LEFT2 - A STRATEGIC FREIGHT TRANSPORT MODEL FOR GREAT BRITAIN.

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1. INTRODUCTION

This paper reports some innovative model building that yields a useful addition to models of freight in Great Britain. Currently, the Great Britain Freight Model (GBFM) is part of the Department for Transport's (DfT) national model suite. That model is over-detailed for some purposes and internally only models mode choice effects. Freight modelling requirements in Great Britain were reviewed in work for the DfT, the Strategic Rail Authority (SRA), the Highways Agency (HA) and Transport for London (TfL). Arising from our work on that project, and our involvement with GBFM, we identified a need for a strategic freight transport model, near instantaneous to run, that could handle both the mode choice effects and market size effects of policies.

Section 2 of this paper sets out the background to our work. Section 3 introduces the LEeds Freight Transport (LEFT) model series. Section 4 describes the model LEFT2 from that series, and section 5 gives some results using version LEFT2.6. Section 6 lists the plans we currently have for LEFT3, and section 7 concludes.

2. BACKGROUND

2.1 The DfT/HA/TfL/SRA Freight Modelling Review

In 2001 the (then) UK Department of Transport, Local Government and the Regions, following a recommendation of SACTRA (1999), commissioned a review of "the current freight modelling techniques with the view of recommending the most suitable techniques for use in Great Britain." By the completion of the project the Department had become simply the Department for Transport (DfT). Funding came from DfT, SRA, HA and TfL.

Three teams, including one led by ITS, Leeds, bid for the work. Instead of awarding the work to one of the bidders, the Department sought to involve the widest available range of expertise by merging two of the bids and inviting the third bidders to act as auditors. After negotiations, the study team emerged with 9 partners and led by ME&P-WSP. The largest single input by ITS Leeds was Fowkes (2002), which reviewed past freight models in Great Britain.

The project reviewed options for modelling at five different levels: the National Transport Model (NTM); Urban and Regional models; Multi-Modal Studies (MMS) models: Scheme models; and Small Scheme models. Findings for these are available on the DfT website (ME&P-WSP et al, 2002) but the present paper will concentrate on national level models. The following sub-sections look briefly at the then available national level models in turn.

2.2 The Department's National Road Traffic Forecasting model (NRTF)

This methodology had developed over many years, with a reversion to a disaggregation by 15 industry/commodity sectors in 1997, following advice commissioned from ITS Leeds (Fowkes, Nash, Toner and Tweddle, 1993). The methodology in that report was enhanced by McKinnon (NEI et al, 1998) by viewing the various steps in the generation of road vehicle-km as 'Key Ratios'. In that methodology, monetary values of production were converted into tonnes by the Key Ratio 'Value density'. Applied in some combination, the Key Ratios 'Handling factor', the 'Proportion carried by road' and the 'Average length of haul' would give road tonne-km moved. From there, 'Vehicle capacity', 'Load factor' and (the inverse of) 'Proportion of empty running' would yield road vehicle-km. Rail traffic was only considered for sectors where it was significant. Individual sectors were handled separately, and the process was not fully computerised. This methodology did, however, form the basis of the Department's Ten Year Plan, produced in 2000 (DETR, 2000).

2.3 The Great Britain Freight Model (GBFM)

This model evolved from a model of Cross-Channel lorry traffic built by MDS Transmodal. They added a choice of modes (in conjunction with ITS Leeds) during the EU STEMM (Strategic European Multimodal Modelling) project (STEMM, 1998). Mode and route split was achieved (simultaneously) by an algorithm called Flat Logit (Fowkes and Toner, 1998), which heavily favoured the least generalised cost alternative but, when allocating the remainder of the traffic, favoured alternatives dissimilar to those with lower generalised cost, eg. those involving different modes. This methodology now forms one routine within the much larger GBFM. This latter was built, with SRA support, additionally to allocate GB domestic traffic to (the best) road, rail and intermodal alternatives, again using Flat Logit.

