

# Investing in transport: Making the change

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**MTRU**



# Investing in transport: making the change

By Keith Buchan, MTRU

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## Keith Buchan, Executive Director, Metropolitan Transport Research Unit

Keith Buchan has been Executive Director of the Metropolitan Transport Research Unit (MTRU), an independent transport planning consultancy, since 1989. Prior to that he worked for local authorities, including the Greater London Council where he was responsible for implementing the Night and Weekend Lorry Ban. His work has included objectives led assessment, traffic restraint, 'new generation' bus priority, demand responsive transport and heavy vehicle studies. Keith recently completed a draft UK strategy to reduce carbon emissions from transport including aviation and shipping. He was a Government adviser for the 1997 national road traffic forecasts (NRTF) that were part of the original NATA in 1998, and is a member of the advisory group now working on the NATA Refresh.

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Green Alliance

36 Buckingham Palace Road, London, SW1W 0RE

020 7233 7433

[ga@green-alliance.org.uk](mailto:ga@green-alliance.org.uk)

[www.green-alliance.org.uk](http://www.green-alliance.org.uk)

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## Executive Summary

### NATA and its Refreshment

The Department for Transport (DfT) introduced a new transport appraisal framework, the New Approach to Transport Appraisal (NATA) in 1998<sup>1</sup>. Its aim was to reflect a wider range of objectives in appraisal rather than just trade off a few monetised items, such as time savings against capital costs. Objectives were at a high level and could command widespread public and professional support. These were grouped into the following five categories:

- environment, including both local impacts and greenhouse gas emissions;
- economy, where time savings and fuel costs were calculated;
- safety, including accidents and security;
- accessibility, including equality of opportunity; and
- integration.

The last one was quite clearly not an objective in itself, but a process for achieving the others. It was put in to ensure a greater emphasis on a cross cutting, multi-modal approach.

In this sense the original NATA was a move towards a more comprehensive appraisal, and one which included all the impacts of a transport proposal. It was also designed to follow objectives that underwent full consultation and generated a range of options using different techniques (such as demand management) and different modes. This was intended to avoid the “pet scheme” syndrome that lay behind much transport infrastructure proposals.

The outcomes were to be summarised in an intelligible way in the Assessment Summary Table (AST). This was essentially a form of multi-criteria analysis, which tests the cost effectiveness of a scheme in achieving each individual objective and brings the results together in a summary.

The development of this system had started a decade before<sup>2</sup>, and it promised a genuine reform of the appraisal process so that it would become more comprehensive.

In reality, the older system of appraisal was still carried forward for most individual schemes, with elements added on in order to fill in the AST, often without the quality or consistency originally expected. Guidance was produced, and made available on the web<sup>3</sup>. This added much new material but did not set out a comprehensive management of change and replacement of old habits. There developed a double headed problem, some elements in the appraisal hardly changed and still had precise money values, others were poorly assessed or not at all. The guidance was not followed consistently and the old issue of “solutions looking for problems” was not addressed.

In 2007 a review of NATA, entitled the “Refresh” was started with a public consultation, and this process is still continuing. The responses were wide-ranging and fundamental, including the forerunner to this report<sup>4</sup>. There are now a series of reforms, which are

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<sup>1</sup> See *New Deal for Trunk Roads in England*, DfT September 1998

<sup>2</sup> For example the “Goals Achievement Matrix” – GAM - developed in the 1980s

<sup>3</sup> See webtag on: <http://www.dft.gov.uk/webtag/>

<sup>4</sup> *Decision making for sustainable transport*, MTRU, Green Alliance, 2008

either in place, in draft, or undergoing further consultation. These are reviewed in this report, using the experience gained so far, by examining a number of scheme case studies.

Five case studies are included in the main report, covering tram, road, rail freight, bus and cycling. Beyond this, another ten schemes were considered, including four passenger rail infrastructure schemes and four road schemes.

The first observation to be made is that the 2008 MTRU report probably underestimated the extent to which the practical implementation of even the 1998 NATA process had been so inconsistent. This occurred both within single scheme appraisals (with different entries in the AST filled in by different people with varying levels of detail) and between appraisals. The wider trawl of schemes and those considered for the 2008 report revealed that this was a widespread and serious problem.

In fact, a series of Multi-Modal Studies (MMS) had explored some of these issues and produced their own conclusions, some of which had scoring systems for each objective. The Guidance on Multi-Modal Studies (GOMMS)<sup>5</sup> was designed to lead this forward. Unfortunately, even the MMS were mostly predicated on former major road schemes that had become subject to the new system, rather than logical transport corridors. Most of them were completed earlier this decade. Following on from this process, transport objectives were supposed to be developed and achieved through local transport plans, and later through regional transport strategies and funding allocations for schemes within them.

Over a decade after NATA was introduced, it is clear that many very large schemes are being appraised in a way that would be completely familiar to pre NATA practitioners. Favourite local schemes, sometimes with origins both obscure and historical, are still being promoted without a hint of a strategic context, or going back to consider real objectives or real alternatives<sup>6</sup>. The way in which these should have been prepared has been clearly set out in guidance, but there has been little monitoring of whether it was being followed.

Small time savings to motorists, despite the precarious justification (and little evidence) for a few seconds being of any value whatsoever, still dominate scheme benefits, including some for public transport. Greenhouse gas emissions currently have hardly any impact on most transport appraisals.

There has thus developed a major disconnect between the clear purpose of the original NATA and its impact on the world of transport appraisal. This report explores this further and reviews the ongoing process of refreshing and reforming NATA. It also suggests a small number of important changes that would address some of the key residual problems.

The main aim is to achieve better value for money, especially important in the current economic climate. Many schemes that are not cost effective, and are even counter productive to Government objectives, have been or are being funded. The reforms are therefore not simply academic.

The key reforms relate to:

- greenhouse gas emissions;
- alternative means of achieving objectives;

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<sup>5</sup> Published by DETR, 2000, see webtag unit 1.2 on:  
<http://www.dft.gov.uk/webtag/documents/overview/unit1.2.php>

<sup>6</sup> This is clear in the CBT analysis of Regional Funding Allocations (RFAs) in 2009

- time savings; and
- dependence on far distant benefits to fund current costs.

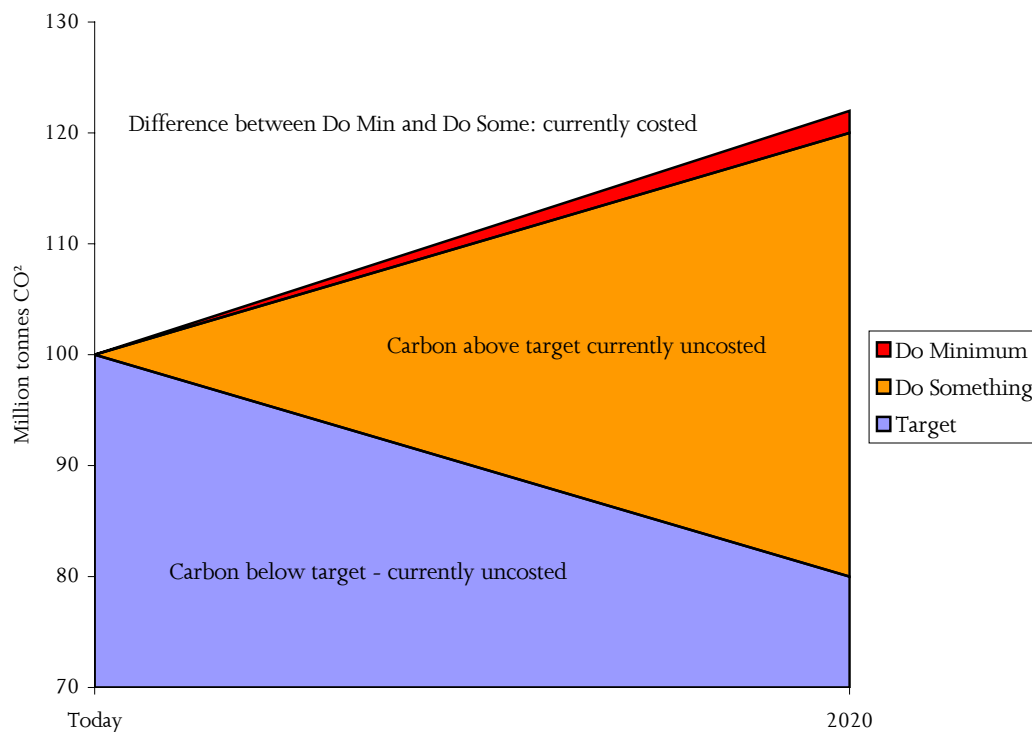
These are summarised below and explored further in the rest of this report.

### Greenhouse gas emissions

These are not properly represented, as at the moment only a very small amount of carbon is costed. The amount of carbon assessed is often a tiny fraction of the true impact of the scheme, which is the amount of carbon produced in excess of climate change targets. The reason for this is that the scheme is compared to a future scenario (called the ‘Do Minimum’) that usually fails by a considerable margin to achieve the climate change targets. It is only this failure that makes the scheme look acceptable.

