NETWORK MODELLING FRAMEWORK

Appraisal

Background Documentation

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1. INTRODUCTION

Overview

1.1 This document outlines the purpose, structure and usage of the NMF appraisal module. It is intended to permit readers to understand what the model is designed to achieve (and what is excluded), how the module works and what actions are required to use the model to generate meaningful results.

1.2 The appraisal module calculates the value for money of strategies/initiatives tested using the NMF in comparison with an alternative (for example a do minimum or base) case. Value for money analysis demonstrates the justification (or otherwise) of using public sector funding to implement the strategy/initiative.

1.3 The appraisal module is consistent with demand and revenue calculations undertaken by the relevant NMF modules. Input parameters, calculations and output specifications are consistent with WebTAG and STAG.

Running the NMF Appraisal Module

1.4 The appraisal results form one of the standard set of results output by the NMF. The user specifies the reports from the tree on the left of the user interface in the model. The appraisal module requires two NMF studies to be specified and presents the comparison between them. Generally these two runs should be the test study and a comparator study. In most situations the only differences between the two runs should be the 'change' specified.

1.5 Information contained in Section 4 of this Chapter provides guidance to users on the years for which both the comparator and test study should be run, in order to obtain robust appraisal results.

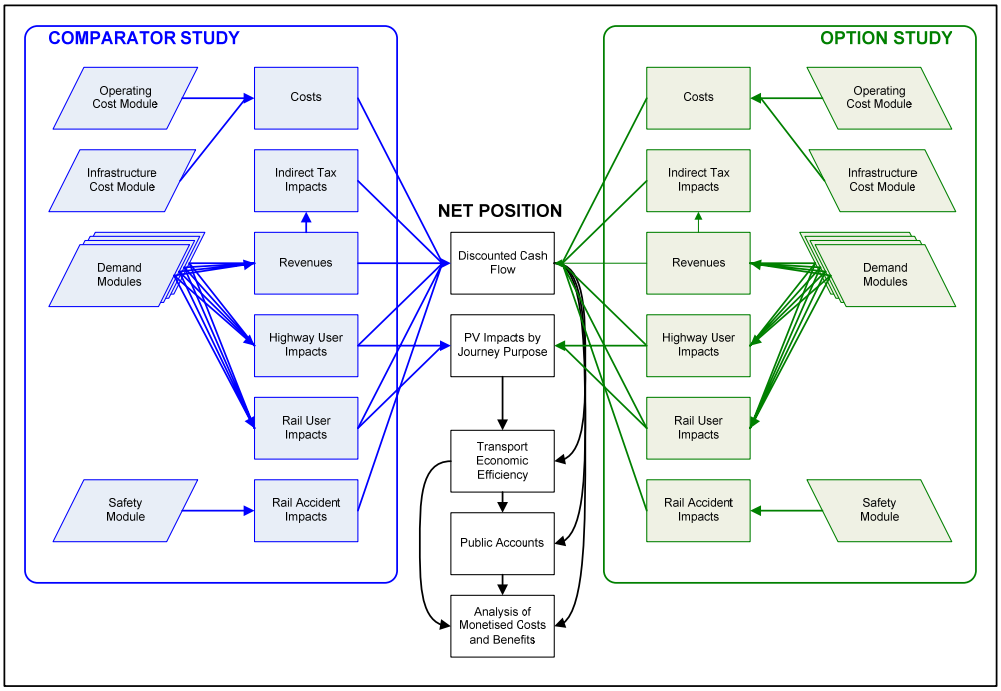
1.6 Five sheets within the Financial and Physicals workbook form the appraisal outputs:

- **Discounted Cash Flow** – the direct output from the NMF appraisal showing the net difference between the two options in each impact category. This sheet provides a useful check of when changes occur and what impact they have.
- **Appraisal by Journey Purpose** – sets out the split of the user benefits into the journey purpose categories of 'Business', 'Commuter' and 'Leisure'. The latter two are combined in the appraisal as the 'Consumer' user impacts.
- **TEE** – Transport Economic Efficiency table in line with WebTAG guidance. The TEE sets out the impact of the tested option on all private sector parties: users; transport operators and developers.
- **PA** – Public Accounts table in line with WebTAG guidance. The PA presents the impact of an option on the public sector in terms of the requirement for capital funding, subsidy or changes in indirect taxation.
- **AMCB** – Analysis of Monetised Costs and Benefits. The AMCB summarises the outputs of the TEE and PA tables and includes non 'economic efficiency' impacts including changes in accident costs or journey ambience (crowding in the NMF) benefits. The outputs of the AMCB are the Net Present Value (NPV) and Benefit:Cost Ratio (BCR) for the appraisal, which show whether the option tested represents public sector value for money.