GBFM works from base matrices of traffic flows, projected through time according to various assumptions. Traffic is assigned to rail and road networks, but there are no capacity constraint feedbacks. Average length of haul is allowed to alter over time, by massaging the OD matrices, but this is not permitted at a point in time in reaction to policy changes. The model is therefore essentially a mode choice model, with OD matrices only changing by external intervention. Nevertheless, both the SRA and DfT found GBFM to be valuable, and used it for their respective 10 year plans in 2000. Although not owned by DfT, it can reasonably be regarded as part of DfT's National Transport Model suite. GBFM is documented in Newton and Wright (2003).

2.4 The Sinclair Knight Merz (SKM) Additional Freight Model

In order not to be too closely tied to GBFM, as part of its work for its 10 year plan in 2000, SRA commissioned SKM, teamed with AEA Technology Rail and ITS Leeds, to work up an alternative method. This method has never been fully documented, and what working papers there are remain commercial in confidence. Basically, commodity by distance band tables were taken from the Continuing Survey of Road Goods Traffic (DETR, 1999) and similar tables for rail traffic constructed from limited available rail data.

Totals for rail plus road, for all distances taken together, were also obtained for the period 1974 to 1998, and regression methods used to project forward traffic in each commodity group (with some manual intervention to reflect likely non-trend changes). It was found necessary to first forecast the sum over all commodities and then use those forecasts to constrain (the sum of) the commodity specific forecasts. GDP growth rates of 2.0, 2.5 and 3.0% p.a. were assumed. Separate forecasts were produced for tonnes and tonne-kms (or, equivalently, the average length of haul). In that way base matrices for 2010 and 2020 were obtained. Mode split was achieved by some sort of logit model, but the details are not known to us.

When testing scenarios, allocated traffic levels were 'filtered' according to the network assumptions made, eg. that part of the traffic wanting to use routes not cleared for 9 foot 6 inch containers. It is not believed that traffic, either rail or road, was allocated to networks. Some subsequent work was carried out for the SRA using this model, and some use was also made of it during the government's Multi-Modal Studies.

2.5 Findings of the Modelling Review Project

Since one of the preferences of the DfT was to have as few separate models as practicable, the review project favoured an input-output style model, which would allow consideration of detailed regional factors as well as strategic national level ones. It was stressed that the model should be Production-Consumption, with freight ODs derived therefrom using knowledge of the supply chain system. Smaller scale models embodying some of the ethos of the preferred model were becoming available in this country, for example the EUNET Trans-Pennine model (ME&P-WSP et al, 2002).

Nevertheless, there was no extant GB national model of that form, and the scale of such a detailed national model appeared daunting. The auditors were supportive of the ethos, but felt that it might take many years to satisfactorily construct a reliable national level version of such a model. There was therefore a proposal to use the GBFM as a stop-gap until something better was available for the strategic national role. The DfT thereafter funded further work on GBFM, together with improved documentation and a specific detailed audit of the working of GBFM. The latter is now complete but is highly sensitive. One of its recommendations, in turn, was that GBFM was of sufficient value that DfT should fund a project to look at ways of improving it. The DfT is currently seeking Expressions of Interest in such a project.

3. THE LEEDS FREIGHT TRANSPORT (LEFT) MODEL SERIES

3.1 The ITeLS (Integrating Transport and eCommerce in Logistics Supply Chains) project

Since GBFM works at a geographically disaggregated level, it can take a long time to run. Omitting network assignment shortens that time significantly, but it could still take 15 minutes or so. The addition of further desirable features to GBFM might be expected to increase this time and possibly be unduly complex in view of the need to disaggregate everything. For these reasons, there would appear to be a gap in the market for a strategic national level freight model that has no geography and runs very quickly. In particular, it might form a test base for model enhancements that could be piloted quickly prior to introduction on larger models. It is indeed intended to implement elements from LEFT in GBFM.

An opportunity to build such a 'quick and cheerful' (sic) model arose during the Integrating Transport and eCommerce in Logistics Supply Chains (ITeLS) project, funded by DfT under the EPSRC LINK FIT initiative. That project (ITeLS, 2004) was led by Cardiff University Business School and it was part of ITS Leeds's responsibility within that project to produce cost models and evaluate the national level effects of some of the case study results from elsewhere in the project. Thereby began the LEeds Freight Transport (LEFT) series of models.

