Technical interfaces modelling forum

Outcomes from the workshop 2013

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Contents

Acknowledgments

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About the Institution of Environmental Sciences (IES): The IES is a membership organisation that represents professionals from fields as diverse as air quality, land contamination and education - wherever you find environmental work underpinned by sound science.

The organisation leads debate, dissemination and promotion of environmental science and sustainability, and promotes an evidence-based approach to decision and policy making.

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Background

Air quality and transport issues are rising ever higher on the political agenda as they have the potential to derail projects of all sizes and can also be problematic in locations where people or potentially sensitive ecological resources are found in close proximity to transport infrastructure. In such circumstances careful consideration of public and natural environmental health implications is required. As environmental, societal, political, technological and economic constraints add complexity to transport planning, it is vital that interfacing processes between transport and air quality modellers evolve to deliver efficient and effective 'solutions' that quantify the impact of infrastructure and land development projects in numeric terms to the satisfaction of all stakeholders.

The EU has imposed a mandatory air quality limit value for NO2 of 40 micrograms per cubic metre. This limit represents a very real challenge as assessing results from air quality models against a single value is problematic due to model uncertainties, including the robustness of the input data. Air quality models tend to be better at predicting changes in concentration rather than the absolute concentration.

It has been felt for some time that conventional traffic models - as currently formulated - are not able to provide the accuracy and precise type of data that AQ models require and can undermine the air quality evidence base.

With this in mind, the Transport and Air Quality Modelling Forum was organised for a practitioner-level discussion between Air Quality (AQ) and Transport Modellers (TM) to advance and seek to standardise current practice. The aim is to produce practitioner-led recommendations that can be adopted as standard practice across the modelling communities.

STRUCTURE OF THIS NOTE OF PROCEEDINGS

This note firstly presents the recommendations arising from the workshop held on 17th April 2013. This is followed by details of the workshop itself including format of the day, attendees and outcomes of the discussion.

Recommendations and actions

It is important to recognise the lifecycle of a project and so frame recommendations within this lifecycle. As such the proceedings have been summarised within four distinct project phases below.

The list below has been compiled by considering the discussions held during the forum. The list should not be considered exhaustive and provides additional ideas generally over and above current practice.

To help the potential implementation of suggestions below highlighted items will be addressed at a forthcoming conference.

PHASE 1: PROJECT INITIATION

- To encourage better project planning two stage commercial contract
    - Stage A – Project Scoping
    - Stage B – Project Implementation
- Client appointed Scheme Delivery Risk Manager, to investigate AQ and other delivery risks
- Prepare AQ & TM 'interface checklist' that can be adapted to different scheme specifications
- Prepare AQ and TM risk register that can be adapted for use with different projects
- Identification Project Manager, AQ and TM project personnel, which could be one, two or three people depending on the scale of the project
- Demonstrate one team mentality, including recording details of TM/AQ interaction throughout the project

PHASE 2: PROJECT SCOPING

- Strongly encourage use of Appraisal Specification Report (ASR) - a dynamic communication and tracker document, including review and risk status for different tasks
- Project Team
    - Demonstrate one team mentality, including recording details of TM/AQ interaction throughout the project
- Scheme Scoping
    - Undertake preliminary AQ risk screening using base data (existing and new for missing strategic locations)
    - AQ capacity mapping to define what type of scheme is feasible
- Model Scoping
    - Focused on AQ exceedance areas found through preliminary risk screening
    - Define scenarios and tests to explore AQ issues not just BCR scenarios
    - Define network detail in AQ issue areas
    - Check validation in AQ issue areas
- Data Collection
    - Focused on providing preliminary AQ risk screening and detailed heavy vehicle fleet data collection
    - Emphasise use of link based ATC collected for at least two weeks and calibrated for AQ appropriate fleet definitions – can be used as base for AQ screening and TM forecasting, and help define local vehicle fleets
    - Monitor ATC sites at critical locations if project development is prolonged
    - Use GPS and mobile phone OD and speed data to provide full network coverage
    - Improve trip matrices wherever possible with mobile and GPS data, especially goods vehicles
    - Provide data for missing periods important to AQ – overnight and weekend