Description

1.7 A graphical summary of the appraisal module is presented as Figure 1.1. The appraisal outputs are a comparison of two NMF runs: a comparator study and the study being tested. Any two complete studies can be specified in the appraisal module, which will present the incremental value for money case of one against the other.

FIGURE 1.1 APPRAISAL MODULE SCHEMATIC



1.8 The appraisal module undertakes six strands of calculations, set out in the following paragraphs. The resultant impacts from each strand are combined at the end of the process in the option comparison and value for money calculations.

1.9 The appraisal module converts all monetised inputs into standard appraisal units. In line with DfT guidance the appraisal uses 2002 real prices and a discount year of 2002. All monetised inputs are converted into a market prices unit of account. Appraisal is undertaken over a sixty year timeframe from the start of CP4 (April 2009). This appraisal period is fixed and cannot be altered by the user. However, appraisal data for off-line analysis can be extracted for years prior to 2009/10 through the use of model scripts; assistance with this should be requested from the NMF User Support helpdesk.

Costs

1.10 The appraisal module draws annual cost data from two sources: the operating cost module and the infrastructure cost module (ICM). From the former the appraisal takes true service operating costs, excluding the costs of station/track access payments. The ICM supplies rail infrastructure costs including operations, maintenance, renewals and to a limited extent the costs of certain pre-defined enhancements.

1.11 The cost inputs to the appraisal module are disaggregated by strategic route section and by year. The result used in the value for money assessment is the present value (PV) of the difference in costs between two specified options over the appraisal period.

1.12 The majority of costs dealt with by the NMF are frequently/regularly incurred costs with a detailed evidential source; therefore no adjustment for optimism bias or risk is automatically made within the appraisal. Enhancement costs require the specification of appropriate adjustments for optimism bias and risk.

Revenues

1.13 Rail passenger revenues are taken from the demand/crowding modules. Over the period covered by the *External Demand Growth and Fares Module* revenues (and demand) include the impact of specified real changes in fares; post 2030 the appraisal assumes that rail fares are fixed in real terms. The appraisal also takes account of the resulting change in bus revenue, based on the proportion of the change in rail demand abstracted from bus.

1.14 Revenue inputs are disaggregated by Origin Destination (OD) flow, ticket type and by year. The appraisal module converts ticket type to journey purpose by flow type (consistent with the assumptions in the RIFF-Lite external demand growth and fares module).The PVs of the difference in rail and bus revenues between two specified options are used in the value for money assessment.

Rail user impacts

1.15 The appraisal module sequentially calculates the impact of each demand driver (fares, service pattern, reliability, crowding) in terms of passenger benefits, applying the rule-of-a-half to passengers changing their travel behaviour. The change in generalised journey time (GJT) between options is supplied by the demand modules, and monetised in the appraisal module using standard appraisal values of time from WebTAG.

1.16 The GJT impacts for each demand driver are disaggregated by OD flow, ticket type and year. The appraisal module converts ticket type to journey purpose by flow type, using the assumptions specified as an input to RIFF-Lite. The PVs of each impact's difference between two specified options, for each demand driver, are used in the value for money assessment.

Rail accident impacts

1.17 The forecast numbers of fatalities/casualties are supplied by the safety module. Fatalities and casualties are monetised in the appraisal module through the use of standard valuations from the Highways Economic Note No 1 (2001). Rail accident fatalities/casualties and incident costs are disaggregated by strategic route section and year. The result used in the value for money assessment is the PV of the difference in total accident costs between two specified options over the appraisal period.

Highway user impacts

1.18 The impact of mode-shift to/from rail as a result of an option tested is based on changes in car-km travelled. This change is calculated from the change in rail passengers, adjusted to account for the proportion of passengers from highway, vehicle occupancy and the distance travelled. This impact is monetised through the use of a unit rate of benefit per car-km change, derived from the National Traffic Model. Separate rates represent the impacts of mode shift on congestion and on highway accidents. The congestion impact is disaggregated using the standard highway journey purpose split into consumer and business users for presentation in the appraisal output tables.

1.19 Highway impacts are calculated at the demand section level, allowing the equivalent road alternative to be specified more explicitly. NMF has been set up with a single road type; however the appraisal database is set-up to allow future versions of the model to be populated with unit rates for more road types (this is not something that can be done by the user in NMF). The PVs of the difference in highway congestion and accident cost impacts form the required inputs to the value for money assessment.

Indirect Tax Impacts

1.20 Two indirect tax impact calculations are undertaken; these estimate the impact on the level of overall indirect taxation revenue when consumer spending switches between expenditure subject to differential rates of indirect taxation. All the calculations in NMF are in line with WebTAG guidance. Note that such calculations focus on consumer expenditure on final consumption; the impacts on other indirect taxation streams, such as Bus Services Operators Grant, are ignored.

1.21 The first is a result of consumers transferring their spending between the taxed economy and untaxed public transport fares (both rail and bus fares). There is no corresponding impact for business travellers, as VAT paid in the taxed economy can be claimed back by the private sector.

