WCC Modelling Protocol

Advice Note 02b.2– Use of Isolated Junction Models

Purpose of this Note

1. The purpose of this note is to set out WCCs expectations regarding the need for, and expectations around any Isolated Junction Modelling Undertaken as part of the development process.

Modelling triggers

2. Several conditions may trigger the need for isolated junction modelling, including:

    - Supplementary junction assessment to consider junction specific matters.
    - Absence of an available microsimulation model.
    - Insufficient detail or calibration levels within an existing microsimulation model.
    - To support detailed design of junction proposals.
    - To provide the necessary evidence that a signal strategy can be delivered (i.e., through LinSig).

3. Isolated junction modelling may/will be requested either to supplement or in certain instances replace the microsimulation modelling when:

    - The development is not sufficiently large to justify assessment within an existing microsimulation model.
    - The calibration within the microsimulation model requires supplementary analysis.
    - The proposed scheme involves signalisation and therefore needs to also be proven through application of a LinSig assessment to provide a summary of junction performance.

4. Through scoping, it may be agreed that a small development (i.e. one which does not generate trips within the identified thresholds within the licence agreement and not located near sensitive areas) may not require an assessment of impacts through microsimulation.

5. Where it is agreed as necessary, all isolated junction modelling requirements including the location and form of assessment and scenarios/years must be agreed with WCC prior to commencing the assessment.

6. If an isolated junction model is required, then traffic flows should be derived from the microsimulation models where possible.

Traffic Flows extracted from a Microsimulation model

7. Traffic flows can be extracted from the microsimulation model either via turning flows for simple junction models, or Origin Destination (O/D) matrices for linked junctions.

8. Guidance on how to request this information is available on the WCC Traffic Modelling Webpage[1] and the associated costs and timescales for the provision of this information can only be confirmed once scoping has been completed to determine the necessary level of complexity and number of scenarios associated with the data extraction exercise.

9. As a minimum, flows should be requested from the microsimulation model to be disaggregated by:

    - Light Vehicles
    - Heavy Vehicles
    - Development Specific Traffic Flows

10. These traffic flows would be run through the isolated junction modelling once converted to PCUs. WCC considers an HGV factor of 2.5 (subject to the observed HGV composition within the local area) as appropriate to adopt in such circumstances.

11. In areas where calibration of the microsimulation model is an identified weakness then it is recommended that a further level of disaggregation, concerning the light vehicles, is requested as follows:

    - Baseline traffic
    - Heavy Vehicles
    - Committed Developments
    - Generic Traffic Growth
    - Other Growth (such as Local Plan or other developments considered pertinent)
    - Development specific trips

12. There are two different sets of flows which can be extracted from the microsimulation models these are:

    - Modelled Flows – The flows observed through the modelling (where practicable flows should include end queues to account for supressed demand)
    - Demand Flows – Flows observed through the modelling absent, as far as it is possible to do so, of the effects of congestion.

13. Modelled flows are extracted as turning flows from the model without any additional adjustments to the model being required.

14. However, use of modelled flows in isolation means the isolated junction model only considers throughput levels which align with those levels identified as being achieved at the junction through the microsimulation model. This means that the isolated junction assessment will only consider what has been proven to work within the microsimulation model and as such WCC may

[1] https://www.warwickshire.gov.uk/modelling-surveys

also require analysis of the queue lengths at these junctions, to be incorporated into the turning flows, to ensure that supressed traffic volumes are accounted for.

15. Demand flows are extracted as turning flows from the model but based on a run of the model with the effects of congestion removed. This is required because, as has been mentioned previously, use of modelled flows in isolation can often serve to prove that the flow which was accommodated within the microsimulation run can be accommodated within the isolated junction model. Two key elements are omitted through this approach:

    - Traffic which is in a queued state at the end of the simulation.
    - Traffic which has not travelled through the junction because it has either reassigned due to congestion or is unable to reach the junction for the same reason (i.e., it is trapped in congestion upstream).

16. It is prudent to consider both sets of flows within an assessment and it is recognised that these two sets of flows represent the potential range of outcomes that may occur.

17. Traffic flows which are extracted based on modelled flows may underestimate the flow that the junction needs to be able to accommodate through the design. It is possible to compensate for this by incorporating the vehicles which are queued on each junction approach at the end of the simulation hour since this would account, to some extent, for supressed demand within the period. It accounts for vehicles wishing to travel through the junction but not able to do so within the assessment hour, it does not account for traffic which has diverted away from the junction in response to adverse conditions.