Instead, **all** the carbon emissions produced in a future with the scheme, which are in excess of the level set to comply with the transport sector’s share of the target set under the Climate Change Act, should be costed. Recent increases in the cost of carbon do not address this. The point is illustrated in the chart below.

Figure 1: Which carbon is costed in NATA?



The cost of climate change should also be added to the capital cost of a scheme, not traded off against time savings as at present. If carbon permits had to be bought to compensate for a scheme producing excess carbon, these would have to be purchased by the scheme promoter.

## Alternative means of achieving objectives

As part of the process of moving to an objectives-led process, alternative ways of achieving results, including demand management as well as different modes, were supposed to be considered. These alternatives should be compared with each other before any 'preferred scheme' was selected. Apart from the early attempts in the Multi Modal Studies, now almost a decade old, this is hardly ever done and is a major failing that is widely recognised in the profession.

The DfT has engaged consultants to review this, and proposals to strengthen the guidance have been published for consultation. In fact the guidance is already pretty clear; it is the difficult and critical issues of monitoring and enforcement that have not yet been resolved.

## Small time savings

The value of small time savings (less than 3-5 minutes) is not supported in the evidence base currently used by the DfT. While an average value is still being applied to all sizes of time savings, the NATA Refresh proposes that the size should be reported.

This will have very little impact unless specific action is required in the appraisal. A simple sensitivity test which omitted all time savings below, for example, three minutes and then five minutes, from the appraisal would reveal exactly how sensitive a scheme was to this externally imposed average valuation. Such schemes would rank below those that were not sensitive to very small time savings. This would be recorded in the AST user benefits section.

## The length of appraisal periods

In recent years these have been doubled, to at least 60 years. This was done because inflation and interest rates fell and benefits between 30 and 60 years from now became more valuable in today's money.

Very little thought seems to have been given to the side effects of this decision on transport appraisal. It means that people today are being asked to pay or suffer major financial or environmental costs to achieve time saving benefits for people several generations away. In economic theory, the groups who benefit should be willing to pay the sufferers more than their cost<sup>7</sup>. This becomes less and less plausible in the case where the cost group, to put it bluntly, will mostly be dead when the benefit group sees the time savings.

There is another issue. Do we really know what value people will put on their travel time in 2070? If we think back 60 years, the world had just fought a world war, there were only a handful of computers in existence, and they, like radios and the newly emerging black and white televisions, used valves. Passenger travel was dominated by rail and public transport (60%) and cycling had ten times the mode share of today (12%)<sup>8</sup>. We are in the early stages of a change to transport and communications (through the internet and mobile phones) probably more significant than the introduction of the motor car. Assumptions about the interaction between human beings and technology which take us even 30 years hence are uncertain enough.

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<sup>7</sup> This is the whole basis of the cost benefit analysis used in transport and elsewhere – see *Decision making for sustainable transport*, MTRU, Green Alliance, February 2008, Chapter 3

<sup>8</sup> These are actually for 1952, from *Transport Statistics Great Britain*, 1991 edition.

In fact, time saving benefits are simply increased in line with economic growth, which is assumed to grow over the 60 years.

Surprisingly, a summary of the time profile of such benefits is rarely given in transport appraisals. It may be available in a computer print out from the modelling<sup>9</sup>, in an appendix to an economics report, but even then it has to be manually calculated. A key value for money question in the real world is “how soon do I get my money back?” and this is not currently addressed.

One interesting side effect of the extended benefit period is that all schemes which have any net benefits (ignoring costs) in year 30 simply go on clocking them up. This causes one of the key standard measures for appraisal, the ratio of total benefits to total costs (Benefit to Cost Ratio – BCR) simply to get much bigger.

Originally, BCRs were put into one of four categories:

- Poor – less than 1
- Low – between 1 and 1.5
- Medium – between 1.5 and 2, and
- High – over 2.

A less than one score meant that benefits were lower than costs and there would have to be very powerful non-monetised reasons for proceeding. Below 2 was considered weak.

It has been hard to obtain much data on this, but it appears both in logic and in the limited examples that the extension of the benefit period has a significant impact on the BCRs of most schemes. It is not entirely clear but is likely that this is one of the key reasons why the DfT have had to create (April 2009) a new “Very High” category. Discrimination was becoming difficult, with most schemes approved (95%)<sup>10</sup> in the “High” category. The elevation of the BCRs due to the longer time scale is a concern as these benefits carry a different and far higher level of risk. Currently they are discounted at 3% and 3.5% but this is hardly a true representation of uncertainty.

Thus a second test which should become standard is the calculation of the benefits compared to costs at different times in the scheme’s life, and this should be shown as a simple chart annexed to the AST. The AST would describe the chart and give a snapshot BCR at 20 and 40 years as well as 60. To put this in context, modelling is not usually continued beyond 25-30 years.

There are alternatives to this solution, such as increasing the discount rate over time, or removing the growth rate, to represent uncertainty, but this is more complex and would take more time to implement. Meanwhile schemes with high risk benefits would continue to be favoured.

In the above proposal, the BCR score at all three times should be reported, and schemes which relied on distant future benefits would be considered to perform less well than those which gave a more certain return.

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<sup>9</sup> Nowadays usually TUBA

<sup>10</sup> 2004 Spending Review, reported in NATA Refresh, DfT April 2009

## Public transport schemes

One conclusion from the process of identifying case studies was an additional problem in relation to public transport schemes, in particular passenger rail outside urban areas. Some of these would clearly have significant impacts in terms of mode switch. This would in turn lead to high carbon and congestion benefits.

In urban areas, a multi-modal transport model may be available which could identify these. However, elsewhere such models would take considerable time to build, requiring major new data collection. The cost would also be very high. Thus if an investment scheme makes a sufficient return for there to be a strong business case without such benefits, it is not worth calculating them. This means that the candidates for passenger rail case studies do not have comparable data to the other schemes for such benefits, and so they are not included in the report.

The rail freight scheme used average congestion and carbon savings per mile for the traffic assumed to transfer from different types of road, taking into account the levels of congestion (the Sensitive Lorry Miles costs and benefits<sup>11</sup>). Thus comparable data could be obtained.

However, this does mean that some published BCRs for public transport schemes, in particular rail schemes outside urban areas, have BCRs which underestimate their value for money. Some of these are significant in size.

One approach might be to use a comparable table to Sensitive Lorry Miles for the carbon and congestion impact. This would still require a broad brush estimate of the transfers from car. However, this could be done for car trips using an elasticity based approach in a spreadsheet model. This is an area where more work is needed. In the case where a financial case has been made on operating costs alone, at least an indication of carbon and congestion costs would help decision makers in allocating limited resources.

## Conclusion

In several key areas NATA needs further reform. Some of this has begun however investment decisions are still being made which fund schemes that completely fail to achieve some objectives, and some that rely on highly uncertain benefits. Urgent action is required to avoid any future misallocations of expenditure. All schemes, including those which have passed the Major Business Case stage, that have not yet been finally approved should be reviewed in the light of the issues identified in this report.

This report suggests three immediate changes to appraisal that should be applied in the above scheme review:

- costing of all greenhouse gas emissions above the transport sector reduction target, not a comparison with emissions under a completely unrealistic 'Do Minimum' scenario;
- clear implementation of the objectives led process including the preparation of genuine alternatives and packages – if this has not been done schemes should be sent back to promoters;

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<sup>11</sup> The SLM table has entries for various external costs and benefits by type of road per mile transferred. It is being replaced by a similar table for "Mode Shift Benefits" – MSB – in April 2010. See: <http://www.dft.gov.uk/pgr/freight/railfreight/modeshiftben/>

- pending further research, all appraisals should include a test for the sensitivity to the size of time savings. This would involve producing BCRs with small time savings omitted, publishing them in the AST and taking them into account when deciding which schemes to approve; and
- all appraisals to publish a benefit profile in the AST, with BCRs at 20 and 40 years as well as 60, again ensuring that they are taken into account in any approval decision.

In the longer run, the issues of the uncertainty of costs and benefits beyond 20 and 30 years, including time savings and real carbon values, needs further work. Simply continuing costs and benefits from early years over such long time periods is unsafe.

The DfT needs to be more proactive in ensuring that people understand and implement appraisals consistently and follow guidance.

Attention needs to be given to producing a simple method to estimate public transport scheme benefits from mode transfer where multi-modal models are not available.

## 1 Introduction

The New Approach to Transport Appraisal (NATA) was launched in 1998 with the aim of providing a new multi-modal approach to transport planning. Inherent to this idea was the assessment of transport schemes and packages against the government's key objectives for transport, and quality of life. This would have included within it the pre-1998 system that used the transport version of cost benefit analysis<sup>12</sup>. In this system, only the impacts that could be given money values were included, such as time savings or accidents. Even these money values were subject to considerable uncertainty. It was thus designed to implement, at least in part, a form of multi-criteria analysis for transport. It is based on finding the most cost effective way of spending to achieve clear objectives.