1.22 The second indirect tax impact results from any change in car travel. Around 80% of the cost of fuel is duty; any transfer of passengers between car and rail will change the amount of fuel consumed, and therefore the level of duty received by the exchequer. This calculation is undertaken for both consumer and business travellers as fuel duty cannot be claimed back by the private sector.

Outputs

1.23 The main output from the appraisal module is presented in the tables making up a standard Transport Economic Efficiency Analysis as specified in WebTAG. Three tables are provided:

- a Transport Economic Efficiency (TEE) table summarising the difference between time and cost impacts on passengers and transport operators for a pair of options
- a Public Accounts (PA) table summarising the difference between the requirements for local and Central Government subsidy and on the Exchequer for a pair of options

- an Analysis of Monetised Costs and Benefits (AMCB) table summarising the TEE and PA tables and including the difference in monetised impacts of crowding, reliability and accident impacts for the two options

1.24 The figures presented in these tables are in £million market prices in 2002 real prices and 2002 values. The appraisal represents the difference between any two options, generally one of which will be a do minimum.

1.25 The appraisal output template also includes two further output tables, a discounted cash flow of all parameters over the full appraisal period and a presentation of the PV total demand driver impacts disaggregated by journey purpose. These tables provide the inputs for the TEE etc tables, most impacts using the sum of all years from the discounted cash flow except user impacts (disaggregated into consumer/business users) which use the appraisal by journey purpose table.

Exclusions

1.26 The appraisal module presents only the monetised elements of a transport business case. Other elements of a NATA assessment may also be critical in making a decision on whether to take an option forward, including the impact of the proposals on the objectives of Environment, Accessibility and Integration, and on the sub-objectives of security and wider economic impacts.

1.27 The ICM module forecasts the marginal change in infrastructure operating, maintenance and renewals costs of the options tested, and to a limited extent the costs of certain pre-defined enhancements to the network. Where other network enhancements form part of a test in the NMF, the cost of such enhancement is required to be input manually to the TEE table[1], including appropriate adjustment for risk and optimism bias. A separate assessment of the 'appraisal' cost is likely to be required undertaken by a user competent in economic appraisals; the use of any cost unadjusted for price base, discounting, or indirect taxation will skew the outputs of the appraisal module.

1.28 The TEE analysis is set up to assume that any change in subsidy requirements falls on Central Government. Options with an impact on other sources of public sector subsidy, for example Transport for London, Scottish Executive, Welsh Assembly Government, PTEs, will not be presented accurately in the PA table – however this has no effect on the overall result of the analysis. There is a facility within the PA table[2] to include a local government grant/subsidy impact; a PV value specified in this section of the table will reduce the Central Government subsidy by an equivalent amount.

[1] Cell J21

[2] Cell H9

1.29 The TEE analysis does not automatically include any developer contributions. A facility is provided within the TEE table[3] to specify a developer contribution to the cost of a project – with a corresponding reduction in local/Central Government costs.

[3] Cell I25

2. INPUT PARAMETERS

General Parameters

2.1 The following sets out the general parameters employed in the appraisal module of NMF:

- Discount factor (2002 – 2038) 3.5%, (2039 – 2068) 3.0% - *Treasury Green Book*
- Average level of indirect taxation in the economy 20.9% *WebTAG*
- Real operating cost growth (2030 – 2068) – extrapolated from *Operating Cost Module* final year at constant rate, reduced proportionally by the change in discount rate in line with Green Book guidance after 2039
- Real demand growth (up to 2030) implicitly from *External Demand Growth and Fares Module*, including the impact of real fare increases specified within that module (the default value being +1.0% pa)
- Real demand growth (after 2030) – in line with GDP forecasts from *WebTAG Unit 3.5.6* with an elasticity to demand of 1, reduced after 2039 as real cost growth
- Historic RPI (2002 – 2005) *National Statistics*
  - 2002/03 177.5
  - 2003/04 182.5
  - 2004/05 188.2
  - 2005/06 193.1
- Forecast RPI (2006 onwards) 2.7% from *Operating Cost Module*
- Rail Journey Purpose split (all years) *External Demand Growth and Fares Module* by flow type
- Highway Journey Purpose split[4] (all years) *WebTAG Unit 3.5.6*
  - Business 13.1%
  - Commuting 25.3%
  - Other 61.6%
- Abstraction rates (all years) *NTM*
  - From highway 46%
  - From bus 7%
  - From other 47%
- Car occupancies (all years) *WebTAG Unit 3.5.6*
  - Business 1.20
  - Commuting 1.14
  - Other 1.85

Economic Benefit Parameters

- Values of Time (2002) *WebTAG Unit 3.5.6*
  - Business Rail £36.96 per hour

[4] Used in the disaggregation of highway impacts between consumer and business users in the TEE