18. Similarly, the demand flows may represent overly optimistic conditions in instances where there are simply too many other constraints which may prevent traffic reaching the junction being assessed (namely up and downstream capacity issues).

19. It should be noted that it is not always the case that the demand for a junction may exceed the modelled flows. The modelled flows may be higher in instances where the junction attracts traffic which is rat-running to avoid congestion on other routes. In such instances the modelled flows may be a more appropriate design input but, if it is the case that rat running is to be discouraged, it is not recommended that mitigation which may further encourage rat-running should be promoted.

20. Where a junction is on a main corridor or route of strategic importance, it is expected that the demand flows should at least form part of the design target since the design should be able to minimise the occurrence of rat running away from these routes.

21. WCC will consider both in their appraisal of scheme options through isolated junction modelling.

22. Where a design is complex or proposed in a sensitive part of the network it may also be necessary to iterate the proposals through the Paramics models whereby any scheme identified in the isolated junction model is put back through the Paramics model to enable a full appraisal of the scheme to be completed.

Model Data Requests

23. Traffic data may be requested from WCC microsimulation models to support the assessment of development impacts at key locations which are not expected to undertake a full assessment within WCC's microsimulation models.

24. The traffic flows are typically extracted from the microsimulation models to aid in the determination of forecast year flows which are, in turn, affected by a variety of factors including traffic growth associated with future developments and any associated schemes proposed within the area (all of which is accounted for to some extent within WCC's models).

25. Ideally junction models will be calibrated to existing baseline conditions through the collection of survey data at the key locations before flows from WCC's models are input. However, as it is not possible to survey future years, outputs from the microsimulation models can provide suitable inputs for this purpose.

Data Checking

26. WCC requires that checks are undertaken when data is requested from the microsimulation models and that these checks include:

    - A review of the calibration of the Base microsimulation model to determine if survey data was used for calibration or if the junction is included based on modelling assumptions.
    - A review of the validation of the base microsimulation model to determine if journey times travelling through the junction have been checked as part of the model development exercise.
    - Confirmation that the future year model assumptions remain current as well as a summary of the assumptions contained within any future year model scenarios for which traffic flows have been extracted.

27. WCC requires that this information is requested at the same time as the data for completeness.

28. Completing the checks will enable WCC to comment on the suitability of the extracted data.

29. Caution should be exercised when traffic flows are being extracted from junctions which have not been calibrated against observed data, especially in instances where the junction includes links which serve to load traffic into the model rather than connecting through to other junctions. There are high levels of uncertainty associated with traffic flows at junctions which include loading points due to the reliance upon assumptions applied to the zones and associated demand estimation process rather than observed survey information. Instances may include residential zones within a model where trip generation was constrained through the demand estimation process rather than through a survey of the access.

Data Limitations

31. WCC considers that, subject to the appropriate checks having been completed, the data provided is fit for purpose at the time of extraction from the models but not in perpetuity.

32. Data which has been extracted from the models may no longer be considered valid if the model has been updated since the time of extraction. This is because any update will mean traffic flows have been refined based on more up to date assumptions and may materially impact upon any assessment derived therefrom.

33. WCC requires that the validity of model data is checked prior to any submission based on the data, particularly if more than 6 months has passed since the data was provided.

34. Where data is no longer considered valid, the magnitude of change should be checked to determine how different the new data is compared to that which was provided during the original data extraction.

35. Significant changes in traffic flows will result in WCC requesting the assessment be redone based on new flows. Where changes are less significant then WCC may not require the assessment be updated or may request that a sensitivity test is sufficient to ensure that the development assessment conclusions remain valid.

36. Data requests for turning flow information should come direct to WCC and include the necessary checks set out earlier within this note so as to provide assurances around the validity of the data when requested. Once data has been provided there is an expectation that full payment should be received before further data requests are made to WCC. Furthermore, WCC is not liable for any decisions made which are based on the traffic flow inputs which have been provided from the modelling, nor does WCC accept any liability for costs incurred as a result of new data extractions being requested to overcome issues identified in the data after it has been extracted from the models.

Traffic Flows derived from Survey Data

37. Where it is not possible to obtain traffic flows from a microsimulation model, traffic data collected from traffic surveys may be permitted and converted to PCUs. The scope of the data collection required, **must** be agreed with WCC in advance but should include queue lengths and the methodology used for collecting queue data, so it can be correctly applied when calibrating any models.