This ambition has not been fulfilled for a number of reasons. First, due to inherent and continuing problems with the cost-benefit appraisal itself, and second, because the guidance is often not implemented as it should be, as the larger process, within which decisions are made, is flawed. The Department for Transport was aware of issues with the system and started a review (known as the Refresh) in 2007. These two points were both raised by many respondents to the consultation undertaken as part of the Refresh process.

This review is now generating changes to the appraisal process, with a new version of NATA published in July 2009 (to be called NATA 2 in this report) and further changes out for consultation. Almost all of these changes will lead to improvements in the NATA methodology and in its transparency. Many of them relate to the problems in our earlier report on this topic<sup>13</sup>. However it is still not clear how the review will address some of the larger issues within the process of transport decision-making, and there is a sense that the big issues have yet to be finally settled, including how to address climate change, social distribution of benefits, and wider economic impacts<sup>14</sup>.

This report contributes to the reform of NATA by highlighting some of the broader remaining problems with transport decision-making through the use of a number of case studies.

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<sup>12</sup> Entitled COBA

<sup>13</sup> *Decision making for sustainable transport*, MTRU, Green Alliance, February 2008

<sup>14</sup> NB Climate change is the next major issue on which the DfT have said they will provide further draft guidance.

## 2 Implications of the changes already proposed to the NATA model

In this chapter we consider the details of both the changes already proposed by the Department for Transport (DfT), as published in July 2009, and additional changes that we recommend on top of these revisions.

We are focusing here mainly on changes to the cost-benefit analysis part of the appraisal process, but it is important to remember that this should only be undertaken in the context of two other elements. The first is the strategic policy fit, and the other is assessment against deliverability (including affordability).

There is a strong argument for testing policy fit first, on the grounds that it would avoid a lot of detailed work on schemes which achieve a high score in a cost benefit analysis, but run contrary to overall policy. We explore the implications of this on reducing greenhouse gas emissions later in this report.

Below we concentrate on reform to the cost-benefit analysis process itself. This model puts a value on most of the costs and benefits of a particular scheme, from the simple cost of materials and labour to a value on the noise pollution it causes. It sums up these costs and benefits and produces a simple assessment summary table (AST) of them all, and a single figure. The higher the figure, the better value for money a scheme is deemed. It is invariably this figure and table that a decision-maker uses to decide which transport scheme to support (alongside the broader assessment of strategic policy fit and deliverability mentioned above). It is the key engine in transport decision-making.

Box 1 summarises the key changes we recommended to NATA in our first report on this topic. Below that we summarise to what extent each change has been addressed to date.

## Box 1 Key proposals

### Transparency and consultation

The transport appraisal guidance website (webtag) was strongly supported and should now be better used by practitioners. Greater engagement with appraisal users of all types through meetings and the internet was also proposed.

### Climate change

This objective was different in kind to other factors and needed to be treated more as a “pass/fail” test – it had only a weak impact on appraisal in NATA.

### Testing against alternatives

This was clearly stated in webtag and in treasury guidance but was hardly ever done properly (or at all). This needed to be an absolute pre-condition before any scheme could be finally assessed for value for money.

### Move to cost effectiveness

Levels of achievement compared to cost should be used, rather than putting money values on all factors.

### Avoid excessive monetisation

Use of cost effectiveness could avoid problems such as trading off the value of time savings against damaging a unique landscape. This is an example of where monetisation cannot capture the real impacts that are needed for a full appraisal.

### Avoid distortions caused by tax losses

When less fuel is used, fuel tax revenue is lost and in NATA this was added to the capital cost of schemes. This meant that schemes that reduced fuel most were performing badly in the cost benefit analysis. This could be corrected by putting tax in the same category as other costs and benefits and was a major proposal in the first report.

### Are time savings usable?

Another issue considered in detail in the first report was the evidence (from the DfT’s own research) that small time savings for road users (below a few minutes) were not valued by private individuals or businesses. They did place a value on larger time savings. This reflects common sense – small differences would be lost in the daily variations of travel time. The research did not consider public transport where services are timetabled and savings are guaranteed.

### A fuller picture

In many ways excessive monetisation was concealing a scheme’s impact. For example a summary figure in £ over 60 years for a scheme’s benefits could conceal whether this was a large number of very small time savings or a smaller number of big time savings. The social distribution of costs and benefits was rarely considered in any detail. One further issue is the timing of benefits in relation to their certainty. Some schemes have a majority of their benefits between 30 and 60 years from now, and this needs to be fully set out in the appraisal.

### Improve Appraisal Summary Tables (ASTs)

The individual entries in the Table were being compiled by a range of different people and varied hugely between schemes and within individual tables, both in terms of quality and consistency. There should be less emphasis on a single money figure and more on accurate description of the impact. A major initiative including training, monitoring and enforcement was needed in any case.

## Changes to NATA already proposed by the DfT or awaiting further consultation which address these issues

The first DfT revisions to NATA were published in April 2009<sup>15</sup>. The report contains the following specific proposals:

### Greater transparency and consultation

The Department is committed to publishing draft proposals for new guidance on the webtag site, is rationalising the dates for formal changes to guidance, and has set up an informal group of experienced users. There is ongoing discussion about an internet forum for all users.

### Dealing with climate change

New values for carbon have recently been published by DECC, so attention now must be given to how these values are used and their relationship with achieving targets. This work is continuing and major proposals are planned for the end of 2009. This issue is explored in detail in this report and its case studies.

### Testing against alternatives

As part of the process of moving to an objectives-led process, alternative ways of achieving results, including demand management as well as different modes, were supposed to be prepared. These should be compared with each other before any “preferred scheme” was selected. Apart from the early attempts in the Multi Modal Studies, and some recent public transport schemes, this is hardly ever done.

The DfT has engaged consultants to review this, and proposals to strengthen the guidance have been published for consultation<sup>16</sup>. In fact the guidance is already pretty clear, and yet the difficult and critical issues of monitoring and enforcement have not yet been resolved. Again, this is an area of concern for this report and its case studies.

### Indirect tax, such as fuel duty, will be treated differently

This is one of the most important changes that has been proposed so far, and will have a major impact on benefit-cost ratios (BCRs).

Currently, if a consumer (this includes businesses) uses more or less fuel, NATA puts this in the same cost and benefit “pot” as time savings, at the full price including tax. This is called “market pricing”.

However, the tax gains or losses are put in the capital cost “pot” in the appraisal. The problem occurs when the benefit to cost ratio (BCR) is calculated, because this is based on comparing the consumer pot to the capital cost pot. In a case where fuel use is reduced (an outcome which usually supports Government policies) the capital cost rises and the BCR falls.

On the other hand, if a scheme causes more fuel to be used, the new tax income reduces its capital cost.

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<sup>15</sup> NATA Refresh: Appraisal for a Sustainable Transport System, DfT, April 2009

<sup>16</sup> See <http://www.dft.gov.uk/webtag/docs/project-manager/overall/2.1.2c.pdf>

If only the net benefits were counted (i.e. total benefits minus total cost) rather than a ratio, this would not matter. However, most decision makers look at the benefit to cost ratio (BCR) which fluctuates significantly according to where the tax is positioned. The new proposal is to move the change in tax income to the same place as the tax element in the costs to transport users. This simple change, however, is not to be fully implemented until April 2010.

Overall the new approach (NATA 2) should eventually avoid some of the worst cases of bias, examples of which were identified in the first report. Schemes which actually increased fuel use were favoured, while public transport schemes which reduced fuel use and tax income suffered. The position of the tax change in the cost and benefit table was influencing the apparent value for money.

The theory behind the change is discussed at some length in the NATA refresh response document<sup>17</sup>, although this does not address the underlying contradiction of using revenue over 60 years to reduce up front capital costs. The conclusion is nevertheless that tax will be accounted for in the same part of the assessment as other costs and benefits, which should improve the accuracy of value for money appraisals.

### Moving to cost effectiveness

The discussion around using levels of achievement compared to cost appears to have receded since it was raised in the first stage of the Refresh.

However, the new policy objectives from the Government's "Delivering a Sustainable Transport System"<sup>18</sup> (DaSTS) are being introduced. For example, there is now a high value placed on health benefits from cycling and walking which has boosted the appraisal scores of such schemes. In a sense these values try to deal with the problem of attaching artificial money values to all factors.

The DaSTS objectives are summarised below in box 2.

### Box 2: DaSTS objectives

Towards a Sustainable Transport System proposes a revised set of objectives for NATA. These are:

- **competitiveness:** maximising the overall competitiveness and productivity of the national economy, so as to achieve a sustained high level of GDP growth.
- **climate change:** reducing transport's emissions of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases, with the desired outcome of avoiding dangerous climate change.
- **health:** contributing to better health and longer life expectancy through reducing the risk of death, injury or illness arising from transport, and promoting travel modes that are beneficial to health.
- **quality of life:** improving quality of life for transport users and non-transport users, including through a healthy natural environment, with the desired outcome of improved well-being for all.
- **equality:** promoting greater equality of transport opportunity for all citizens, with the desired outcome of achieving a fairer society.