  - Commuter £5.04 per hour
  - Other £4.46 per hour
- Real growth in values of time (2003 – 2068) *WebTAG Unit 3.5.6 (see Table 1.1)*
  - Reduced proportionally by the change in discount rate after 2039 in line with Green Book guidance

TABLE 2.1 VALUE OF TIME REAL GROWTH RATES

Range of Years	GDP Growth (% pa)	Population Growth (% pa)	Work VOT Growth (% pa)	Non-Work VOT Growth (% pa0
2002 – 2003	2.25%	0.27%	1.98%	1.57%
2003 – 2004	2.50%	0.27%	2.22%	1.78%
2004 – 2005	3.50%	0.28%	3.21%	2.57%
2005 – 2006	3.25%	0.28%	2.96%	2.37%
2006 – 2007	2.75%	0.28%	2.46%	1.97%
2007 – 2011	2.50%	0.29%	2.20%	1.76%
2011 – 2021	2.25%	0.31%	1.94%	1.55%
2021 – 2031	1.75%	0.20%	1.55%	1.24%
2031 – 2051	2.00%	0.01%	1.99%	1.59%
2051 – 2061	1.75%	-0.06%	1.81%	1.45%
2061 onwards	2.00%	0.00%	2.00%	1.60%

- Costs per casualty (2002) *DMRB Volume 13*
  - Fatal casualty £1,249,890
  - Serious casualty £140,450
  - Slight casualty £10,830
- Real growth in casualty costs (2003 – 2068) *DMRB Volume 13*
  - As real growth in Work VOT
  - Reduced proportionally by the change in discount rate after 2039 in line with Green Book guidance
- Highway decongestion benefit (2002) *NTM* average of all road types and congestion bands weighted by national relative distance travelled
  - Work £0.529 per PCU km
  - Non-work £0.103 per PCU km
- Highway accident savings (2002) *NTM* average of all road types weighted by national relative distance travelled
  - All trips £0.0147 per PCU km
- Fuel Duty Impact (2002) *WebTAG Unit 3.5.6*
  - All trips £0.030 per PCU km
  - Based on average speed of 50 km/h

Update of Parameters

2.2 All appraisal parameters are capable of being updated, either by the user (through the NMF user interface), or by using a change script (either developed by the user or supplied by NMF User support) to update the database.

2.3 The following parameters can be edited via the annual index node (as described in Chapter 8 of the NMF User Guide):

- Post 2030 real demand growth factor
- Discount factor (and real growth adjustment factor)
- Indirect taxation factor (and exchequer impact)

Through the use of these parameters a series of sensitivity tests can be run, for example to establish the impact of a 'no real demand growth past 2030' scenario on the appraisal.

2.4 All other parameters can be updated by running a script which will change the values in the database (the location of the parameters is set out in the NMF Data Model, part of the technical documentation). For example if recommended values of time change, a single script would update these values in the database. An expert user with experience of running database queries could construct a script to update the database, or the user could request assistance from NMF User Support.

3. APPRAISAL FUNCTIONALITY

3.1 This section sets out a more detailed explanation of the calculations undertaken by the appraisal module to convert the inputs received from linked NMF modules into the appraisal outputs. This explanation is provided for reference purposes, principally for economic appraisal experts and other users wishing to gain an in depth understanding of the workings of the model.

Impact of Changes in Real Fares

3.2 The impact of real fare assumptions are calculated from the following inputs:

- Semi-constrained demand (excluding fare impacts) by OD flow by ticket type
- Semi-constrained demand (including fare impacts) by OD flow by ticket type
- Revenue (excluding fare impacts) by OD flow by ticket type
- Revenue (including fare impacts) by OD flow by ticket type

3.3 The change in yield per passenger before and after the fare impacts runs is calculated from the input data. Passengers who do not change their travel behaviour, the smaller of the demand numbers, receive a disbenefit equal to the fare increase (or benefit for a fare decrease). Passengers changing their behaviour, the difference between the two demands, receive half of the (dis)benefit.

3.4 Flows by ticket type are converted to a split by journey purpose using the relationship by flow type defined within RIFF-Lite. All economic impacts remain disaggregated by journey purpose through the appraisal module.

3.5 The impact of ongoing real fare changes is essentially cumulative. The default real fare increase is 1% pa from the base year; therefore by 2010 the impact is equivalent to a one-off increase of 5.1%. The fares calculation is undertaken first in the appraisal and therefore in a comparison of NMF runs with the same real fare assumptions the impact will always cancel out. If changes in real fares occur before a timetable change (even the same change in both options) the different size of the market for travel results in differences in timetable, performance and crowding benefits.

3.6 Changes in real fares are specified in the *External Demand Growth and Fares Module,* covering the period up to 2030. Beyond this date it is assumed that fares are constant in real terms.