38. Junctions models must be calibrated against observed data that reflects existing baseline conditions before future year flows are input. Evidence to support the Junctions model calibration should also be included for review, see **Reporting** below.

39. Where base traffic flows have been derived from traffic surveys, growth factors may be obtained from the Department for Transport TEMPro (Trip End Model Presentation Program) software using the NTEM (National Trip End Model) dataset. Analysis of the NTEM dataset can be made by

    - geographical area
    - transport mode

- travel time of day
- purpose of journey
- years of interest (from 2011 to 2051)
- type of trip

40. Details of the parameters used for analysis must be agreed with WCC in advance and presented for review once the analysis has been completed.

Modelling tools

41. WCC recommend the use of LinSig to assess signalised junctions and Junctions (ARCADY/PICADY) modelling (using the latest available software version) for roundabouts and priority junctions.

Linsig

42. LinSig modelling is expected to be completed where a development is considered likely to influence or trigger a change at an existing signalised junction or as part of the evidence to support the delivery of a new signalised junction on WCC's network.

43. LinSig modelling should also be completed in consultation with WCC's Traffic Control and Information Systems (TCIS) within Engineering and Design Services.

44. Where WCC already holds an agreed/approved Linsig model it can be made available to the developer for a fee. WCC would recommend that, where it is possible to do so, agreed models are used to minimise the need for additional audits to be undertaken.

Junctions (ARCADY/PICADY)

45. Where a development is considered likely to influence or trigger a change at an existing roundabout or priority junction or as part of the evidence to support the delivery of a new junction on WCC's network, Junctions modelling should be used.

46. It may also be used to assess a small network of junctions (linked junctions), if considered outside of any existing microsimulation model extents. However, it should **NOT** be used as a substitution for microsimulation modelling. Instances where this may be permitted should be discussed and agreed with WCC, prior to any work being undertaken.

47. Junctions models should be built according to the guidance set out in the Junctions User Guide. Details of how to correctly measure the geometric parameters that affect capacity can be found in Appendix B and guidance on the suitability of the various demand flow profiles available within the software is provided in Section 9.2 of the guide.

48. Other situations may also be assessed using the Junctions modelling software. These include:

- Assessment of a pedestrian crossings close to an existing or proposed junction.
- Assessment of roundabout bypass and filter lanes.
- Modelling unequal lane usage at roundabouts, modelling of chicanes, narrowings and kerb build-outs etc.

49. In some of the alternative situations listed above, the use of the Lane Simulation mode in the Junctions software is a requirement. Specific parameters and examples for each situation are described within the user guide in Section 15.

50. All Junctions modelling should be completed in consultation with WCC's Traffic Modelling team and calibration, input and required outputs agreed in advance.

Reporting

51. Upon completion of the isolated junction modelling, it is expected that all models, reports and inputs (including reference to the Paramics model scenarios they have been extracted from where applicable) should be submitted to WCC for review. This would include:

    - Turning flows for each junction and in each modelling scenario, ideally be presented in excel format.
    - Relevant queue data and methodology by which it was collected.
    - Details of junction geometry measurements presented in PDF format, but also supplied in AutoCAD format for review.
    - Details of any additional assumptions and evidence to justify/ support those assumptions.
    - Details of any changes from the default Junctions settings, aside from those that would generally be adjusted. This would include HV percentages, and additional lane simulation requirements., such as lane storage length etc. Both the input information and the justification for it should be reported for review.

52. Outputs should be always provided in the form of a report for the junctions modelled. This should be considered as a separate document which should have reference on the main document. In addition, a copy of the junction model must be provided for technical assurance purposes. WCC cannot be expected to comment on outputs from a model which it has not been able to review to confirm the model conforms to best practice with regards development and operational standards

53. Where a microsimulation model exists, the isolated junction modelling should be reported supplementary to the microsimulation modelling and not in the absence of the microsimulation modelling. WCC will prioritise a review of the microsimulation modelling, which provides an overview of the effects of any proposal on a corridor basis allowing for the effects of junction blocking. Isolated junction modelling will be used to confirm design principles. However, it is important to note that, if a scheme is not demonstrated to function acceptably within either model (subject to necessary calibration and validation standards having been achieved) then WCC may not accept the proposals.