<sup>17</sup> NATA Refresh: Appraisal for a Sustainable Transport System, DfT, April 2009

<sup>18</sup> "Delivering a Sustainable Transport System", DfT, November 2008

These are to be reflected in a revised version of the Assessment Summary Table (AST).

### Monetisation to be extended

The idea of placing money values on all factors is still prevalent and will cause problems as the values use more and different methods to derive the price of a range of social and environmental “goods”. The DfT is already producing “adjusted” BCRs which apply values, for example to landscape, which are less well established than other values, for example time savings.

The old problems of trading off non-comparable impacts have not yet been addressed. Other problems include how to deal with uniqueness, and how to deal with the value of something existing even if people do not use or visit it (sometimes called the option value). However, there are some moves to look beyond pure monetisation (see time savings below).

### Value of time savings

The DfT has not accepted that small time savings should be valued at a lower or zero level. However, whether time savings are small or large is to be reported in appraisals, although still valued in full whatever their size. The implications of this and exactly how the information will influence decisions have not yet been spelled out.

This issue is explored in more detail in section 2.2 and Chapter 6.

### A fuller picture

As well as reporting the size of time savings, some indication of “who benefits where” is also planned – initially showing a map of where the journeys which benefit most start. This will enable a check to be made against the social conditions (including income) that prevail in the areas that benefit. There are some issues, for example a lot of journeys do not begin from home but from work. However, this will begin to provide information on some of the social distribution impacts from transport schemes.

### Improve Appraisal Summary Tables (ASTs)

The Assessment Summary Table (AST) is to be aligned with the objectives in *Delivering a Sustainable Transport System (DaSTS)* but the proposed draft AST is more complex and in some areas less well defined than at present<sup>19</sup>. Some of the key issues raised by the new proposals are:

- Land use integration would be removed from the AST and replaced by the much more limited “support the delivery of housing”. Demand for transport is created by the disposition of all land uses, not just people’s homes but where they work, or go for shopping, leisure or education. In addition, this needs careful definition since it could easily lead to double counting for example where a road link saves travel time between land uses and this is counted in the economic benefit objective.
- Putting values under “wider impacts” is still a controversial area – this includes concepts such as “agglomeration”, for example assessing the benefits of bringing businesses closer together. The real value and where it is relevant still requires

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<sup>19</sup> For example, what is to be entered under the “resilience” score in the AST? Is this just providing spare capacity – in itself bad value for money since by definition it will be under used?

much further work. It is complicated by the concept of “FURS” – Functional Urban Regions” - which are key areas where agglomeration is proposed. There may again be potential for double counting with time saving benefits added to “wider” benefits of time saving. It should be noted that time savings were for some time considered to capture all the economic benefits of a transport scheme.

- As well as the positioning of tax revenues (see above) there is another bias against bus based public transport schemes that has not yet been fully resolved. This can arise because the proportion of business travellers and their time values are both lower for bus users. Because of an earlier simplification to NATA, people who change modes who were assigned a high value for their time, have their value reduced if they transfer to bus. There are other complications introduced by what was intended to make calculations simpler. A move towards using the same values for all users, at least for a sensitivity test, would illuminate this issue for decision makers.

### Use of the Benefit to Cost Ratio (BCR)

In addition to considering the AST, the Department has introduced a new “very high” category for BCRs of over 4. There is some contradiction here, since the Refresh (and webtag) warns against over reliance on the BCR. In fact, it may well be that the additional benefits from using a 60 year time period rather than 30 years has, as might be expected, simply raised all the BCRs and made a new classification necessary.

It is important that the DfT guidance sets out clearly that the role of BCRs has been much overemphasised, and that this can lead to problems, for example leading to the dominance of time savings in all appraisals and diminishing the importance of the underlying objectives.

## Outstanding issues that still need to be addressed within the cost-benefit appraisal

### Climate change

This is a key issue, and is the next in line for attention from the Department for Transport's NATA refresh team. Treatment of climate change under NATA is crucial for delivery of the DfT's obligations under the government's new carbon budgets and its objectives under "Delivering a Sustainable Transport System" (DaSTS). The Government targets for transport have been set out in "Low Carbon Transport: A Greener Future", published in July 2009. The box below sets out some of the key features of the UK approach to reducing emissions nationally and from the transport sector.

The climate change target itself differs from other targets in that its achievement is considered necessary rather than desirable. Failure in this policy area has a qualitatively different impact too, for example, failing to improve travel speeds or reliability.

In this context, it might therefore be expected that particular attention would be paid to climate change targets when assessing the costs and benefits of transport spending. The fact that transport schemes are now assessed over a 60 year time period, well beyond the 2050 climate change target date, seems to support this. Many of the schemes currently undergoing appraisal will not open until 2015, close to the 2020 target date.

Surprisingly, the importance of greenhouse gas emissions in transport appraisal is at a very low level. There are several factors at work, but the most important one is relatively simple. Schemes are compared to a future without the scheme (the Do Minimum). This future itself may completely fail to reduce emissions. Therefore, if the scheme (known as the Do Something option) also fails to reduce emissions, it may still achieve a similar result to the Do Minimum. It is only the marginal difference between the Do Minimum and the Do Something that is used in the appraisal. Usually this is small.

In fact, it is the amount of carbon emitted that exceeds Government targets that should be included in the appraisal (it is already measured in most transport models). This would transform the level of seriousness applied to emissions in appraisal.

The current system is plainly misleading, since it produces appraisals that would fund schemes that resulted in the UK transport sector failing to achieve its target carbon reductions.

Remarkably, many schemes do not even report present day transport emissions in the AST, let alone the normal climate change base year of 1990.

### Box 3: Targets for reduction in emission from transport

There is now a clear framework for emissions reductions in the transport sector provided by the Climate Change Act. This Act set up the Committee on Climate Change (CCC) which submits formal advice to government on the level of five-yearly carbon budgets which place legally binding ceilings on the level of allowed UK emission. In its first report, the CCC has advised on the level of the budgets for 2008-2012, 2013-2017, and 2018-2022.

The reason for setting budgets is that achieving the targets at a specific date is insufficient to meet the challenge of climate change. Emissions stay in the atmosphere for considerable periods of time (over 100 years in the case of CO<sub>2</sub>) and it is in fact the total emissions within a given period that determine the degree of climate change. Achieving the target at the last possible moment while permitting high levels of emissions in the interim periods would completely fail to stabilise or slow the rate of growth of the level of greenhouse gas in the atmosphere.

The five-year budgets allow some flexibility and adjustment, but keeps to a tighter reduction profile than the two target dates and creates a means of monitoring progress.

Apart from aviation (and potentially international shipping) transport is in the non-traded sector, which means that reductions in the transport sector will be policy led<sup>20</sup>. Transport represents over half of the emissions in the non-traded sector. The latest reduction plan from the DfT<sup>21</sup> is heavily reliant on technology and biofuels, but confirms that emissions from road transport will have to be reduced by 20% between 2007 and 2020. The emissions used to produce biofuels and to refine fuels are however **not** included in the transport emission figures. Neither are the biofuel production emissions included in the agricultural sector, and it is possible they have fallen out of the balance sheet altogether. Behavioural change is expected to make a major contribution but a method for the precise calculation of its carbon impact has not yet been agreed.

In fact, it is unthinkable that an increase in emissions would fit with Government or regional policy. Any such prediction should trigger urgent investigation into an alternative option which would fit within the target. However, there is no encouragement for schemes to reduce carbon because the transport appraisals only score the marginal difference between Do Minimum and Do Something. This results in entries in the AST as small amounts of benefit or cost, and a “no change” or “slows down growth in emissions”. The latter is usually scored as “positive” even though the best prediction of the future with the scheme increases emissions compared to today, rather than reducing them to the target level. This should in fact be scored as strongly negative and the carbon costs should be very high.

In many cases the Assessment Summary Tables do not even mention whether the future without the proposed scheme (the “Do Minimum” option in the appraisal) and the future with the scheme (the “Do Something”) are in line with national emissions targets for 2020 or 2050.

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<sup>20</sup> Aviation will be included in the EU Emissions Trading Scheme (ETS) from 2012 and there are discussions about the inclusion of international shipping. Road transport is unlikely to be included in any future emissions trading scheme.

<sup>21</sup> Low Carbon Transport: A Greener Future, DfT July 2009

This issue is very clear in the case studies (and the wider group of cases) and the webtag guidance needs to be changed to ensure that schemes are not compared to futures which to run unchecked. This is linked to the failure of scheme proposers to produce alternative ways of achieving objectives. Instead, an unrealistically carbon intensive future is used as the base for comparison. This is in fact not a “Do Minimum” but a “Business As Usual” scenario.

This objective is perhaps the easiest to understand, the goal is to avoid the worst impact of climate change and adapt to the changes already happening through our current and historic emissions. It is, however, yet to be included at the heart of most transport appraisals.

We consider the basis for factoring carbon emissions more fully into decision making in Chapter 11.

### The dominance of time savings

Time savings to motorised road users dominate the impacts in most transport appraisals. In relation to road schemes this is no surprise, but it is also the case that public transport and even rail freight schemes have their appraisals powerfully influenced by travel time savings to car and lorry users. This is often in a way that would cause them to pass or fail DfT criteria. This is explored further in the case studies in this report.