3.7 Revenues in the external demand growth and fares module are in real 2005/06 prices. For the purposes of the appraisal the resulting benefit values are converted to 2002 prices. No indirect taxation adjustment is made to these values.

Changes in Generalised Journey Time

3.8 The benefit calculation from changes in service pattern, including journey time/speed is calculated from the demand assignment module, from the following impacts:

- Semi-constrained demand (pre demand module) by OD flow by ticket type
- Semi-constrained demand (post demand module) by OD flow by ticket type

- GJT (pre demand module) by OD flow by ticket type
- GJT (post demand module) by OD flow by ticket type

3.9 The change in GJT resulting from the service pattern tested is calculated from the data. Passengers not changing their behaviour receive the full impact of the time change. Passengers who change their behaviour receive half of the impact of the time change.

3.10 The inputs by ticket type are converted to a split by journey purpose using the relationships by flow type. The total minutes resulting from these calculations are monetised using standard values of time. No further conversion is required.

Changes in Performance

3.11 The benefit calculation for the impact of changes in performance on demand, is based on the following impacts:

- Semi-constrained demand (pre demand performance interface) by OD flow by ticket type
- Semi-constrained demand (post demand performance interface) by OD flow by ticket type
- GJT (pre demand performance interface) by OD flow by ticket type
- GJT (post demand performance interface) by OD flow by ticket type

3.12 The change in GJT generated by the demand performance interface is calculated from the data. Passengers not changing their behaviour receive the full impact of the time change. Passengers who change their behaviour receive half of the impact of the time change.

3.13 The performance demand impact model applies a multiplier[5] (effectively a behavioural weighting factor) to the AML/GJT impacts. The appraisal uses the same weightings for the calculation of benefits for both consumer and business users. This represents a departure from appraisal guidance which specifies that business user's time impacts should not be weighted in the appraisal. There are reasons that this departure is required by the NMF as follows:

- The use of different weightings in the demand and appraisal modules could result in anomalous results – for example an increase in passengers where there is effectively a time disbenefit if no weighting is applied. This example could happen in the case of a service which is retimed with more recovery time to deliver performance benefits.
- The base of all calculations within the NMF is generalised journey time, which implicitly is weighted for time spent interchanging or waiting, implemented through as interchange and frequency penalties by MOIRA as set out in PDFH. It is not straightforward to remove this weighting. This is broadly consistent with the use of weighted performance impacts in the appraisal.

[5] See Demand Assignment Documentation v4 Paragraph 7.17

3.14 The inputs by ticket type are converted to a split by journey purpose using the relationships by flow type. The total minutes resulting from these calculations are monetised using standard values of time. No further conversion is required.

Changes in Crowding

3.15 The calculations of the crowding impact are different from other demand drivers, because they are done on a link by link basis, for different peak types. Where crowding exists on the network it affects some shorter distance passengers for their entire journey, but also it affects longer distance passengers for part of their journey. The NMF crowding module assess the impact on key demand sections based on the total number of passengers (from all OD flows) assigned to that particular link.

3.16 The appraisal module follows current best practice by undertaking calculations on an OD flow basis, allowing the change in passengers to be derived and treated differently (with the rule of a half) to existing passengers. The crowding module translates the link by link demand changes back to the OD flow level using the link allocation table, which specifies the proportions of any OD flow/ticket type on every link. The appraisal module uses the following inputs derived from the crowding module:

- Semi-constrained demand (pre crowding module) by OD flow by ticket type
- Constrained demand (post crowding module) by OD flow by ticket type
- Demand (post crowding module) by demand section by ticket type

3.17 The crowding calculations do not use GJT as an input or produce a change in GJT as an output. This information is derived from the change in demand, as the equivalent change in GJT which would have the actual impact on demand.

3.18 The standard demand formulation is as follows:

$$Demand\_Index = \frac{Demand_{option}}{Demand_{comparator}} = \left(\frac{GJT_{option}}{GJT_{comparator}} \right)^{g}$$

Where ‘g’ is the elasticity of demand with respect to Generalised Journey Time. This formula can be rewritten:

$$GJT\_Index = \frac{GJT_{option}}{GJT_{comparator}} = \left(\frac{Demand_{option}}{Demand_{comparator}} \right)^{g^{-1}}$$

From this formula the proportional change in GJT is calculated. The base GJT (following the performance calculations) is known for each OD flow and ticket type. Therefore the post crowding GJT can be calculated and the change in GJT (effectively giving the relevant change in demand) derived.

3.19 The same method as the earlier GJT can then be employed, after again converting the flows by ticket type to a split by journey purpose. Passengers not changing their behaviour receive the full impact of the time change while passengers changing their

behaviour receive half of the time change. Again the total minutes resulting from these calculations are monetised using standard values of time.

