments on Transyt model

Stages

As described in the PBA Transport Assessment Addendum, paragraph 6.2.6, the signal timings were set so that a red signal for traffic at the pedestrian crossing stopline would only be presented to right-turning vehicles from Comberford Road, with the intention of offering good progression for the ahead traffic from Ashby Road. **Figure 1** highlights the timings from the PBA Transyt model for the AM Sensitivity Cumulative scenario.

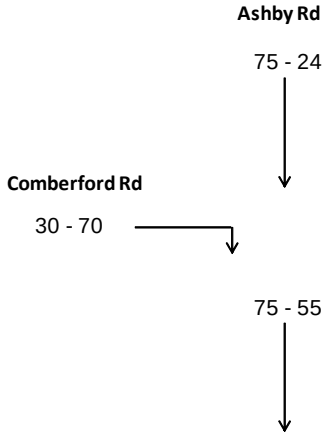


Figure 1: Start – End Green Times AM Sensitivity Cumulative, PBA Transyt Model

Referring to the timings shown in Figure 1:

The traffic leaving the Comberford Road stopline takes approximately 4 seconds to arrive at the stopline downstream. Therefore, any traffic crossing the Comberford Road stop line from time 30 (start of green) to time 51 (21 seconds into green) should pass through the downstream stopline during a green signal. However, any traffic crossing from time 51 to time 70 (end of green) will encounter a red signal at the crossing. Drivers arriving from Comberford Road are turning a corner and may not expect to encounter another signal, those arriving just after 21 seconds may therefore not be attentive to the red signal at the second set of signals and may fail to stop. The right turn from Comberford Road is relatively high, 510 pcus, and if traffic demand at the end of any cycle remains high, this has the potential to stop a large number of vehicles at the next stopline (up to 10 pcus per cycle). Queues will potentially block back to the stop line at Comberford Road. This is also likely to have an impact on Ashby Road. Although the signals at Ashby Road begin the green phase at the same time as the phase downstream, there will be a queue in the reservoir ahead due to the traffic that was stopped from Comberford Road. As this does not disappear as soon as the signals go green, the traffic from Ashby Road will be impeded by this queue for a short period once released from the first stopline.

The PBA Transyt model uses the Cell Transmission Model (CTM) in an attempt to replicate queues blocking back to upstream stoplines. The results for the AM Sensitivity Cumulative scenario indicate that a queue of 7.4 pcus will form at the stopline at the pedestrian crossing. However, it is important to remember that this is the average cyclic queue, and could be higher during periods within the peak demand is higher.

JCT consider that including the pedestrian crossing within the same stage stream as the signal junction, and maintaining suitable clear out periods, will offer increased safety by reducing the risk of red running.

Lane Length

The Transyt model assumes that the short lane length of northbound lanes at the signal junction are 45m. As such, the free flow left turn movement will not be blocked by traffic queuing in the ahead lane until the queue exceeds 45m. This is not consistent with site observations and is likely to have a significant impact on the modelling results as both left and ahead movements are relatively high.

Intergreen Timings

The intergreens used in the PBA Transyt model do not reflect those in the existing controller specification. The PBA Transyt model assumes lower traffic to traffic phase intergreens.

Cycle Time

In the original modelling by JCT, a relatively short cycle time (not more than 70 seconds) was assumed in the modelling, to ensure sufficient periods for pedestrians to cross. This was considered to be important during the AM and Early PM peak periods, due to the heavy volume of school children who cross at this point. In the Sensitivity Cumulative scenarios modelled by PBA, the cycle time was increased to 104 seconds and 98 seconds in the AM and PM peak periods respectively. The higher cycle time would increase pedestrian delays, and could increase the likelihood of pedestrians attempting to cross before the green man signal.

4.2.3 Traffic Flows used in Transyt Model

The traffic flows shown in **Figure 2** represent the flows used in the PBA traffic model, and identify the difference between the 2024 Sensitivity Do Something and the 2024 Do Something Cumulative scenarios.