### Are time savings real?

This might not be as serious a problem if the savings were literally that – real money flowing in within the immediate period following implementation. However, the value of the savings do not appear in any real world balance sheets, or household budgets, and thus are never tracked or audited. In fact, private user savings are based on surveys of what people say they would be willing to pay to save time, and business time savings are based on estimates of the average costs of employee’s working time, again with no consideration of whether it can actually be used.

This is complicated further by the fact that people use potential journey time savings for other purposes. The National Travel Survey<sup>22</sup> has for years tracked how the time spent travelling has stayed fairly constant, and that making journeys faster has simply allowed people to make them longer. It has also allowed for more dispersed patterns of land use with facilities, such as shops and healthcare, getting bigger and fewer. This has had the unfortunate side effect has been to reduce the self sufficiency of local communities and the ability to access local facilities without driving.

This valuation problem is not the end of the story. The value of time is measured over 60 years from the date of implementation of any transport scheme. It rises with forecast GDP, while being “discounted” to represent factors such as uncertainty and people placing a lower value on future savings. This long time scale is in itself worth considering, given that most of the people paying for transport today will be dead by the time that the benefits arrive to justify them paying for it.

In transport, these long time horizons, which depend on underlying forecasts for items such as GDP, population, housing and social structure and human behaviour, have introduced massive uncertainties into the procedure that are largely unrecognised.

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<sup>22</sup> The National Travel Survey (NTS) is a household survey undertaken annually designed to provide a databank of personal travel information for Great Britain.

This is additional to the high level of uncertainty given to the time values themselves. The surveys on which they are based did not show a uniform result. It was not clear whether people or businesses valued small time savings of less than a few minutes at all. This appears entirely in line with common sense.

The problem is that most schemes produce small savings, and it is only the large number of users over the large number of years which produces the apparent benefits. These are, of course, represented in pounds at today's prices.

### Pricing other elements

The problem of a single item dominating the appraisal has been indirectly addressed by putting similar prices over the same time frame on to impacts such as noise, accidents, and more recently health. The term "wider economic impacts" has been coined to cover some of the effects which are apparently not captured by the time savings. None of the costs so far used have approached the level of the time savings in the majority of schemes and the problem has thus remained.

One issue is that the health benefits of cycling schemes are now being included in appraisals. Logically, the mirror image of this, the health disbenefits of using motorised forms of travel, are not counted. Locking in such behaviour does have a cost and this also needs to be addressed in the further reforms.

### Sensitivity testing

The internal DfT testing of scheme appraisals where there are major uncosted elements (landscape is a common example) was set out in the recent NATA Refresh. The DfT regularly puts a value on these uncosted elements to see its impact on the BCR.

This appears in strong contrast to the high levels of mathematical complexity, requiring extensive computer analysis, which are present in the other areas of transport forecasts and appraisals. In addition it does not address the issue of whether any constraint (for example not damaging a unique landscape) can be given a price and thus be traded off against other benefits such as time savings. This issue was discussed at length in our original report, and the conclusion that there are certain things that simply cannot be traded<sup>23</sup> remains the position of this report.

However, the principle of testing appraisals for sensitivity to assumptions is one that is essential in producing robust and reliable decisions. The problem is that sensitivity testing at present is limited to minor adjustments in the models. Undertaking tests that are predictably and regularly of minor impact seems to go against the whole principle of trying to understand the key sensitivities in an appraisal.

Genuine sensitivity testing needs to address the issue rather differently. At the moment a standard set of minor changes are made which usually come to the conclusion – "not sensitive".

Rather than asking: *is the appraisal sensitive to the standard changes?* The question should be: *what are the sensitive elements in the appraisal?*

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<sup>23</sup> Decision making for sustainable transport, MTRU, Green Alliance, February 2008

## Summary

Overall the DfT has responded in detail to the outcome of the Refresh and is undertaking a major review of NATA. The specifics in their first report summarising the Refresh will be influential but are only the start of a much larger range of reforms. As well as those promised on climate change and the preparation of alternatives, there remain issues over the dominance of time savings and the need for further equity analyses. These should include the issue of undervaluing bus user time. This report updates the 2008 MTRU overview of appraisal and uses a number of case studies to illustrate the remaining issues. These are then considered further in the final section.

### 3 Further changes needed in the decision-making process

While selecting the case studies for this project a number of recent transport infrastructure schemes were considered. It became apparent from the large number of schemes in the selection process that there were some serious delivery issues with the quality and consistency of the majority of the appraisals considered. The thrust of the original NATA reforms in 1998 were to address some of the problems of variable decision-making (see box 4 below). One of the key problems today is that in practice, appraisal methods have changed far less than intended.

#### Box 4: Purpose of NATA

There were two fundamentally new principles to appraisal, which NATA introduced in 1998.

- The first was a move towards a more objectives led approach. Thus transport schemes were both developed and assessed using specific criteria within a family of clearly stated goals. This is sometimes referred to as multi-criteria analysis (MCA) and may involve targets or constraints. Overall, the costs of any scheme, package or policy should be compared to the achievement of a range of transparent and clearly defined goals.

- The second principle was related to transport in particular and was that problems should be defined, and solutions then developed, without any bias towards one or more modes. The guidance, introduced to accompany NATA, stated that decisions should be “based on a full range of options and a comprehensive analysis of the impacts using a consistent approach.” This fitted with the government objective of an integrated approach to transport.

The first problem with the decision-making process is the way in which **appraisals vary hugely from scheme to scheme**. There appears to be a low level of auditing at crucial stages. Much effort is expended on appraisals but this is often technical and not particularly effective at the strategic level. Efforts need to focus more on what the appraisal is trying to achieve.

The second is the **preparation of realistic alternatives**. Despite clear guidance from webtag and the Treasury Green Book<sup>24</sup>, adequate examination of alternative schemes that could help to deliver the same solution to a transport problem, is rarely undertaken. **This is essential for ensuring the best value for money**.

The third is **consistency with national and regional goals**. This requires assessment of transport schemes in packages, to see whether as a whole they are contributing to government objectives. The Regional Funding process has not delivered such packages so far.

Last is **guidance on proportionality**. It is understood that the DfT are preparing guidance on the degree of assessment needed for small schemes, and on the assessment of scheme packages, but we have yet to see detailed proposals on this.

These issues are discussed more fully in the following sections.

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<sup>24</sup> Treasury Green Book, HM Treasury, for example Chapter 5

### Quality variation

The publication of appraisal guidance on the web (webtag) has been a major advance for practitioners, by making it clearer how appraisals should be undertaken. However there is still great variation in the quality of appraisal estimates, which the 2008 NATA report undertaken by MTRU for Green Alliance drew attention to<sup>25</sup>. In undertaking work for this report, looking at a range of schemes, it is clear that greater emphasis should have been given to this problem.

It is not just a matter of poorly completed Assessment Summary Tables, but also a matter of weak or missing alternatives or strategic assessments. For this reason, there needs to be more checking that the overall process has been undertaken properly, and not just one part (usually the traffic modelling). The DfT needs to be more proactive in promoting good practice consistent with guidance, rather than making case-by-case interventions. They are themselves more focussed on the traditional areas of modelling rather than the “new” areas such as the proper completion of summary tables.

### Preparation of alternatives

Transport is an activity that is undertaken to achieve ends, rather than being an end in itself. This means that there are likely to be different ways of achieving a wide range of objectives for a particular location. In order to make an informed decision, and provide value for money, these alternatives must be properly developed and tested alongside each other. This is the very basis of any appraisal – and is rightly emphasised by the Treasury Green Book. In this case the best value should be the most cost effective way of achieving all the objectives.

In practice this just doesn't happen. The comparison of highway schemes with a “Do Minimum” is still undertaken in a way which has hardly changed since well before the introduction of the original NATA reforms. In other cases schemes are assessed against a poorly worked up alternative so that they appear better by comparison.

This report has a clear example of the problem of alternatives in relation to a bus scheme and a road scheme that were developed in the same transport corridor in Cambridge. A study completed in 2001 proposed a package of measures which were tested for their effectiveness according to the NATA objectives. This was the only study to fulfil the requirements to test alternative schemes. The problem was that this study was superseded by further appraisals, where the individual elements were modelled and assessed in a way that produced different results from the original assessment, and were assessed individually rather than with regards to alternatives or parallel schemes. This resulted in schemes going ahead in isolation and persisting where an alternative might have done the job better. More details on this issue can be found in the case studies in Chapters 5 and 7.

### Consistency with national and regional goals

In order to assess consistency with broader goals it is necessary for transport schemes to be bundled into packages, to see if overall they are achieving these objectives, as individually each scheme cannot be expected to meet all goals. This package can then be tested with or without various elements to see the individual impact of the various constituent schemes on these goals.

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<sup>25</sup> Decision making for sustainable transport, MTRU, Green Alliance, February 2008

Unfortunately the opportunity offered by the Regional Funding Process<sup>26</sup> has not delivered such packages in the first round. The result has too often been a collection of local schemes agreed as a result of inter-authority bargaining, rather than a co-ordinated multi-modal package, developed through the testing of alternatives. This has had serious impacts on the national achievement of policy goals through transport infrastructure.