We began in 2003 with exploratory work on structure and a search to bring together all of the many items of data that would be required. A first version, LEFT1 was ready in the first half of 2004. This was just a mode split model, with only road and rail considered. Many corners were cut and heroic assumptions made. It mainly served to show ITeLS partners what a model would look like, and we gave a few preliminary results to stimulate discussion. When it came to actually producing results that were to stand for all time as outputs of ITeLS, it was felt that something considerably better was required. LEFT1 was therefore abandoned without ever being documented or used in anger.

The next version included such fundamental enhancements that a new series number (LEFT2) was allocated, with subsequent versions numbered 2.1, 2.2 etc. Results from version 2.6 are presented in section 5 below. The biggest change from LEFT1, and the most difficult to implement, was the addition of a market size total effect. By that we mean that the total (i.e. road plus rail) tonne-kms (by commodity) were allowed to be affected by the policies being tested. LEFT1 had only allowed the mode split between road and rail to change. LEFT2, which is described in section 4 below, also separated out traffic suitable for trainloads. Generally, though, many lessons learnt from LEFT1 were incorporated. After much effort, it was possible to produce the results needed for the ITeLS Final Report. These are summarised in section 5 of this paper.

3.2 The Rail Research UK (RRUK) C3 Project

As part of the ITS work on Project C3 of the EPSRC Rail Research UK programme (RRUK, 2005), documentation of all demand models that might be used in the RRUK programme was required. The first task was to list all of RRUK's requirements for a strategic freight model. A review of available models then showed that LEFT2 would form a good basis for the freight modelling within RRUK, with GBFM being held in reserve in case needed. Since documentation for GBFM was now available to us, having been funded by DfT, it was decided to use RRUK funds to document LEFT2, which involved publishing all our data inputs. This documentation has been made available on the ITeLS website (ITeLS, 2004), as it there serves the purpose of underscoring the results referred to in 3.1 above. In return, LEFT2 was made freely available for use in RRUK.

RRUK's modelling aspirations, however, went well beyond the capabilities of version 2.6 (of LEFT2). In particular, there was interest in the implications for local pollution and global warming. This predicated a move to producing estimates of vehicle kilometres, which involves several complications. There was also interest in later forecast years. A version 2.7 was mooted, but has for the time being been rejected in favour of a move to another new series number, LEFT3, for the reasons discussed in Section 6. Before going there, let us first describe LEFT2 in section 4, and look at LEFT2.6 results in section 5.

4. A DESCRIPTION OF LEFT2

4.1 The Form

LEFT modelling has borrowed heavily from many existing models, hopefully combining the best from each and making progress. The outward form of LEFT2 is similar to the SKM model discussed in 2.4 above, in that it is a spreadsheet model working on matrices 9 distance bands wide and 7 commodity types deep. Base data has come from CSRGT and rail industry sources. A believed difference from the SKM model is that the matrices are further divided into traffic deemed suitable to move in Trainloads (TL), and the remainder (NTL). The model therefore contains 9x7x2 = 126 cells.

Within each distance band the average distance is the same for each commodity, usually being the mid-point of the band. It follows that base tonne and tonne-km matrices are reconciled in that way. No adjustments have been made in respect of those road journeys that are the Collection and Delivery legs of rail movements (though that will be done in LEFT3). This allows us to say that, for the sum of road and rail, the policy scenarios for a particular year can affect tonne-km but not tonnes. Policies such as moving taxation from Vehicle Excise Duty to Lorry Road Pricing are extremely unlikely to have any noticeable impact on the amount of each commodity we consume, whilst it may well have travelled a different distance. Even if new lorry tolls were not balanced by VED reductions, we can assume that the Chancellor's macroeconomic requirements will be unaffected, so the extra raised cash will be returned to the economy somehow, and so spending on commodities should not vary much. Only if very drastic policies were introduced that significantly raised the prices of some commodity groups relative to others would we expect to see any changes in tonnes, and then only relatively small changes. For the purposes of LEFT2, it was assumed that the model would never be used in such circumstances.

4.2 The Base Years

The base years chosen were 2000 and 2010. Base data was clearly not yet available for 2010, but this has been estimated by looking at past long term trends and more closely at trends over the last few years. Hence, LEFT2 does not predict 2010, but merely contains a built-in projection for 2010, around which various policies can have their effect.