PHASE 3: PROJECT IMPLEMENTATION

- Transport Modelling Improvements
    - Identify local convergence issues to check if affecting AQ areas
    - Check traffic model validation in AQ issue areas and discuss findings
    - Relate forecasts to reliable base data, particularly important for HGVs
    - Improve HGV modelling, including model HGVs with separate speed / flow relationships
    - Post-processor of macro model data for specific AQ requirements

        - Add functionality to convert from macro model outputs to data useable for AQ
        - Built in meso- or micro-scale calculations
        - Microsimulation models
        - More accurate modelled lane choice
        - diurnal predictions

- Transport Model / AQ Interface

    - Standard metadata
    - Standard geo-referencing, including both static (network based) and dynamic (coordinate based) systems
    - Recognise centre line accuracy issues
    - Standard units of measurement
    - Standardise definitions, e.g. define a queue, and HGV and HDV

- AQ Improvements

    - Use band / range TM results, e.g. range of speeds
    - Use disaggregate / raw TM outputs
    - Use probability from scenarios to predict risk of AQ issues
    - Consider how to change trigger for AQ modelling from absolute to likelihood, e.g. 1 in 100 AQ exceedance

- Treatment of Uncertainty

    - Improve heavy vehicle modelling
    - Investigate probability modelling, for example
        - Monte Carlo modelling
        - Prepare scenario range outputs as High and Low AQ Issues Scenarios
        - Predict scenario occurrence probability, e.g. 1 in 100
        - Use probability to determine the error in the link or cordon based information
        - Use probability to define random releases within a cordon based microsimulation model and predict average point flow and speed and associated error

PHASE 4: PROJECT LEGACY

- Feedback

    - Report key project issues to guidance custodians
    - Report experiences to AQ/TM forum

- Guidance

    - Seek to provide guidance for TM / AQ interface

ACTIONS

- IES to investigate hosting a conference in order to address the 'easy wins' identified in the workshop
- AQ and TM practitioners to get Defra/HA buy-in for the checklist / client to encourage wide adoption
- AQ & TM communities to encourage wider availability of national data e.g. Trafficmaster / PCM databases

Workshop format

The workshop was facilitated by Emma Fenton, Adam Donnan and Claire Holman from the Institution of Environmental Sciences (IES).

Andy Talbot (Atkins), Richard Bradley (Mouchel) and David Hardcastle (Mouchel) were also available to offer technical understanding where necessary.

Three challenges were discussed:

SESSION 1: QUICK FIXES

Are there any quick fixes for improving modelling methods for transport or AQ models that overcome present problems without significant extra cost?

SESSION 2: NEW THINKING

Are there any new methods/techniques that can help to resolve current technical issues of suitability/compatibility of transport model outputs for use in AQ models?

SESSION 3: CONSEQUENCES AND RECOMMENDATIONS

The aim was to generate a list of recommendations and actions to advance guidance for use by the AQ and TM communities to help in delivering model results more efficiently and effectively, and for a variety of different clients and project objectives. Attendees were asked to be honest what can be achieved and guide expectations of governing bodies and clients.

The discussions were governed by the ***guiding principles*** set out at the beginning of the workshop as listed below.