In particular, there is serious dichotomy between ambitions to reduce greenhouse gas emissions in regional policy and the best assessment of the collective impact of the schemes. Some regions did not include an emissions assessment at all.

The two factors set out above (alternatives and quality of appraisals) would alone suggest that appraisal is not delivering *cost effectiveness* in relation to government objectives. To ensure that this is rectified, a series of cost effectiveness tests could be undertaken and used to fill in the Assessment Summary Table, for example on carbon reduction, congestion, and health and environment. This would replace some of the opaque single numbers or standard phrases which are entered at present.

The DfT say that they are also working on the alignment of schemes with regional and national goals, however there is no current timetable. From the scheme analysis done in the case studies presented here, and in the wider “long list” of schemes, this should be a priority. It should be noted that another set of “National Policy Statements” are being prepared to form the context for major schemes. Such proposals would be assessed by the new “Infrastructure Planning Commission”. This is clearly on a longer timescale than NATA reform, and would need to take full account of the proposals set out in this report. Details of any new appraisal process have yet to emerge.

### Proportionality

Given the potential cost and time taken for full scale forecasting and appraisal, guidance on “proportionality” is obviously needed. This should cover the degree to which small schemes have to be analysed, and perhaps should set a threshold for this. It should also give advice on how to assess packages of schemes. The DfT is fully aware of this, and is preparing guidance that is due to be published soon.

### Summary

Whatever is done will require major changes, some of which are explored later in this report. The key issue remains how to create an appraisal system which is robust, yet able to deal with elements which cannot be accurately costed now, let alone over the next 60 years or more.

Given new challenges as diverse as climate change, less cohesive communities and personal fitness, transport appraisal must be reformed and those reforms carried through to genuinely influence decision-making. In light of the current economic situation, understanding exactly what we want to achieve, and finding the most cost effective way of doing so, will be even more critical.

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<sup>26</sup> The RFA process was to facilitate an integrated, multi-modal approach to transport investment at the regional scale. Budgets were meant to be allocated on the basis of a regional strategy which itself would be sustainable.

## 4 Case Studies

### Introduction

Five case studies are included here, covering tram, road, rail freight, bus and cycling. The latter is based on three schemes using DfT data. Beyond this, another ten schemes were considered, including four passenger rail infrastructure schemes and four road schemes. The aim was to use examples that were current, although this has meant that some information was not available. The case studies reported are not free from this problem, but have enough data to illustrate the issues involved and allow at least some comparisons to be made on a consistent basis.

The overall conclusions in the report draw on the wider group and the schemes considered in the 2008 MTRU report.

Each case study includes a brief description of the scheme in question and what happened with it as a result of the appraisal and decision-making process.

This is followed, wherever possible, by an assessment of the benefit-cost ratios under the initial NATA methodology, another using the DfT's proposed changes (NATA 2) and finally, where possible, an estimate of the impact of our suggested changes.

Finally we identify the key elements for each particular case study that would be affected by NATA reforms, and the implications of these. We also look at the implementation of the NATA process and the key implementation issues in the decision-making process.

## Merseytram Line 1 Case Study

### Description of scheme

Merseytram was designed to provide high quality public transport between Liverpool city centre and areas to the North East, East and South of the city. Overall, three tram lines were planned. Line 1 would improve links to Kirkby and Knowsley as well as a city centre loop supporting new and existing development and connecting bus, rail and ferry services. This first line successfully completed its Transport and Works Act (TWA) inquiry in June 2004, and the orders were made in January 2005. Its benefits exceed its costs, and the benefit to cost ratio (BCR) for the base case, accepted during the inquiry by the independent Inspector, was 1.97.

During 2005 the processes of securing finance, construction contracts and vehicle builders were undertaken. Towards the end of 2005 there was fresh discussion over the need for contingency funds and these were doubled from £24million to £48million in October 2005, under direction from the DfT.

It appears that, despite the use of fixed price contracts, the contingency fund was not considered sufficient by the DfT, and local authorities were asked to underwrite any unforeseen costs with no limit. This appears to be an unusual request and was considered to be outside the powers of a local authority (effectively creating an unlimited liability).

The local authorities felt unable to meet such a request and were thus not able to provide the additional contingency money. Therefore the DfT did not release the first amount of Government funding (£170million) in November 2005, and the scheme could not proceed. Although this was challenged in Court, the scheme is still on hold.

Merseytram remains a key project in the Local Transport Plan and Merseytravel remains committed to it. The TWA Order is still valid. This case study focuses on the TWA evidence, on grounds of available data, although appraisal work has continued. It remains hard to understand why the scheme was asked to overcome such a severe additional financial hurdle at the last moment.

### Available material

Detailed material is available for the case study from the 2004 TWA inquiry documentation, and this comprehensive data set was the first line of analysis. In 2008, further work was undertaken which updates scheme costs in the light of new development and updated the benefits to a 60 year time scale. As predicted by the initial work for this report, this increases the benefits. However, other factors such as capital costs, private sector costs (mainly to bus operators) and local government costs (including leasing) have also been adjusted in this latest study. This means it is not directly comparable to the TWA evidence.

The recent work also reveals further complex issues in relation to taxation and fare revenues in the appraisal. All the following examples from the 2008 study are totals over 60 years at 2002 prices.

National government is assumed to gain £43million in tax income because people no longer spend the money on VAT free bus fares. However, lost tax revenue because tram fares are not subject to VAT is a major loss item at £54million. While tram costs and fares income are in the appraisal, £249million of lost income to private bus operators is counted as a cost, reducing the scheme's overall benefits and thus value for money.

The issue of the bus service operator’s grant (BSOG), which is paid to bus operators but not for trams, does not appear to be included in the appraisal. BSOG is in fact about to be substantially changed and is clearly an item that will be influenced by the NATA Refresh reforms.

It should be noted that these sums are significant in relation to the capital cost of the scheme, which is £233million (also at 2002 prices). All this suggests that arriving at a robust appraisal needs further reform, in particular to ensure that complementary measures and policies are fully in place, and that exactly who gains and who loses is clearly set out.

### Comparative Assessment

Using the appraisal results and the Assessment Summary Tables from both sets of documents, it is possible to derive the following comparative table. This shows key results under original NATA assumptions and the refresh changes. Further reforms considered in this report would produce a *negative* entry under the greenhouse gas emissions. This would itself trigger a review of the tram policy towards attracting car users, because this is a relatively straightforward source of providing savings.

Switching car users (for example through parking controls) so that reductions in carbon could be achieved would address this issue, and produce a neutral or positive score. More importantly, congestion would also reduce, increasing the user benefits still further. Without rerunning the model it is not possible to give precise numbers for the improved benefits, so they are not included in the table. However, they would be produced as a result of modest demand management coupled with a high quality alternative.

**Table 1. Comparative results under different NATA assumptions**

	NATA 1 TWA	NATA 1 2008 Update	NATA Refresh TWA	NATA Refresh 2008
BCR	1.97	1.82	2.07	1.97
Greenhouse gas	Negligible	+£0.9mn Negligible	Negligible	+£0.9mn Negligible
Policy fit	Positive	Positive	Positive	Positive

### Key Issues

The scheme as presented to the TWA Inquiry is assessed in similar terms to the other case studies:

- how well it considered alternatives,
- how it dealt with climate change,
- the impact of tax revenues on the benefit to cost ratio,
- the impact of land use assumptions,
- and in this case the number of years of benefits which were included.

The case study reveals

- some interlocking constraints which seem to have underestimated the benefits,
- a thorough approach to preparing and testing alternatives,
- a lack of detail in relation to carbon emissions,
- a BCR which would be significantly increased if the NATA Refresh were applied, and is very sensitive to changes in the way tax and bus provider losses are handled in the appraisal.

The carbon results probably reflect the fact that much of the work was originally focussed on operational issues undertaken over 5 years ago, but also the way in which the scheme has to be considered in isolation for the Business Case and Inquiry process. It scores very well in terms of policy fit nationally and within the LTP, but the valuation of items such as time benefits seems to have counted more in the decision making process.

Some of the key items in the case study are considered below.

### Alternatives

It is clear that Merseytravel (the proposers) were asked to explore a range of alternatives in some detail. A report was submitted to DfT in July 2002 which was not in fact used for the public inquiry. This contained options including one agreed as a “next best performing” alternative, and other bus based options, including electric trolley type buses with high levels of priority.

This approach is entirely in line with Webtag guidance, and the alternatives were developed realistically so that estimates could be provided for capital and revenue costs, and benefits. This enabled a proper consideration of alternatives to be undertaken.

None of the alternatives could deliver a positive value in terms of a normal appraisal.

In this sense the Merseytram proposal had already passed a somewhat novel test since the preparation of alternatives in the context of a Major Business Case submitted to the DfT is often not enforced. Clearly for small scale schemes this level of effort would be disproportionate, and in some instances there is only one alternative (for example the freight case study). However, the tram scheme fully complied with major scheme guidance in this respect.