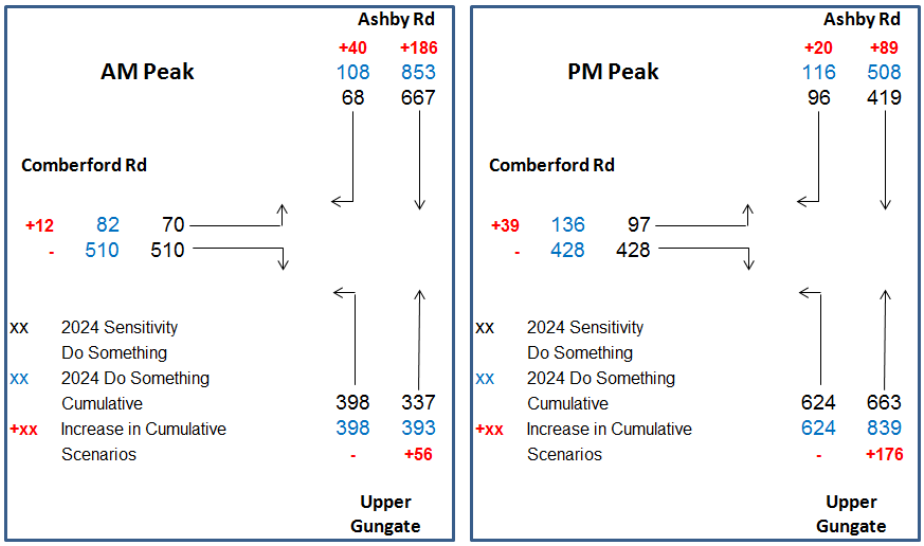


Figure 2: Traffic Flows in Transyt Model, Fountains Junction (in pcus)

4.3 Junction of Upper Gungate with Salters Lane and Offadrive

In the original JCT study no geometric changes to the junction were suggested, and the current method of control (i.e. operating both junctions as one stage stream) was retained so that progression through the internal lanes was not compromised. However, one issue identified with the junction was the green for southbound traffic from Upper Gungate (N) started at the same time as the green signal at the ahead lane downstream. JCT recommended an update to the phase delays, so that southbound traffic from Upper Gungate (N) could start earlier, and arrived at the downstream stopline as the lights turned green, thus maintaining good progression.

4.3.1 Comments on design changes

The PBA Transport Assessment Addendum paragraph 6.4.1 states *"the junctions were tested with the existing phasing layout, but with improved phase delays, as were identified by JCT in Technical Note TN12028.2*". Investigation of the PBA Transyt model suggests however that PBA are proposing an alternate design for this junction (see comments in 4.3.2), JCT have not been provided with details of these design changes other than those apparent in the PBA Transyt model, and discussions with Staffordshire suggest that no details of the alternate design have been submitted.

4.3.2 Comments on Transyt model

Timings and blocking

Phase labelling in the PBA modelling does not match those within the original JCT modelling. Phase delays in the PBA model are significantly different, to those in the JCT models. **Figure 3** illustrates the green timings for the AM Do Something Cumulative scenarios that will result from the PBA phase delays, and the impact these will have on southbound progression.

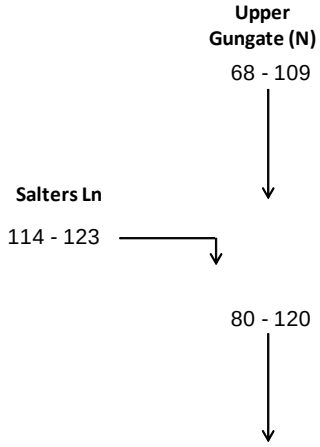


Figure 3: Start – End Green Times AM Sensitivity Cumulative, PBA Transyt Model

The cruise times between the stop lines at Salters Lane and Upper Gungate (N) to the stopline downstream are short (about 3-4 seconds). Therefore, the majority of traffic leaving Salters Lane each cycle will be stopped at the stopline downstream. The ahead traffic from Upper Gungate is then provided with a green signal 12 seconds before the downstream green signal. This traffic will join the back of the queue, and will result in blocking back to the upstream stopline, and result in underutilised green time. The timings in the JCT model were set up so that the southbound traffic from Upper Gungate (N) would not be delayed at the next stopline.

Although the modelling attempts to take into account blocking back using the Transyt Cell Transmission Model (CTM), Traffic Stream 3A, Lane 2 has incorrectly been set up to use the Congested Platoon Dispersion Model (CPDM) Model rather than CTM. As a result, the model does not model any blocking back to the upstream stopline. This was clarified by TRL, who stated "CPDM will not model blocking back effects if TRANSYT does not identify it as a flare" and "CTM needs to be chosen for both traffic streams on both Arms 2Ax and 3A".