3.20 The difference between the pre-fare revenue (from the external demand growth and fares module) and post-crowding revenue (from the crowding module) is also an input into the appraisal. The total revenues are adjusted to be consistent with appraisal values by converting to a 2002 price base. The proportion of revenue abstracted from bus is calculated at this stage as a fixed percentage of the resulting change in revenue; NMF v1 assumes that bus fares are equal in value to rail fares. This is a simplification of reality, but is considered to be a better representation than excluding changes in bus revenue.

3.21 Both rail and bus revenues are converted to market prices using the average level of indirect taxation in the economy. For consumer users the impact of the switch in spending to untaxed public transport fares is calculated. This impact is of opposite sign for rail and bus for a transfer of revenue from one mode to the other. Separate calculations of the impact for each mode are used in the TEE table presentation, but nets out in the total impact – leaving only the impacts of generated passengers and those transferring from highway.

3.22 The demand from the crowding module at the link section level forms the input to the highway impacts assessment. The pre-fare demand is also converted from OD flow level to link level using the allocation tables. The change in demand resulting from the NMF test run is split by highway journey purpose and then multiplied by the link lengths to give passenger km.

3.23 Rail passenger km is converted to PCU km by factoring by the proportion of highway abstraction and dividing by average car occupancies. The change in PCU km is monetised by using unit rates of decongestion and accident benefits derived from the NTM. The change in fuel duty received by the exchequer is also calculated on the basis of a unit rate of consumption per PCU km from WebTAG[6] standard parameters assuming an average speed of 50km/hour.

Changes in Operating Costs

3.24 The following TOC outputs from the operating cost module form inputs to the appraisal:

- Staff costs
- Rolling stock costs
- Traction costs (including EC4T)
- Commission
- Performance
- Other

[6] WebTAG Unit 3.5.6

3.25 Costs in the operating cost module are in nominal values. For the purposes of the appraisal the base inflation element is factored out of the resulting benefit values, which are converted to 2002 real prices. The costs are converted into market prices by using the average level of indirect taxation in the economy.

Changes in Safety

3.26 The outputs from the safety module forming inputs into the appraisal module are as follows:

- Number of fatalities
- Number of major/serious casualties
- Number of minor/slight casualties

3.27 Fatalities and casualties are monetised in the appraisal by the application of standard casualty valuations. Accident costs in the safety module are in real 2005/06 values. For the purposes of the appraisal the values are converted to 2002 prices.

Changes in Infrastructure Costs

3.28 The following Network Rail outputs from the infrastructure cost module form inputs to the appraisal:

- Operations (including EC4T and long term station charges)
- Maintenance
- Renewals

3.29 Costs in the infrastructure cost module are in real 2005/06 values. For the purposes of the appraisal the values are converted to 2002 prices and to market prices, using the average level of indirect taxation in the economy.