### Indirect tax revenues

Given the level of detail available from the inquiry documentation, it is straightforward to reposition the tax gains and losses in accord with the NATA Refresh. This had a relatively small impact (less than 10%) on the BCR.

Given that this is a public transport scheme, this result appears at first to be counter intuitive. However, the underlying reason is related to assumptions about who will use the Merseytram. By far the largest group of users are predicted to be former bus passengers. Table 2 illustrates this using 2010 predictions without generated traffic.

**Table 2. Proportion of Merseytram users transferring from existing modes 2010**

	Car direct	Car P&R	Bus	Rail	Public Transport
AM peak	7.3%	5.9%	73.1%	13.7%	86.8%
Inter peak	4.5%	3.8%	80.9%	10.7%	91.6%

Source: Merseytram Inquiry, Proof P4/A, Tables 4.1 to 4.3

Car direct are transfers from car for whole journeys, there is also a Park and Ride (P&R) scheme linked to the tram for which part of individual car journeys are transferred

This explains why the benefits derive strongly from existing public transport passengers, most of whom will be switching from bus to tram. In the Base Case Economic Efficiency

Table<sup>27</sup> 80.6% of non-business user benefits are to public transport users, most of whom simply transfer to the tram from bus or rail. On the other hand, only 33.5% of business user benefits are from transfers. Most are from time saved due to a small reduction in congestion. This probably also reflects the low value of time used for bus passengers in transport appraisal.

Because the business user benefits are predicted to be much lower than non-business users, the overall impact is that 69.1% of all user benefits are from public transport users, mostly transfers from bus and rail.

Low car switching seems in part to derive from the availability of free parking for those travelling to work outside of the city centre. Even in the heart of the city, only 33% of am peak car users pay for their parking. These commuters were excluded from the potential passengers that might use the tram and thus the significant potential for increased benefits was not realised.

There is a park and ride scheme that is linked to the tram, and its impact is almost as great as that of people who transfer from car for the whole journey. It is also clear that the park and ride scheme produces almost as much tram income as the direct car transfers, but with much lower congestion savings.

The use of 2010 for forecasting also underestimated the problems caused by rising traffic congestion. This is exaggerated by the shorter timescale used for the benefits in the TWA case (see below).

### Land use planning

The approach adopted in forecasting mode switch was thus cautious, and this was compounded by a lack of certainty about potential users from new development. This is included in the appraisal as a “strong beneficial” score in the appraisal under land use planning. Some users from new development were included, but at a low level. However, there is some concern that the nationally produced estimates for local trip generation<sup>28</sup> were not in line with realistic forecasts of future development. For example, the TWA appraisal showed no further development beyond 2010<sup>29</sup>. Overall, this is part of the interlocking problem of short timescale, failure to reflect development and low mode switch.

Much of the evidence in support of the tram is related to increasing accessibility for those without a car, and supporting regeneration. However, this cannot appear as a money value in the appraisal under current guidance, and would not do so even under the proposed reforms. Work by Merseytravel is continuing to address these issues.

### Timescale

The TWA appraisal uses a 30 year time period rather than 60 years as is now normal. Since the scheme is positive in terms of its benefits, extending the time period will improve the economic case. The 30 year BCR is thus not comparable to current scheme BCRs. It is difficult to apply a simple factor to increase BCRs, but simply assuming the same benefits for another 30 years, and using the standard discount rate of 3%, the BCR for this scheme would rise significantly. This, together with the tax effect, is shown in Table 3.

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<sup>27</sup> Inquiry Proof P4/B, Table 1

<sup>28</sup> Based on the DfT TEMPRO forecasts

<sup>29</sup> This has been addressed in the 2008 work by using 2012 and 2027 forecasts

**Table 3. Change in benefits from tax adjustment and minimum time correction**

**Merseytram**

**Base case £'000**

<b>Benefits</b>	<b>Costs</b>	<b>BCR</b>
426,466	215,997	<b>1.97</b>
<b>After indirect tax adjustment</b>		
407,734	197,265	<b>2.07</b>
<b>After extra 30 years</b>		
562,545	197,265	<b>2.85</b>

Source: Inquiry Proof P4/B Appendix 3, Table 1, MTRU calculation

However, this is not the limit of the problem. The standard assumptions for transport schemes are that car ownership and use will increase over time, and that the value of users' time will also increase. This is particularly strong for car users. Higher levels of congestion in future would mean greater likelihood of transfer to tram, and therefore higher benefits. It is not possible to quantify these at this stage, but it indicates that rerunning the forecasts with a full package would produce a major uplift in the value for money. Any such rerun should be comprehensive, allowing for actions to be taken which would maximise the potential of the scheme to attract car users.

Of course, this is assuming that all schemes are appraised using standard forecasts. These currently do not allow for a long-term impact from the current economic difficulties. The cautious approach adopted for the Merseytram should at least make it more robust to any such risk.

**Climate change**

One remaining issue is that climate change impacts were considered to be small and thus scored neutral. This seems to have been a low priority for the Business Case approval. Further work should reveal the difference between bus emissions and the tram's electric power (which would change over time), and if the changes implied above were to be implemented, the new estimates for mode switch and land use would provide a full assessment. Again, precise estimates cannot be made at this stage, but the impact should be beneficial.

**Conclusions**

The value for money seems to have been underestimated due to a series of inter-related assumptions. Revising these to be more in line with the NATA Refresh reforms and existing practice should raise the BCR significantly. It is also clear that any policies that would discourage car use, for example restrictions on parking, would have a major beneficial impact in terms of attracting car users. This would be reflected in much greater improvements in the carbon performance and in the monetised benefits. These would exceed the increased benefits from re-positioning the tax gains and losses and extending the timescale for costs and benefits.

## A14 Case Study

### Description of scheme

The Highways Agency (HA) plans to improve the A14 between Ellington, to the west of Huntingdon, and Fen Ditton, to the northeast of Cambridge. Earlier proposals to increase capacity on this road corridor were remitted to one of the first multi-modal studies (MMS) entitled CHUMMS, which was completed in 2001. This put forward a preferred package for the corridor which included new road capacity, the Cambridge busway (see Case Study 4) and strong demand management. The latter was modelled as a road user charge.

Public consultation on proposals for the scheme was held in Spring 2005. Agreement to consult further was reached following a legal challenge. Further public consultation on additional route options was held between December 2006 and March 2007.

Draft orders and an environmental statement were published during the drafting of this report (October 2009). Depending on the type and number of objections to the draft orders, there may well be a public inquiry.

### Available material

The original CHUMMS results for the package are available, but differ significantly from the results for the individual components which are being pursued separately from one another. This issue is discussed further in this report and in the results for the other CHUMMS case study, the Cambridgeshire Busway. The latest figures for the A14 are those provided by the Highways Agency (HA) for the preferred option (Orange). As well as supplying an alternative BCR with the tax changes moved, the Agency have provided baseline carbon emissions allowing for comparison of future forecasts with targets.

### Latest Assessment

Using the latest model results and the Assessment Summary Table, it is possible to derive the following comparative table. This shows key results under original NATA assumptions, refresh changes and possible further changes as outlined in this report. The calculations behind them are explored more fully later in this case study in the climate change section.

**Table 4: Comparative results under different NATA assumptions**

	NATA 1	NATA Refresh	Further reform
BCR	10.83	a) 6.69 b) 3.25*	1.30*
Greenhouse gas	+33,900tonnes C (increase of 2%)	-£478mn (only in b) above)	-£1.75billion
Emissions policy fit	Neutral	Moderate Adverse	Strongly Adverse

Note: carbon costs for second NATA column is based on 2015 results factored up by 60 years, 2008 base year, latest DECC prices. Further reform uses latest estimates for 2015 and 2031, factored up for two time periods (see Climate Change section on page 34).

No carbon costs assumed after 2050.

\*BCR is approximate due to the lack of carbon data year by year over the 60 years and for illustrative purposes only.

### Key issues

The key issues for the A14 scheme now being finalised are assessed in more detail in similar terms to the other case studies:

- how well it considered alternatives, and in this case its relationship with the earlier corridor study (CHUMMS),
- the impact of tax revenues on the benefit to cost ratio,
- how it is dealing with climate change, and
- its current relationship with other schemes in the corridor.

The case study reveals

- time savings dominate the appraisal, amounting to over £2.4billion over 60 years, reducing the significance of all other impacts,
- analysis of viable alternatives is weak because CHUMMS is somewhat out of date, and focussed on Cambridge rather than the whole corridor,
- the Highways Agency have been quick to test the impact of the NATA Refresh reform on indirect taxation. This reduces the BCR by 38% however it remains very high,
- a low impact from the valuation of carbon emissions (updated since CHUMMS), and
- there is a lack of integration between the appraisals of the constituent elements of the CHUMMS package, especially demand management, and with the parallel rail freight scheme (see Case Study 2).

Some of the key items in the case study are considered below.