4.3 Generalised Costs

These drive the model, and considerable effort has been expended on getting a good understanding of them. We used the best available evidence on monetary costs, summarised in relationships with distance for the different lorry types (FTA, 2003, RHA, 2003, Transport Engineer, 2004). Rail monetary cost data was taken mainly from the GBFM documentation. Speeds (and hence average journey times in each distance bracket) and reliability were taken from recent survey data to which we have access. Values of Time, Reliability, and Mode Specific Constants (all by commodity) are our best estimates based on considerable experience (see for example Fowkes et al, 2004).

4.4 Mode Split

This is achieved by a simple Logit model almost exactly (within each commodity/distance/TL-NTL cell) reproduces the base data by adjusting the generalised cost scale parameter, the percentage captive to road, and the percentage captive to rail. This calibration is clearly under-identified, but it permits us to select parameters in order to meet certain subsidiary criteria. There has been no attempt to calibrate the model to raw survey data on mode split.

4.5 Market Size

A simple elasticity approach has been used to adjust market size, the datum being the elasticity of road tonne-kms with respect to road monetary costs. The LEFT2 modelled mode split effect can easily be determined, so the remainder of the elasticity effect must be a market size effect. LEFT2 adjusts the tonne-km totals (over distance bands) appropriately. As discussed earlier, the elasticity of road plus rail tonnes with respect to road costs is assumed to be virtually zero, so we are faced with altering tonne-km while holding tonnes constant (for each commodity). This implies a change to the average lengths of haul. As previously remarked, the average length of haul in each distance band is fixed, so we must move tonnes across distance bands. For reductions, this is not too problematic, but for increases in length of haul we wished to hold substantial traffic in the lower distance bands since many short journeys will obviously continue to be made. A non-converged iteration was used to give a 'high traffic' way-point. Together with a 'low traffic' way-point and the base, any future tonne-km figure in that range can be obtained by interpolation.

5. RESULTS

Following consideration within the ITeLS project, we decided to test five scenarios relative to a base 'no change' scenario. Our base data is representative of the position around the year 2000. We have also made use of a projection to the year 2010. In both cases we have considered the effect of the scenario relative to the base forecast of that year. It should be stressed that the base figures are in no way a prediction, merely something to compare the scenarios against.

5.1 Scenario 0: No Change

Scenario 0 assumes merely that past trends will continue as far as the total market size is concerned, but with the real costs of transport held constant as far as the mode split calculation is concerned. It is implicitly assumed that journey times and delay times remain constant for each mode.

This scenario serves two purposes. Firstly, in the 2000 base it checks that the calibration data is recovered at the level of aggregation presented in the tables. That means that any changes in the 2000 base as the result of other scenarios can be safely interpreted as due to the scenario being tested, and not due to any divergence between the model and the data in the 2000 base. Secondly, it shows how our base assumptions for 2010 differ from our 2000 base, in the absence of any scenario changes.

It can be calculated from Table 5.1 that there are forecast growths of 7.5% in total tonnes lifted, 20.3% in total tonne kilometres moved, and 11.9% in the overall average length of haul between 2000 and 2010. Within the totals, rail's share of (road + rail) tonne-km rises from 0.108 to 0.121 between 2000 and 2010. Within rail, the percentage of tonne-km moved in trainloads falls from 57.9% to 55.1%, as overall rail traffic growth is biased towards commodities less suitable for movement in trainloads. The trainload percentage of tonnes lifted is higher, falling from 68.5% to 66.7% since trainload traffic is moving shorter distances than average.

Without having considered a worsening of road congestion faster than built into the trend, and with Scenario 0 not including cost increases to road, or subsidies to rail, the growth in rail tonne-km is predicted to be only 34.3%, rather than the 80% that was, until recently, the government target. Some of the following scenarios suggest ways in which rail traffic might be increased further.

5.2 Scenario 1: Working Time Directive (WTD)

The UK Regulations on working hours came into force on 23 March 2005 and cover mobile workers who are participating in road transport activities that are covered by EU drivers' hours rules. Self-employed drivers will initially be exempt. The main provisions are for an average 48 hour week over a 4 month reference period, with up to 60 hours working time during any single week. Working time at night is limited to 10 hours in any 24 hour period. Workers cannot work more than 6 consecutive hours without taking a break.