Lane Usage

Site observations suggest that the usage of the offside lane on the northbound entry (Upper Gungate (S)) is low. The JCT model reflected this by reducing the short lane occupancy to 2 pcus (despite the length of the lane being physically longer). This was done to ensure the capacity calculations assumed only 2 pcus per cycle utilising the offside lane on average. The PBA model uses a flare length of 35m, which effectively assumes an average usage of about 6 pcus per cycle. This could be considered overly optimistic when comparing this to observed driver behaviour.

Weaving Connectors and Flow Consistency

The junction permits two right-turn lanes from Offadrive. The PBA model utilises weaving connectors that allow traffic turning right from either lane to enter either of the exit lanes. In reality this will occur very infrequently, particularly during the peak periods, as drivers will not be able to safely merge into adjacent traffic lanes. The use of these weaving connectors results in an equal volume of traffic entering the two exit lanes of the junction. However, this does not reflect the modelled volume of traffic arriving at the northbound stopline before Salters Lane, in that a much larger proportion use the offside lane. Due to the short distance between the Offadrive and Salters Lane junctions, it would be reasonable to expect little lane changing and the proportions using nearside and offside lanes to remain consistent at the exits with the entry.

Traffic Streams

The entry to Offadrive before the left-turn flare (Arm 3B UC) is modelled as a single traffic stream consisting of 2 lanes. This assumes that any blocking from the downstream flared lanes has an equal impact on the two full lanes. However, blocking will be more significant in the nearside of these two lanes, as the short left-turn flare will block traffic turning right from the middle lane, and vice versa. Therefore it would be more representative to split Arm 3B UC into two traffic streams.

Saturation Flow

The saturation flows in the PBA model have been predicted using the RR67 formula. The Transyt programme computes these automatically when supplied with lane width, gradient, turning radii (if any) and nearside / offside classification. Although the predictions in the PBA model vary slightly from the original JCT modelling, one notable difference is the southbound saturation flow from the offside lane at Upper Gungate (N), PBA have coded this as an offside lane. It is a recognised modelling convention to code lanes where there are no overtaking opportunities (i.e. lanes that will contain slow moving vehicles) as nearside even though they may be physically on the offside. PBA appear to have adopted this approach elsewhere in the model but not at this particular lane. The result is that the PBA model assumes a saturation flow of 2118 pcu/hr for southbound traffic, which may be considered overly optimistic.

Intergreen Timings

The intergreen timings in the PBA LinSig model do not reflect the current controller specification or the JCT model for the proposed junction. The differences in intergreen timings are significant and inevitably will have an effect on the predicted capacity of the junction.

4.3.3 *Traffic Flows used in Transyt Model*

The traffic flows shown in **Figure 4** represent the flows used in the PBA traffic model, and identify the difference between the 2024 Sensitivity Do Something and the 2024 Do Something Cumulative scenarios.

