

Forth Replacement Crossing Model

Transport Scotland

Forth Replacement Crossing Model Development Audit – Final Executive Summary

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SIAS Limited (SIAS) acting as the Traffic and Transport Advisor and Auditor (TTAA) to Transport Scotland was requested to undertake an audit of the transport model development for the Forth Replacement Crossing Model. This is a multi-modal, regional model developed to operate for a sub-area within the overall Transport Model for Scotland 07 (TMfS07) hierarchy.

The audit involved an examination of the roads assignment model, the public transport (PT) assignment model and the demand model. In the case of the assignment model networks these were examined in detail along with the zoning system.

The audit relied heavily on information supplied by MVA, which was generally in the form of the Draft Model Development, Calibration and Validation Reports for the roads assignment, PT assignment and demand models.

Road Traffic Assignment Model Development, Calibration and Validation

The roads assignment model was developed in SATURN and the review of the road network generally demonstrated that it was appropriately coded and that the simulation and buffer areas had been adequately defined. The TTAA examined the zoning system, network connectivity, link/route lengths, vehicle routeing, flow-delay curve coding, link capacity coding and some junction coding. The Forth Replacement Crossing Model zoning system was specified using the TMfS07 zone boundaries as a start point and was further refined and disaggregated as required within the model area.

The review of the roads network generally demonstrated that this was satisfactorily coded, however, some minor errors and issues were identified in this process. These issues would generally not have a significant impact on the operation of the Forth Replacement Crossing Model as a whole. Nevertheless, users of the model should bear these issues in mind both prior to applying the model and, subsequently, when examining model outputs, particularly in a more detailed or local context.

The roads assignment model trip matrices were cordoned for the relevant sub-area of TMfS07 and used as the start point for further refinement using matrix estimation. The matrix estimation process demonstrated changes to the trip matrices in terms of the absolute and percentage



changes at a sector level and to the overall trip length distribution that were in line with expectations. The resulting matrices were considered appropriate for a strategic model of this nature. The assignment model procedure, generalised cost coefficients, convergence levels and other parameters were considered acceptable.

Analysis was presented that compared the modelled and observed trip distribution pattern for northbound trips across the Forth Road Bridge. This showed that for many sectors the observed distribution was well reflected in the model, however, in the case of trip origins a significant imbalance was demonstrated between trips originating in West Lothian and the West compared with the Edinburgh area. There was also an imbalance between trips with destinations in Fife and those travelling to Perth and beyond. This issue was not considered to be significant at a strategic level across the model as a whole, but could have implications with respect to specific model applications and/or more detailed analysis or assessment using the model outputs. The TTAA recommends that ideally further development work should be undertaken to address this matter. In the absence of such additional development work cognisance should be taken of the detailed commentary provided in the full audit report.

The model calibration process concentrated on aggregate screenline flows and this demonstrated a very good match between modelled and observed values in all time periods. The model validation exercise examined the modelled to observed comparisons on the individual links comprising the screenlines. This demonstrated a much greater level of variability in the quality of comparisons on individual links, although key locations, such as the Forth Road Bridge and Kincardine Bridge, were shown to compare well. The validation to journey times demonstrated a good match between modelled and observed values when considering total journey times along routes. The comparisons were, however, more variable along individual sections and at specific junctions along these routes.

At a strategic level the model was considered to be appropriately calibrated and validated. The more variable validation to individual link flows and to localised journey times does, however, suggest that care should be taken in using and interpreting the model outputs for more detailed assessment or analysis. Users are referred to the full audit report for more detailed conclusions and specific recommendations relating to the issues identified.

Public Transport Assignment Model Development, Calibration and Validation

The PT network and services audit examined the coding of bus and rail services within the model and this revealed no significant issues. Some minor issues in terms of bus link/lane coding and the reflection of bus flows in the roads assignment model were identified.

The PT assignment model matrices were cordoned from the relevant sub-area of TMfS07 without further refinements for the Forth Replacement Crossing Model, thereby retaining consistency between the National and Regional models. The PT assignment model parameters, fares model and general specification were considered acceptable.

Model validation comparisons of bus and rail flows, boarding and alighting at rail stations and bus journey times against observed data have been undertaken. These are generally acceptable at an aggregated analysis level considering total PT flows. Similar to the roads assignment model, the PT validation demonstrates much more variability when considering individual PT link flows and rail station boarding/alighting volumes. Additionally the sub-mode split shows a general tendency towards higher rail and lower bus flows. MVA has identified that this is partially attributable to a software limitation which is currently being investigated further by the software developers.



Users should take note of the variability of PT flows at a more detailed level. In the context of the Forth Replacement Crossing study and for general application of the model, the TTAA suggests that close scrutiny should be paid to the responses in terms of main mode split, PT flows and PT sub-mode split in interpreting the model outputs.

Demand Model Development, Calibration and Validation

The demand model development audit examined the overall model structure, the level of segmentation and the various inputs and assumptions involved. The Forth Replacement Crossing demand model retains general consistency both in its overall structure and in terms of the input data with TMfS07, which is considered appropriate given the relationship between the two models and the intended hierarchical operation of National and Regional models.

Following interrogation of the base data a demand model structure was adopted that locates mode choice before destination choice in the hierarchy which is consistent with WebTAG guidance on default model structure. The resulting estimated mode and destination choice parameters were of the expected nature and order of magnitude. Subsequent realism testing of the modelled response to a variation in a range of assumptions produced elasticities that were largely consistent with the illustrative values identified in the WebTAG guidance.

Park & Ride is included in the main mode choice model in the Forth Replacement Crossing Model. This enables car available, 'from home' trips in the AM peak to choose to use Park & Ride with the return trips all assumed to occur in the PM peak. The Park & Ride module operates in a similar manner to that incorporated historically within TMfS. The calibration process involved comparisons of modelled and observed Park & Ride site use and this demonstrated a good level of calibration at the vast majority of sites. Additional choice modules including trip frequency, macro time of day, peak spreading and high occupancy vehicle choice can be invoked as necessary.

The general specification and operation of the demand model in forecast mode is similar to that well established in TMfS and is considered appropriate for the Forth Replacement Crossing Model.