Scenario 1 assumes that the effect of the implementation of the Working Time Directive in the UK is such that the effect is equivalent to an increase of £36 per day in the standing costs of an HGV. This was based on an average reduction of working hours from 12 to 9.6 per day. LEFT takes wages to be a standing cost rather than a running cost.

This scenario does not have a dramatic effect. Road generalised costs are raised by some 10 to 15 per cent, but collection and delivery costs for wagonload rail rise and so wagonload rail generalised costs rise by some 5 to 10 per cent, keeping the modal switch to rail down to a 0.25% increase in rail's share (of tonne-km).

Total market size, in tonne-km, falls by about 0.25%. The largest effects are for Coal & Coke and (particularly) Ores & Metals, where trainload rail captures around 3% of base road traffic. The percentage of rail traffic moving by trainload rises slightly. The 2010 results have the same message. Rail traffic moved in 2010 is some 38% higher than in the 2000 base, some 4% of that being due to this scenario.

5.3 Scenario 2: Road User Charging (Revenue Neutral)

This scenario supposes that the government has introduced a distance-based system of road user charging for HGVs, but has set rates such that the total tax take has remained unchanged. While this is similar to the then current stated government policy, it should be noted that it was suggested officially that the government would reduce fuel tax whereas we have assumed that the vehicle excise duty (VED) would be reduced. The initial proposed introduction date was 2006, but this was postponed to 2008 and has recently been abandoned. The net effect of our assumptions is that the variable cost of running an HGV increases by £0.013 per kilometre whilst the standing cost falls by £4.80 per vehicle per day.

Again, this scenario does not have a dramatic effect. Long distance road generalised costs rise by about 1%. There is a corresponding reduction in short distance road costs which also feeds into a 1% reduction in wagonload rail generalised costs through reduced road collection and delivery costs.

The total market size in tonne-km is unaffected, Rail tonne-km rise by just over 1%, balanced by a fall in road tonne-km of 0.13%. Ores & Metals and Miscellaneous traffic are most affected, the former by a large percentage change to a small quantity and the latter by a smallish change to a large quantity. The percentage of rail freight moved by trainload falls by half a percentage point. The 2010 results show the same picture. Rail traffic moved in 2010 is some 36% higher than in the 2000 base, some 2% of that being due to this scenario.

5.4 Scenario 3: Road User Charging (Revenue Raising)

This scenario supposes that the government uses a road user charging system to raise revenue, either for the revenue *per se* or in order to reflect the marginal social costs of freight haulage in line with EU directives. We have assumed that VED is still reduced by £4.80 per vehicle per day but that variable costs have been increased by £0.15 per kilometre, this being a rough doubling of the variable cost presently due to fuel duty. Readers can interpolate or extrapolate to get estimates for other levels.

Total market size, in tonne-km, falls by 0.4%, with rail raising its tonne-km by some 18%. The biggest reduction for road is 10% for Ores & Metals. With rail costs constant there is substantial mode shift to rail. The biggest increase for rail is 50% for Food, Drink & Agriculture, from a very small base. The percentage of tonne-km moving by trainload falls from 58 to 51. The 2010 results show rail's share of tonne-km rising to 0.146; rail tonne-km being some 61% above the 2000 base figure, 27% being due to this scenario.

5.5 Scenario 4: The SRA Company Neutral Revenue Support Scheme (CNRS)

SRA (2004) describes a scheme introduced in 2004 which replaces previous Track Access Grant support to Freightliners Limited. This new scheme, called the Company Neutral Revenue Support Scheme (CNRS) is open, on a non-discriminatory basis, to any individual operator moving containers by rail. Support is only paid for O-D movements for which road is cheaper than rail. Rates are published in that document although no guarantee is given that sufficient budget will be available to accommodate all bids. Our scenario has assumed that these rates apply to all non-trainload suitable (NTL) traffic in the food, drink and agriculture commodity group and the miscellaneous commodity group, but not to bulks. No budget limit has been applied.