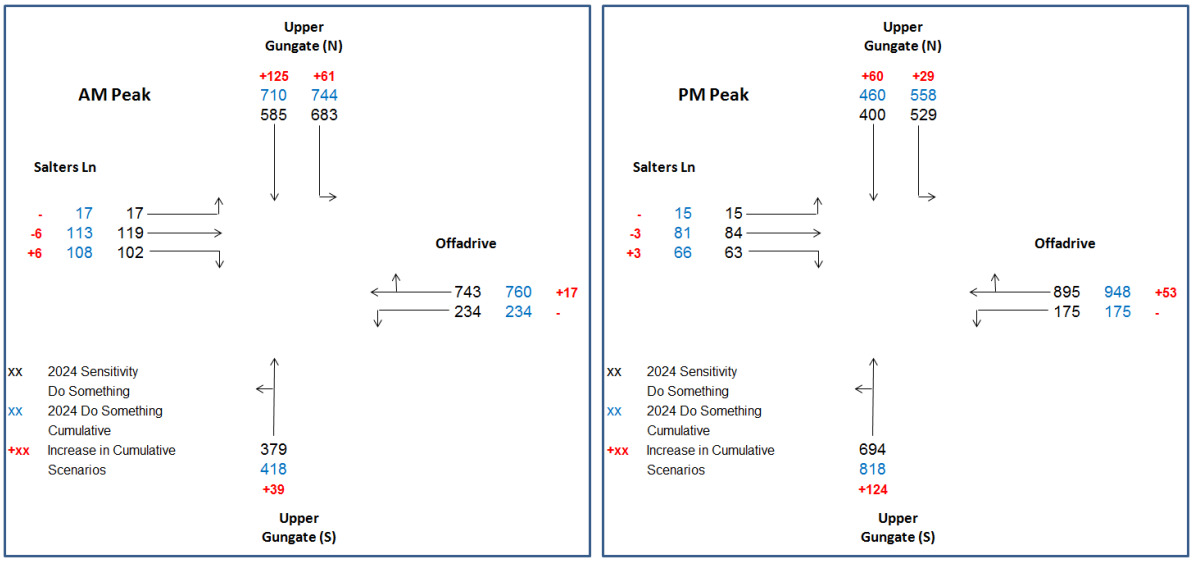


Figure 4: Traffic Flows in Transyt Model, Offadrive / Salters Lane Junction (in pcus)

4.4 Junction of Upper Gungate with Hospital Street

In the original JCT study no improvements were suggested by JCT for this junction. It was therefore modelled as per the existing controller specification, with the demand dependent pedestrian stage assumed to be called every cycle.

4.4.1 *Comments on design changes*

The PBA Transport Assessment Addendum paragraph 6.4.8 states *"The B5493/ Hospital Street/ Albert Road/ Lower Gungate signalised junction uses the existing staging regime as observed on site*". Investigation of the PBA Transyt model suggests however that the design for this junction is different to that modelled by JCT in the original study (see comments in 4.4.2). JCT were not provided with these design changes, while discussions with Staffordshire suggest that no design changes were made at the junction.

4.4.2 *Comments on Transyt model*

Frequency of Pedestrian Stage

The PBA model reflects the pedestrian stage being called once every alternate cycle. The PBA Transport Assessment Addendum paragraph 6.4.6 states *"The B5493 / Hospital Street / Albert Road / Lower Gungate signalised junction has an all red pedestrian phase which when observed was only called occasionally".* However, this does not reflect observations made from survey videos. Having reviewed the videos taken during the traffic surveys, it was observed that the pedestrian stage was called between 80% - 95% of cycles during the AM, School PM and PM peak periods. It was also observed that the pedestrian stage was called almost every cycle for long periods within the peak hours, rather than the pedestrian demand being spread evenly throughout the peak periods. Assuming the pedestrian stage is called once every alternate cycle will produce overly optimistic results.

Phase Minimums

Phase labelling in the PBA modelling does not match those within the original JCT modelling nor the existing controller specifications. The minimum times for all pedestrian phases were set to 7 seconds in the PBA model. However, the controller specifications that some pedestrian phase minimums last up to 9 seconds.

Intergreen Timings

The Intergreen timings in the PBA LinSig model do not reflect the current controller specification or the JCT model for the proposed junction. The differences in intergreen timings are significant and inevitably will have an effect on the predicted capacity of the junction.

4.4.3 Traffic Flows used in Transyt Model

The traffic flows shown in **Figure 5** represent the flows used in the PBA traffic model, and identify the difference between the 2024 Sensitivity Do Something and the 2024 Do Something Cumulative scenarios.