4. DERIVATION OF OUTPUTS

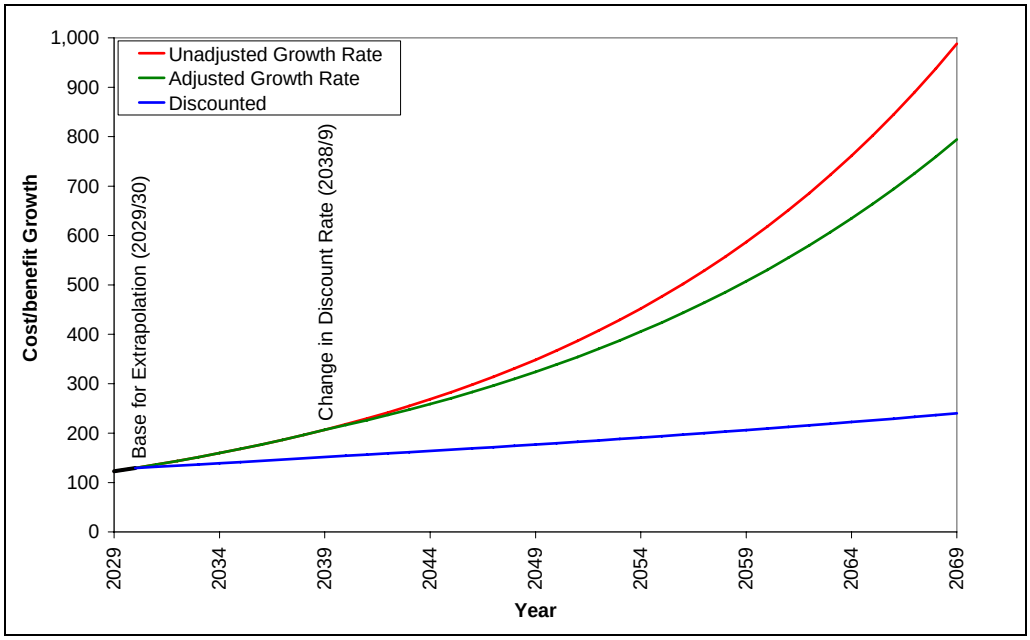
Production of Cash flows

4.1 The NMF model has 5 default forecast years (2004/5, 2009/10, 2013/14, 2019/20, 2029/30) relating to the HLOS and planning horizons, of which all except 2004/5 can be changed by the user (or the final year of the run chosen). Up to nine years can be specified (although increases in the number of years run will be at the expense of runtime). The preset appraisal period is sixty years from the start of CP4, running from the financial year 2009/10 until 2068/69. If it is known that the appraisal is required for the study, ideally the user would run a full 5 year study, including 2029/30, ensuring that there are no significant "gaps" between model run years (even if later years have all the same timetables).

4.2 The model interpolates between model years based on the Compound Annual Growth Rate (CAGR) between adjacent forecasts. Beyond the final modelled period the appraisal extrapolates costs based on the CAGR between the penultimate and final years and demand in line with long-term forecast GDP growth from WebTAG. The resulting real growth rate is proportionately reduced in 2038/39 in line with HM Treasury Green Book guidance. This adjustment ensures that the apparent post-discounting growth rate is not affected by the reduction in public sector discount rate from 3.5% to 3.0% for years thirty to sixty of the appraisal.

4.3 Figure 4.1 presents an example of post 2030 extrapolation showing the impact of the change in real growth rate on discounted and undiscounted cash flows. The growth rate presented is exaggerated in this example to better show the effect.

FIGURE 4.1 POST 2030 EXTRAPOLATION



4.4 The extrapolation relies on the change in the final year of the assessment being only a result of exogenous growth factors. Therefore care must be taken that the 2029/30

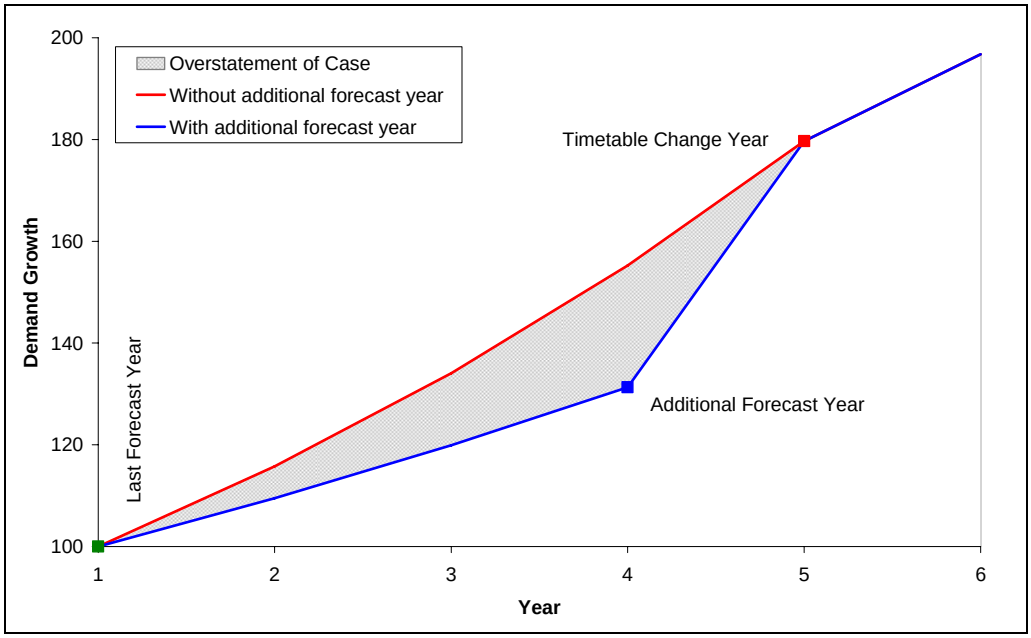
timetable used in the NMF assignment is identical to the previous timetable (which can be as late as 2028/29 with the user specified timetable option).

4.5 The continuing real increase in demand over the latter part of the appraisal is consistent with forecast real growth in values of time and in costs. As a sensitivity test this growth can be switched off, by setting the real growth factor in NMF to unity after 2030/31. There is no specific facility to switch off real growth in operating costs in the model, but this can be achieved by setting 2029/30 cost values equal to 2028/29 values. The extrapolation will then assume no real growth in costs beyond 2028/29 levels.

4.6 Interpolation and extrapolation is undertaken at the input-unit level, for example GJT minutes for user benefits resulting from a change in services. Conversion of the resulting annual impacts, for example monetisation of time impacts, takes place after this stage. All conversion factors including real growth, for example Value of Time growth, are reduced in 2038/39 in line with HM Treasury guidance.