There is virtually no change to the total tonne-kms moved, and hence to average length of haul. Road loses some 0.7% of its tonne-km to rail, which consequently increases its share by almost 6%. The 2010 results show a 42% increase of rail tonne-km over the 2000 base, with 8% due to this scenario. If implemented together with Scenarios 1 and 3, the increase in rail tonne-km in 2010 would be some 75% above the base, and so very close to meeting the recent governmental objective. However, this would involve an element of double counting, since lorries would then be paying more towards the costs they cause, undermining the case for support to rail.

5.6 Scenario 5: Increased Efficiency of Road Goods Vehicle Operations (VEFF)

The definition of this scenario is that development of good practice, such as is exemplified in other Work Modules of ITeLS, plus governmental efforts to spread best practice in road fleet utilisation, has resulted in a 4% fall in both the fixed and variable monetary cost of road movements.

The initial motivation for this scenario came from looking at efficiencies in freight operations of Tesco supermarkets. Results from an ITeLS case study of Tesco movements from factory to Distribution Centre showed the possibility of worthwhile gains in this area (Potter et al, 2004). The scale of such gains will depend on the extent to which they can be emulated by other supermarket chains and the extent to which similar situations arise elsewhere. The figure of 4% has merely been chosen as illustrative, bearing in mind other results within ITeLS.

The government has recently announced that in future bids for funding to deliver such efficiency gains will be considered alongside revenue support grants for rail freight of the type considered in Scenario 4.

Regarding tonnes lifted, the total is as usual fixed, but road gains 130 thousand tonnes from rail in 2010 compared to 2000. The total market size in terms of tonne-km rises by 0.08%, with road gaining 0.18% and rail losing 3% of its traffic in this commodity group (i.e. a fall of 60 million tonne kilometres). This highlights just how sensitive the small rail tonnages in this sector are to even quite small improvements in road costs.

Table 5.1 Detailed Scenario Results

MILL. TONNES		2000 Road: Road	2000 Road: Diff. from as now (%)	2000 Road: Propn of total traffic	2000 Rail: Rail	2000 Rail: Diff. from as now (%)	2000 Rail: Propn of total traffic	2000 Rail: % Rail by train load	2010 Road: Road	2010 Road: Diff. from as now (%)	2010 Road: Propn of total traffic	2010 Rail: Rail	2010 Rail: Diff. from as now (%)	2010 Rail: Propn of total traffic	2010 Rail: % Rail by train load
AS NOW	**0**	**1630.99**		**0.940**	**104.32**		**0.060**	**68.51**	**1749.78**		**0.938**	**116.00**		**0.062**	**66.68**
WTD	1	**1628.68**	-0.14	0.939	106.62	2.20	0.061	69.07	1747.12	-0.15	0.936	118.66	2.29	0.064	67.15
RUC NEU	2	**1630.37**	-0.04	0.940	104.94	0.59	0.060	68.01	1748.94	-0.05	0.937	116.84	0.72	0.063	66.13
RUC HIGH	3	1619.06	-0.73	0.933	116.24	11.43	0.067	63.47	1734.46	-0.88	0.930	131.32	13.21	0.070	60.94
CNRS	4	1626.84	-0.25	0.937	108.46	3.97	0.063	65.89	1744.75	-0.29	0.935	121.03	4.34	0.065	63.91
VEFF	5	1632.04	0.06	0.940	103.26	-1.01	0.060	68.45	1750.98	0.07	0.938	114.80	-1.03	0.062	66.68