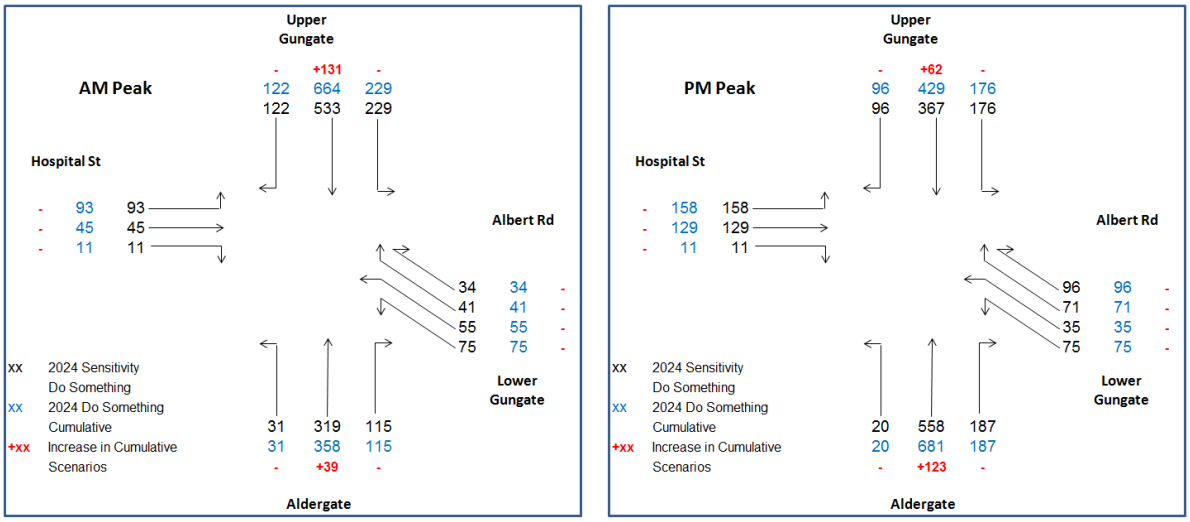


Figure 5: Traffic Flows in Transyt Model, Hospital Street Junction (in pcus)

4.5 Junction of Aldergate with Lichfield Street

In the original JCT study this junction was identified as being congested under prevailing traffic flows. A key improvement was identified and modelled which could significantly improve the capacity of the junction. JCT proposed that the traffic signal stages be changed to allow the Lichfield Street and Aldergate approaches to run in the same stage. To facilitate this JCT recommended the changing of the white lining in the junction to create a right turning bay traffic turning right from Lichfield Road into Silver Street. JCT also recommended some minor kerb realignment within the junction. Other than making these physical changes within the junction and in reconfiguring the existing controller to allow the new stage structure no other changes were deemed necessary. As such the JCT model of the proposed junction reflects the existing controller specification in all respects other than removing the conflict between phases A & B (and the intergreen), modifying stage 1, removing the existing stage 2 and renumbering stages 3, 4 and 5. Since stop lines are not to be relocated it was deemed appropriate to retain the existing intergreen timings.

4.5.1 Comments on design changes

The PBA Transport Assessment Addendum paragraph 6.6.1 states *"It has been assumed that the Gungate Pinchpoint Scheme is implemented, and signal timings/staging was based on the junction modelling completed by JCT on behalf of the County Council have been implemented*". It is JCTs understanding that the Pinchpoint Scheme incorporates the design changes recommended by JCT. Investigation of the PBA LinSig model suggests however that PBA are proposing an alternate design for this junction (see comments in 4.5.2), JCT have not been provided with details of these design changes other than those apparent in the PBA LinSig model, discussions with Staffordshire suggest that no details of the alternate design have been submitted.

4.5.2 Comments on LinSig model

Phases

The PBA LinSig model incorporates three additional pedestrian phases; this does not reflect the current controller specification or the JCT model for the proposed junction.

Stages

The stages in the PBA LinSig model do not reflect the current controller specification or the JCT model for the proposed junction in that one of the new pedestrian phases (across Church Street) runs in parallel with Aldergate, Silver Street and Lichfield Street as well as in the pedestrian only stage.

Stage Sequence

The stage sequence in the PBA LinSig model does not reflect the current controller specification or the JCT model for the proposed junction.

Intergreen Timings

The intergreen timings in the PBA LinSig model do not reflect the current controller specification or the JCT model for the proposed junction. The differences in intergreen timings are significant and inevitably will have an effect on the predicted capacity of the junction.

Saturation Flows

The saturation flows in the PBA model have been predicted using the RR67 formula. The LinSig programme computes these automatically when supplied with lane width, gradient, turning radii (if any) and nearside / offside classification. In auditing the model it was noted that the Aldergate approach assumes a lane width of 4 metres which is considerably wider than the more typical 3.25 metres. The RR67 calculation predicts an increase in saturation flow of 100pcu/hr per 1 meter increase in lane width. It is not clear from the PBA report how measurements for the calculation of Saturation flow were made and clarification should be sought

4.5.3 Traffic Flows used in Transyt Model

The traffic flows shown in **Figure 6** represent the flows used in the PBA traffic model, and identify the difference between the 2024 Sensitivity Do Something and the 2024 Do Something Cumulative scenarios.