Communicate: transport and AQ modellers must work closely together as one team

Concise: the interface should be proportional and relevant to the scale of the appraisal

Consistent: the interface should aim at a consistent level of understandable accuracy

Certain: the interface should endeavour to be 'right-first-time', and promote cost and programme certainty

Cost Effective: the interface should look for cost effective ways of reducing programme costs

List of attendees

Name	Company	AQ/Transport
Nigel Bellamy	Jacobs	AQ
Mark Chapman	Bureau Veritas	AQ
Hannah Dalton	Ramboll	AQ
David Deacon	URS	AQ
Michelle Hackman	AECOM	AQ
Ben Marcher	AQ Consultants	AQ
Stephen Pyatt	Hyder Consulting	AQ
Susie Robinson	Atkins	AQ
Hongbin Wang	Mouchel	AQ
Euan Barr	Jacobs	Transport
Chris Bruce	Arup	Transport
Andrew Currall	AECOM	Transport
Philip Old	Mott MacDonald	Transport
Chris Robinson	MVA	Transport
Eddie Strankalis	Hyder Consulting	Transport
Martin Tate	URS	Transport
Ian Turvey	JMP	Transport
Steven Wood	SIAS	Transport

Outcomes: quick fixes

The discussion during this session was predominantly focused on communication and improving dialogue between the AQ and TM communities. Currently the two communities saw themselves as working in silos, which hinders the efficient delivery of schemes. Imbalances between public and private schemes were highlighted as the private sector generally operates under less prescriptive guidance with respect to environmental risk. From a practitioners perspective private sector schemes can be more complex as there is no compulsory guidance on the process the scheme uses.

On many programmes, the AQ work is undertaken at the end of the overall assessment process and this can risk programme delivery if air quality problems are found so late in the project programme.

Communication became a key theme throughout the workshop and was picked up during all of the sessions.

PROCESS

Many of the attendees expressed a desire to see standardisation of processes associated with the progress of a scheme, from tender to delivery.

The suggestions for improved process communication fell roughly into two categories: Project Scoping and Detailed Modelling.

PROJECT SCOPING

Suggestions focused on communication around the process and called for a greater standardisation of the process by which TM and AQ practitioners engaged in schemes. Specific recommendations included:

- Early engagement between AQ and TM during the process and better scoping, (for example the early stage Appraisal Specification Report - ASR - to try to capture AQ and TM requirements), project managers trained to ensure that discussion includes both communities throughout the duration of the scheme. With respect to early engagement:
    - AQ modellers must take responsibility for contacting project managers to highlight importance of early engagement between TM and AQ practitioners, particularly during the contracting stage.
    - One suggested approach was to have 'teach ins' at the beginning of projects where AQ and TM practitioners explain their models for that scheme
- Greater emphasis on meetings at the start of a project between the Project Manager, AQ modellers and Transport modellers to discuss the scheme and understand the needs and issues of each community i.e. AQ modellers are interested in exceedence and change.
- Screen for AQ risks prior to scoping. This should highlight areas that need more model detail, in terms of transport data and granularity of model outputs.
- Use AQ risk screening to scope schemes. This could highlight the level of risk in pursuing a scheme at locations with significant existing AQ issues, or define 'AQ capacity' or 'headroom' maps to indicate the likely maximum size of schemes.
- In the case of transport schemes, change the form of contract to one similar to the historic DfT multi-modal studies with an initial contract to fully scope the model and scheme, before moving on to detailed model development and application.
- Client to appoint a 'Risk Manager' during the scoping stage to better define the risks specific to the scheme and the Transport and AQ modelling, as well as other risks to the project. This could be given a similar gravitas to CDM Co-ordinators.
- Different terminologies between the communities often result in additional problems further along the process. There is a need for standard definitions at the start of a project, e.g. for vehicle types, queues etc.
- Develop a formalised process for the interaction between AQ and TM practitioners from the start of the project. This should be practitioner-led and should include synchronisation of requirement for both AQ and TM practitioners.

DETAILED MODELLING

Having made a greater effort to scope the modelling and interface the discussions then moved on to the on-going management of this interface.

Suggestions for improved communication of practitioner needs highlighted the importance of a mutual understanding between AQ and TM of the importance and intricacies of each other's work and data requirements. These discussions centred around keeping a dialogue between the two disciplines including a more modern openness and One Team mentality.

This would be achieved through regular meetings and tracking changes through an ASR (for example), which might be best achieved in a tabular format. This could be driven by client performance indicators focused on communication and One Team ways of working, and continuing the idea of the Risk Manager through the detailed work.