4.7 It is recommended that an additional forecast year is run immediately before a timetable change year to obtain the closest representation of the 'step' resulting from the new timetable. For example, if a timetable change in implemented in 2009/10, 2008/9 should also be run (where the service specification and exogenous factors in this year are identical to those in the preceding years). Figure 4.2 shows the behaviour of the appraisal both and with and without this additional forecast year.

FIGURE 4.2 INTERPOLATION EXAMPLE



4.8 Figure 4.1 shows that without the additional forecast year the NMF assumes that the impact of the timetable is introduced over a longer timeframe, the user impacts occurring before the costs/savings of the change are incurred. This overstatement of the benefits would have an impact on the appraisal results.

4.9 Interpolation and extrapolation are undertaken independently for each of the runs compared in the appraisal. The user specified 'any year' timetable is automatically included in the interpolation; in most circumstances it is not necessary for both runs to include this timetable in the same year, as the interpolation results will be comparable.

4.10 There are two situations where differences between two runs in when the user specified timetable is called have an impact on the results. The first is if the timetable is called in only one run before the appraisal period, for example in 2006 for validation of the operating costs. This has the effect of changing the interpolation points before the first year of the appraisal which impacts on the size of the market; the result of this is differences between the two runs in 2009 of the appraisal, before any changes to the timetable are implemented.

4.11 The second case is if the additional user specified year in one run is between two different timetables that are specified in both runs. The appraisal would show an artificial difference between the two runs, assuming that one follows the blue line in Figure 4.2 and the other the red line.

Output Tables

4.12 The economic benefit calculations can only be based on a comparison of the option tested and a comparator run of the NMF. The cash flow of these values across the years of the appraisal is multiplied by an array of discount indices and summed to give a present value for each impact by journey purpose.

4.13 The total revenue and cost associated with any particular option are used at various points in the NMF; however the appraisal module calculates the net difference in revenue and in cost between the option tested and the specified comparator run. These differences between runs are converted to present values as per the economic benefits.

4.14 Table 4.1 sets out the equivalence between the appraisal PV outputs and the fields in the TEE tables.

TABLE 4.1 CORRESPONDENCE BETWEEN NMF OUTPUTS AND TEE ANALYSIS

Appraisal Field		NMF Output
Transport Economic Efficiency (TEE) Table		
Road User Travel Time	Consumer	Commuter Decongestion impacts Other traveller Decongestion impacts
	Business	Business traveller Decongestion impacts
Road User Vehicle Operating Costs		None in v1
Rail User Travel Time	Consumer	Commuter Service impacts Other traveller Service impacts
	Business	Business traveller Service impacts
Rail User Charges	Consumer	Commuter Fare impacts Other traveller Fare impacts
	Business	Business traveller Fare impacts
Impacts During Construction & Maintenance		None in v1
Bus Private Sector Provider Revenue		Change in Bus Revenue

Appraisal Field	NMF Output
Bus Private Sector Provider Operating Costs	None in v1
Rail Private Sector Provider Revenue	Change in Rail Revenue
Rail Private Sector Provider Operating Costs	Change in TOC Operating Costs Change in NR Operations Costs Change in NR Maintenance Costs Change in NR Renewals Costs
Rail Private Sector Provider Investment Costs	Change in NR Enhancements Costs Manual input of other enhancement (PV)
Rail Private Sector Provider Grant/Subsidy	Set such that TOC/NR impact is neutral
Developer Contributions	Manual input of developer contribution (PV)
Public Accounts (PA) Table	
Local Developer and Other Contributions	Manual input if not all local contribution
Local Government Grant/Subsidy	Manual input of local subsidy (PV)
Central Developer and Other Contributions	If manually input in TEE Table
Central Government Grant/Subsidy	Balance of TEE Grant/Subsidy
Road Indirect Tax Revenues	Change in Fuel Duty paid
Bus Indirect Tax Revenues	Change in Consumer Indirect Tax paid
Rail Indirect Tax Revenues	Change in Consumer Indirect Tax paid
Analysis of Monetised Costs and Benefits Table	
Noise, Local Air Quality, Greenhouse Gases	None in v1
Journey Ambience	Total of traveller Crowding impact
Accidents	Total of Rail Accident impact Total of Highway Accident impact
Reliability	Total of traveller Performance impact

CONTROL SHEET

Project/Proposal Name:	NETWORK MODELLING FRAMEWORK
Document Title:	Appraisal
Client Contract/Project Number:	
SDG Project/Proposal Number:	207032

ISSUE HISTORY

Issue No.	Date	Details
1	28/06/06	Draft for internal review
3	30/06/06	Initial draft circulated to client for comment
4	04/08/06	Updated draft circulated to client for comment
5	06/09/06	Final draft issued
6	December 2006	Minor revisions and corrections to Issue 5
7	June 2007	Update incorporating DfT comments
8	October 2007	Further DfT comments
9	November 2007	Final for NMF v1.3

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