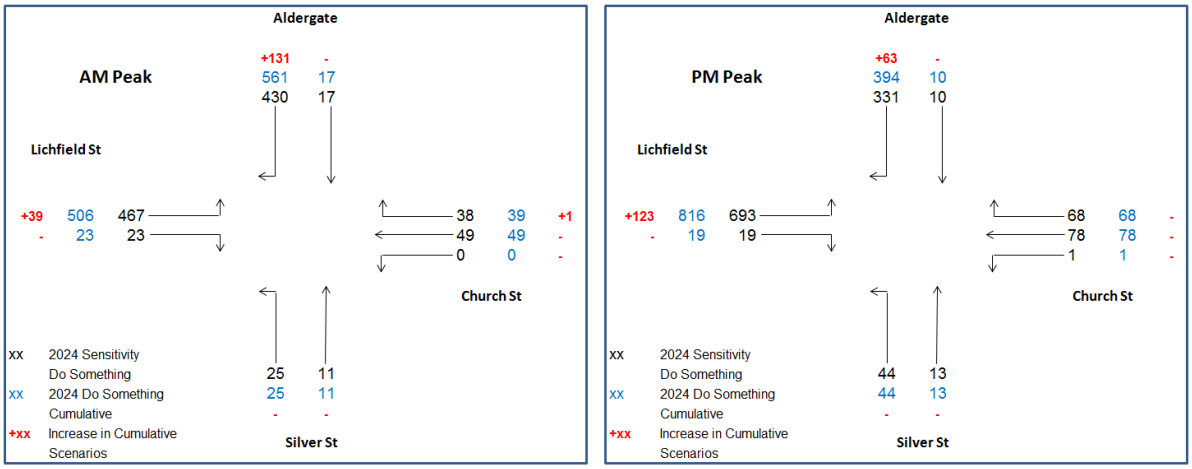


Figure 6: Traffic Flows in Transyt Model, Lichfield Street Junction (in pcus)

5.0 Conclusions and Recommendations

5.1 The PBA Transport Assessment Addendum and models incorporate changes to the operation of the Ashby Road / Comberford Road junction which may increase the likelihood of vehicular / pedestrian collisions and may cause operational problems. The PBA design reduces the amount of lost time at the junction and therefore increases predicted capacity. An independent safety audit should be undertaken to establish if the proposed design is considered safe and to what extent (if any) a reduction in safety can be balanced against the increased capacity.

5.2 The PBA Transport Assessment Addendum and models incorporate changes to the Upper Gungate / Salters Lane / Offadrive junction which may cause operational problems in that the changes in Phase delays will result in southbound vehicles blocking the junction. These changes should be rejected on operational grounds.

5.3 The PBA models use intergreen timings which are inconsistent with the existing controller specifications or the JCT proposed models. Further information should be sought from PBA to clarify why different intergreen timings have been used and how the timings have been arrived at.

5.4 The PBA model of the Aldergate / Lichfield Street junction does not reflect the existing controller specifications or the JCT proposed models. Further information should be sought from PBA to clarify why the design differs and details of the design.

5.5 The PBA models use some flare lengths which are not consistent with the current or proposed highway design. Clarification should be sought to establish if these differences relate to proposed design changes or if not the model should be corrected to reflect true flare lengths.

5.6 The PBA model of the Upper Gungate / Salters Lane / Offadrive junction assumes a flare usage which JCT considers optimistic and is not consistent with site observations. The flare usage assumption should be justified or the model should be corrected to reflect a more conservative usage.

5.7 The PBA model of the Upper Gungate / Salters Lane / Offadrive junction makes use of the Transyt Congested Platoon Dispersion Model (CPDM) on a non-flared southbound lane. This has had the result of underestimating blocking and over estimating capacity. Communications with the Transport Research Laboratory (the developers of Transyt) have established that this is not legitimate. The model should be changed to reflect a recognised and endorsed method.

5.8 The PBA models make assumptions about the frequency of demand dependant stages which are not consistent with site observations. Either the frequency of the appearance of demand dependant stages should be established and coded into the models or a worst case situation modelled which assumes that demand dependent stages are always demanded.

5.9 Conclusions 5.3 to 5.8 inclusive raise concerns as to validity of the modelling and until addressed or answered it is not possible to have confidence in the results and the assertions made in the Transport Assessment Addendum.