MANAGING EXPECTATIONS

Discussion centred on unrealistic expectations, by some clients, on scheme progression. It would be helpful if clients (particularly private sector) would better recognise air quality issues and be more aware of potential problems and risks. It was recognised that the impetus for this to happen must come from both AQ and TM practitioners. This communication should extend to project managers to enable them to understand the whole process of modelling for all aspects of a scheme. This could be achieved by adding AQ / TM interface information to guidance such as WebTAG. Previously mentioned scoping related to AQ issues and capacity, and appointment of a Risk Coordinator could also help in this area.

Attendees felt that it was important for AQ and TM practitioners to know likely areas of air quality exceedence and consult with clients prior to an extensive scheme design phase. This early identification of problem locations would enable both Traffic and AQ models to focus on these areas and enhance the quality of predictions. This would introduce cost savings associated with avoiding repeated or abortive work.

MODELLING SCOPE

It was highlighted that it would be useful to identify the boundaries and limitations of models that will be used on a particular scheme at an early stage. Early communication between AQ and TM practitioners can help to address some issues such as model selection. These included:

- Areas that AQ modellers suggest might pose problems if it is known where AQ issues might arise, additional detailed traffic modelling could be focused in these areas. It would be useful to draw a map of potential problem areas. Being more specific about potential problem areas would allow more focused modelling and would ensure more robust predictions. This needs to be based on screening as existing areas, for example AQMAs, can often represent whole electoral districts – they have lost their focus.
- Strategic transport models are not always appropriate for meso-scale schemes so AQ and transport modellers should discuss project needs
- Budgets for preparatory work to enable early specification
- Monetising environmental impacts as standard output might help project managers to achieve equal prioritisation for AQ and TM objectives, and highlight key variables in value for money assessments.
- Early link validation – AQ and TM practitioners need to understand where the data is good or bad. This will help in the understanding of potential sources of error but also to tailor the scheme to specific requirements e.g. for placement of AQ monitors
- It would be useful to have ATC (automatic traffic counts) at AQ model verification sites (and AQ problem locations), to provide accurate base data (which collect different categories of vehicle).
- It was suggested that AQ practitioners could use existing flow data to provide the initial indication of possible AQ issues, in advance of the main modelling process.
- TM model detail needs to consider AQ issues to ensure that sufficient model network is available at key locations.
- TM convergence needs to be checked and the worst converged links identified as these could be sensitive AQ areas. This could be a significant issue for HDV data.

HGV'S AND BUSES (HDV'S)

These were recognised as a problem as a small additional number of HGVs on a scheme can tip it into exceedence from an AQ perspective. Particular problems included:

- Difficulty in accurately modelling HGVs

- HGV survey data can be unreliable
- HGVs are not prioritised the same by AQ and TM communities
- Getting HGV counts early on would be advantageous for AQ modellers
- Need for separate speed curves for HGVs
- Need to amend TAG guidance for modelling HGV flows, specifically for AQ purposes

With so many issues with sampling and reliability of HGV flow and speed a major re-think on modelling HGVs is required. This is likely to focus on more reliable local data to help pivot forecast changes but may not be a quick fix.

TAG GUIDANCE

Current TAG Guidance is prescriptive for the development of Traffic Models, mainly for Economic Appraisal, but does not address the preparation of these models for supplying robust data for AQ modelling. This is particularly true in the case of HGVs which are less important (than cars) for Economic Appraisal, but much more important for AQ modelling.

Thus new Guidance needs to be prepared and published (under WebTAG) for the interface between TM and AQ models.

QUEUES AND THEIR IMPACTS ON SPEEDS

Queues were mentioned by both practitioner groups as of great importance but the way they are treated is different. Standardisation of the way that queues are treated would be beneficial.

Such standardisation would need to consider queues and what information is important for transport/AQ modellers during queues i.e. acceleration vs queue length etc. A standard approach to converting macro-model flows, speeds and queues would be an obvious quick fix.