BILL. TONNE-KM		2000 Road: Total	2000 Road: Diff. from as now (%)	2000 Road: Propn of total traffic	2000 Rail: Total	2000 Rail: Diff. from as now (%)	2000 Rail: Propn of total traffic	2000 Rail: % Rail by train load	2000 Road & Rail: Total	2000 Road & Rail: Diff. from as now (%)	2010 Road: Total	2010 Road: Diff. from as now (%)	2010 Road: Propn of total traffic	2010 Rail: Total	2010 Rail: Diff. from as now (%)	2010 Rail: Propn of total traffic	2010 Rail: % Rail by train load	2010 Road & Rail: Total	2010 Road & Rail: Diff. from as now (%)
AS NOW	**0**	**151.32**		**0.892**	**18.37**		**0.108**	**57.89**	**169.69**		**179.42**		**0.879**	**24.67**		**0.121**	**55.05**	**204.09**	
WTD	1	150.43	-0.59	0.889	18.83	2.50	0.111	57.96	169.26	-0.25	178.26	-0.65	0.876	25.32	2.63	0.124	55.12	203.58	-0.25
RUC NEU	2	151.12	-0.13	0.891	18.57	1.09	0.109	57.28	169.69	0.00	179.11	-0.17	0.878	24.98	1.26	0.122	54.43	204.09	0.00
RUC HIGH	3	147.32	-2.64	0.872	21.71	18.18	0.128	51.00	169.03	-0.39	173.63	-3.23	0.854	29.64	20.15	0.146	47.93	203.27	-0.40
CNRS	4	150.28	-0.69	0.886	19.42	5.72	0.114	54.75	169.70	0.01	178.02	-0.78	0.872	26.08	5.72	0.128	52.09	204.10	0.00
VEFF	5	151.66	0.22	0.892	18.16	-1.14	0.108	58.06	169.82	0.08	179.86	0.25	0.879	24.38	-1.18	0.121	55.26	204.09	

Length of Haul. (km)		2000 Road: Road	2000 Road: Diff. from as now (%)	2000 Rail: Rail	2000 Rail: Diff. from as now (%)	2010 Road: Road	2010 Road: Diff. from as now (%)	2010 Rail: Rail	2010 Rail: Diff. from as now (%)
AS NOW	**0**	**92.78**		**176.09**		**102.54**		**212.67**	
WTD	1	92.36	-0.45	176.61	0.29	102.03	-0.50	213.38	0.33
RUC NEU	2	92.69	-0.09	176.96	0.49	102.41	-0.12	213.80	0.53
RUC HIGH	3	90.99	-1.93	186.77	6.06	100.11	-2.37	225.71	6.13
CNRS	4	92.38	-0.43	179.05	1.68	102.03	-0.49	215.48	1.32
VEFF	5	92.93	0.16	175.89	-0.12	102.72	0.18	212.39	-0.13

6. LEFT3 PLANS

It is appropriate that effort spent on all facets of the model should move ahead in broad proportion. It is not therefore possible to say that LEFT3 will differ from LEFT2 in a few ways - all aspects of LEFT2 will be reviewed. In particular, it is intended to devote effort to improving the modelling within LEFT3, incorporating multiple polling of the Logit function so as to overcome possible problems of aggregation bias arising from the inherent non-linearity. It is also proposed to computerise the calibration process, minimising a suitably defined loss function, though this will mean that the base data will no longer be exactly reproduced by the model. We also intend to explicitly allow for road tonnes to be generated by a switch of traffic from road to wagon-load rail, since the latter will be assumed to involve an average of at least one road collection or delivery leg.

More visibly, LEFT3 will move on from reporting tonne-km to reporting vehicle-km by taking account of likely vehicle loadings. This will permit the contribution to road congestion to be analysed, as well as the contribution to local air pollution and global warming. However, the two principal reasons for starting a new model series, LEFT3, are as follows. Firstly, the embedded elasticities of road tonne-km to road monetary costs will be changed, so that LEFT3 will give different outputs to LEFT2, even if all inputs are identical. Elasticities are available disaggregated, to some extent, by commodity group, and these will be implemented. Secondly, the present spreadsheet based model (albeit with Visual Basic macros) is being replaced by a Visual Basic based model (but with spreadsheet input and output). This will allow more complex calculations to be undertaken.

7. CONCLUSIONS

This report has sought to describe the genesis and development of the LEFT series of strategic freight models at ITS Leeds, with particular reference to LEFT2. The working of version LEFT2.6 has been illustrated by its application to a set of test scenarios. It must be stressed that LEFT2 is merely a strategic sifting model giving ballpark estimates. No weight should be attached to the minutiae of the results. Equally valid assumptions would yield different results.

We are engaged in training the model to behave properly. By setting the model tasks to do we can get results that we can use to judge the adequacy of the model's behaviour. Any comments from readers of this note will be welcomed. Our own plans for LEFT3 have been briefly described, but the situation is fluid. It is anticipated that LEFT3 will be operative by the end of 2005.

8. ACKNOWLEDGEMENTS

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