GEO-REFERENCING

There was some discussion around the fact that many models are not geo-referenced, which can lead to inaccuracies during the later AQ modelling stages.

- macro transport models should be upgraded to enable inclusion of 'static' geo-referenced networks e.g. ITN, or use more dynamic geo-referencing, e.g. no network but co-ordinate-based.
- consideration needs to be given as to the compatibility of transport model networks and AQ model networks. AQ may require more centreline detail and therefore a standardised and static geo-referencing system may not be appropriate at all locations.

ERROR AND UNCERTAINTY

There was discussion around the difference in levels of uncertainty in AQ and transport models. Recommendations to combat confusion in these areas included:

- AQ and transport practitioners understanding the sensitivities and reliability of each other's model inputs and outputs
- With the complexities of transport models scenario testing is likely to be the obvious way to check the model sensitivity which could include provide a central or Core outputs with limits defined by scenario testing, which are undertaken for value for money assessments already.

One of the more interesting suggestions mooted during this session was that in order to facilitate the progress of schemes transport modellers should do initial air quality screening assessment, in order to focus their efforts to help AQ and TM modellers later on in the process.

Outcomes: new thinking

This session focused on the more technical, time-consuming improvements that practitioners would like to see addressed.

HDVS/HGVS

Discussion centred on modelling of these vehicles as they can be critical in terms of AQ. The following recommendations were made to improve understanding of how HGVs can affect schemes:

- Obtain and use better data (including speed) for HGVs e.g. through INRIX / Trafficmaster or alternative emerging data sources.
- Rationalise what data is needed for HGVs e.g. traffic counts vs no. axles / length. Standardisation of vehicle classification is needed, this could be achieved through the production of a matrix listing data requirements so that AQ and TM practitioners understand what is required.
    - E.g. it would be useful to produce HGV speed curves.
- Development of more local analysis to understand HGVs, which could be meso or micro scopic.

(Note : whilst there are differences in definition between HGVs and HDVs, the above principles apply to both)

DATA

The majority of technical fixes that were suggested were related to data collection and management. All of the data-oriented suggestions revolve around the generation and organisation of data as well as the need to communicate data requirements to all parties involved in a scheme.

- More observed traffic data (including counts) is needed for AQ-sensitive areas. It would be possible to use this data to verify the model and assist in the forecasting.
- It would be useful to have a central database of vehicle data and flow data - particularly for HDVs as you need to know the origins and destinations data. This could be managed by a government department, for example the DfT, and could feed into a revived national transport model.
- More effective journey time / speed validation is necessary, it was suggested that Trafficmaster be promoted as it is available to all local authorities.

    This needs to help understand how link based information can be translated to points along the link.
- Need to know local vs national fleet composition
    - Through intercept surveys / household travel survey / bus company data / haulier surveys
- In order for AQ and transport models to be more effective, practitioners need to know more about speed, vehicle types, and journey origins and destinations.
- TM and AQ practitioners could take advantage of new emerging data sources
    - Sat nav (GPS) / mobile phone data
- More should be done to inform clients of model accuracy and decisions should be made knowing that the results fall within a range of possibilities rather than a single predicted outcome

UNCERTAINTIES

Further to the recommendations around data there were also specific concerns about reporting uncertainties and error during communication about schemes.

- In order to account for transport model uncertainties the baseline should be based on reliable observed traffic count / speed data. In future the forecasts (do minimum) should make reference from the base data.
- It would be useful to report measures in terms of percentage error, which might be best achieved through scenario testing.
    - If AQ practitioners know the margin of error in TM calculations it can be built into AQ models.
    - This would be based on the certainty of the error where the AQ model has been verified.
    - A guide on estimating error is needed - including for threshold volume of traffic & HGV percentages

MODELLING

Some discussion during this session revolved around the models that are used and how they could be adapted to facilitate better working between AQ and TM practitioners.

- Micro-simulation and meso-scale models would be helpful for AQ 'problem areas' - particularly because AQ models are based on a level of detail that is almost impossible to achieve from macro models.

- Off-peak information is as important as peak-time information for AQ modelling

    o There are some highly simplified ways of deriving off-peak information from current models but the results are only useful if sufficiently reliable.

There was some suggestion that existing models should be updated to account for variables that are important to each community i.e. HDVs, acceleration, speed, origin, destination. Both AQ and TM practitioners should be involved in model re-design during the scoping stage so that both fields are taken into account when selecting variables. The detail of the model would be determined by the level of accuracy needed.

Standardisation across the models that are used by AQ and TM practitioners would be useful, for example a consistent geo-referencing system and metadata definition.

Aggregation of TM data for use in AQ models was discussed and whether new approaches could be developed to avoid this aggregation. This may require a 're-packaging' of TM data.

Alternatively, aggregate TM data could be banded to represent the type of accuracy support by the data and modelling process.

Consequences and recommendations

In this session participants were asked to focus on the more practical solutions (in terms of financial and time cost) that they would like to see achieved within the industry.

The following recommendations are those identified by attendees as being those that could have the greatest impact without introducing excessive costs to future schemes.

DEFINITIONS

Having standard definitions could improve efficiency and help handle errors and incompatibility issues associated with interfacing between AQ and TM models.

Practitioners need to develop and agree industry standard definitions for common measurements e.g. for specific vehicles (HDVs/HGVs), queues etc.

PROCESS/COMMUNICATION

One of the main considerations suggested throughout the sessions was early engagement - AQ practitioners need to be engaged early in order to avoid costly delays further down the line in schemes. It will be the role of TM practitioners to raise issue with project managers but AQ practitioners will have a responsibility for raising awareness of the importance of early engagement with AQ concerns. This engagement should include an informed meeting about what the major AQ and TM risks are likely to be for a scheme as validation by AQ & TM practitioners should happen before an extensive design phase has happened. Value of this scoping exercise needs to be explained to the client (i.e. this will enable avoidance of costs associated with doing abortive work - e.g. if a scheme becomes unrealistic).

Additional suggestions included:

- Creating a checklist for TM and AQ practitioners with options as to whether certain measurements are required from a model. All requirements will be clearly specified, this will form part of a standard data request at an early stage in the scheme (e.g. ASR stage).

- Identifying the study area early on - this will incorporate discussions with AQ practitioners as TM and AQ study areas may not overlap exactly.

- Including AQ as part of the key deliverables of a project thereby giving environmental risk greater prominence.

    o There should be someone overseeing the project who has an understanding of both disciplines.
    o AQ practitioners should visit the site to see anecdotally what the traffic is like

- Developing a forum for flagging up emerging data & technology

    o This to include links to previous information to avoid duplication of efforts

- Creating a client information pack on risk from possible AQ issues e.g. consequences of exceedences etc.

- Recognising that neighbouring schemes can conflate results e.g. neighbouring LA-owned vs HA-owned schemes may not take into account the effects of one another thus delaying the progress of schemes through the need to do additional modelling.

DATA

The data requirements of TM & AQ need to be better explained, this should help to deliver schemes without unnecessary delays related to adjusting models in order to meet other parties' needs.

- Standard geo-referencing system for the road network

- New data sources

    o Origin / destination data from mobile phones& sat navs, granularity from Trafficmaster
    o Investigation of off-peak modelling
    o Targeted traffic counts suitably calibrated to pick up HGVs

- Identify and investigate issues where most of the uncertainty is coming from:

    o More data needed on HGVs and queues base level (where / how long / what time)
    o Specific locations that could pose problems

- Boundary of where micro-simulation may be needed (investigation) – to be determined by both TM and AQM

- Establish better model compatibility between AQ & TM practitioners and improve the robustness of the predictions flowing between TM and AQ models.

- Establish new Guidance for the preparation and validation of TM models for AQ assessment.

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