### Alternatives and the CHUMMS context

CHUMMS put forward a package with three main elements:

- Cambridge busway linking to St Ives and improved services to Huntingdon,
- A14 capacity increases at dual 2 or 3 lanes mostly on the existing route, but with a new section South of Huntingdon,
- demand management, initially focussed on Cambridge, which was undefined but modelled as a £3 charge to enter the city.

This is set out in more detail in the 2001 CHUMMS Final Report, paragraph 5.2. Currently the busway is being built, the road scheme is about to have draft orders published and demand management does not appear to be planned to the extent recommended.

It is also clear that the use of public transport within the CHUMMS package is far higher than can be found in the individual Cambridge busway 2002 Business Case, or can be discerned in the A14 material to date. One reason may be the lack of demand management. The other may be a lack of sensitivity in the new modelling to public transport improvement. Whatever the cause, the busway based public transport option is predicted in the CHUMMS report to carry 42-43,000 passengers per day in 2016. The busway Business Case predicts 18,500 trips per day.

Both studies appear to use the same definition of passenger journeys. Flows at a single point will of course tend to be lower because passengers get on and off along the route. It is possible that some of the CHUMMS passengers are on feeder bus routes.

However, this apparent strong difference in predicted passengers is reflected in the 2002 busway appraisal, which predicts a modest impact on A14 road traffic. It estimates a reduction of 4%, or just over 2,100 trips per day in 2016. This is the level used for the A14 road appraisal. The main impact appears to be diversion to the busway park and ride sites at Longstanton and St Ives. The HA have supplied the following table.

**Table 5: Forecast Trips to/from the New Park and Ride Sites**

Site	AM Peak (0800-0900)		Inter Peak (1400-1500)		PM Peak (1700 to 1800)	
	IN	OUT	IN	OUT	IN	OUT
Longstanton	330	25	53	192	26	271
St Ives	289	22	46	145	23	239

Source: HA direct communication

In CHUMMS the model predicted a reduction of 12-13,000 trips per day even if there was no major capacity increase on the A14<sup>30</sup>. Flows on the busway parallel to the A14 were 15,000 per day at St Ives, rising to 20,000 approaching Cambridge.

It is also interesting to note that the CHUMMS option without major road capacity increases actually had the highest BCR of all options, although it was rejected since it did not provide sufficient relief to the A14.

Overall there is a serious discrepancy between the results of the multi-modal modelling and appraisal done for CHUMMS, and the individual, mode by mode, scheme by scheme, modelling and appraisal which has followed.

### Rail freight

CHUMMS also mentions a possible improvement to the Felixstowe/Nuneaton freight route. Felixstowe is a key deep-water port and containers travel throughout the UK. The rail network is currently height restricted and capacity restricted and thus has less than 25% market share. CHUMMS uses the assumption that this will increase by less than 4%. The current scheme should permit at least 12%<sup>31</sup>.

There are currently about 17-18,000 HGVs per day using the A14 corridor between Cambridge and Huntingdon, although only a proportion of these (the HA estimate about a quarter<sup>32</sup>) will be the larger articulated vehicles. They are almost 50% of through traffic.

Thus the freight issue was touched on by CHUMMS but not explored in any great detail. This is unusual in that there is not always such clear competition between rail and road freight transport. In this corridor there is clearly an alternative to the use of the largest and heaviest road freight vehicles and this needs to be reflected in the road appraisal. In the latest A14 appraisal, freight cost savings are over £455million (about 20% of total benefits).

### Indirect tax revenues

The Highways Agency have responded immediately to the NATA Refresh treatment of indirect tax and recalculated the BCRs of all their alternative routes/scenarios for the road scheme. The preferred option (Orange) had an original BCR of 10.83 and this would be reduced to 6.69 if the tax is repositioned. This is a significant fall of 38% but does not change the overall category for the scheme, which remains very high.

<sup>30</sup> See Table 4.24 and Figure 4.1H of CHUMMS final report

<sup>31</sup> See Table 5.3, TIF business case F2N, Case Study 2 in this report

<sup>32</sup> Manual count information supplied direct to MTRU by HA

## Climate change

### *Change in emissions estimates*

There is also a change between the CHUMMS package and the A14 as currently proposed in relation to greenhouse gases. The original CHUMMS package would have reduced emissions by 46,100 tonnes per year by 2016, compared to a Do Minimum (low level road or public transport improvements).

The busway was considered separately for funding approval a year later and was estimated to make a small reduction of 2,777 tonnes of CO<sub>2</sub> emissions by 2016<sup>33</sup>.

The A14 package was predicted to increase carbon emissions by 33,930 tonnes in 2014 compared to the Do Minimum (+3%), or 76,194 tonnes compared to the present day (+7%)<sup>34</sup>. There are new figures available at the time of publication<sup>35</sup> which suggest that the “compared to Do Minimum” number of 33,930 for 2014 should be 36,021 in 2015, but rising significantly to 98,574 in 2031. This equates to 128,938 tonnes over the DfT national target in 2015 and 433,304 tonnes over target in 2031. Unsurprisingly this has a major impact on the BCRs in Table 4.

Deducting busway carbon benefits from the original estimates produces a net increase of at least 31,000 tonnes of CO<sub>2</sub> per year by 2016 compared to a Do Minimum. It also underperforms the CHUMMS package by over 77,000 tonnes of CO<sub>2</sub> per year. Once the recent figures are confirmed, this could be much higher.

### *Cost of carbon over target, rather than compared to “Do Minimum”*

In this case it is possible to estimate the impact of comparing the scheme with the target level of reduction rather than the Do Minimum. This is important because the Do Minimum fails to achieve the Government’s target for transport by a considerable margin. To compare the scheme to this future failure is a false approach. It is really a comparison to a “Business As Usual” future, which is clearly against Government policy and the Climate Change Act. It is not consistent with the approach in the traded sector, where it is the carbon in excess of target which is covered by the market in carbon emission permits.

The estimate is approximate, but could easily be refined when annual carbon emission data for the 60 year period becomes available from the model. Even so, this change would clearly have a major impact, increasing the carbon cost from around £478million to £1.75billion. This figure is approximate because only two future year estimates are available (2015 and 2031). It needs to be recalculated once a year by year assessment of carbon impacts has been published. This should be available early in 2010.

## Loss of an integrated approach

While the original CHUMMS study had a very limited area of interest, strongly influenced by the A14 road proposals and access to Cambridge, it did attempt to take an integrated, multi-modal approach. The evolution of separate schemes in the same corridor has moved away from the CHUMMS package, which relied upon demand management to achieve

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<sup>33</sup> See Table 1, Appendix H, Cambridgeshire LTP 2002

<sup>34</sup> October 2007 AST for A14 Orange Option

<sup>35</sup> A14 Environmental Statement October 2009

many of its objectives. This has led to a position where the integrated package, which was the product of a review of a wide range of alternatives, is no longer being implemented.

The analysis for this case study shows that this separation has led to major differences for the current appraisals compared to CHUMMS, in particular between mode choice predictions and greenhouse gas emissions. In any case there have been significant developments since CHUMMS, for example the higher levels of mode switch both to bus and rail, which can be achieved in the right policy context, and the capacity of travel planning (Smarter Choices) to change behaviour<sup>36</sup>.

Guidance in Webtag requires that proper alternatives to any major scheme proposed should be prepared and assessed if value for money is to be established. A new multi-modal approach should be used to set out a genuine alternative and this would provide the additional opportunity of recreating the package approach. It is becoming increasingly clear, on carbon grounds alone, that major schemes will have to be assessed in a full policy context. Comparing them to “Do Minimum” futures in which problems are not addressed creates a completely unrealistic level of benefit from that scheme. A re-evaluation of a multi-modal package for the area should be undertaken in order to address this problem. For this reason, individual schemes can no longer rely on the CHUMMS report as fulfilling the need for consideration of alternative solutions to transport problems without prejudice for or against any one mode.

## Conclusions

It is clear from both the climate change impacts, busway development and the freight issue, that this corridor has significant transport investment planned or being implemented, but even the limited integrated framework from 2001 has been lost. The various individual cases and TEE tables which are intended to be NATA compliant have turned out to be extremely difficult to compare.

In these circumstances, whether or not the original analysis which considered alternative solutions was fit for purpose is no longer relevant. The appraisals of the individual elements are simply not consistent with it. In the case of the busway, the benefits appear lower than previously estimated but the case remains robust. In the case of the A14, there are several questions to be answered including the real cost of carbon emissions and the lack of impact of the busway on traffic flows. The material produced for draft orders and any inquiry should address these issues directly.

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<sup>36</sup> See the ongoing work on sustainable travel towns and cities

## Felixstowe Nuneaton Case Study

### Scheme description

Felixstowe is one of the two main deep-sea container ports in the UK. Currently all container traffic from Felixstowe that is heading to markets in the West Midlands, the North West and Scotland is routed via London, with access to the heavily used southern section of the West Coast Main Line (WCML) at Willesden Junction. Through the Strategic Rail Authority (SRA) this route was enhanced to W10 gauge to allow the movement of 9' 6" boxes on conventional height wagons in 2004. W10 gauge is necessary for rail to compete effectively with road in the container market.

The port operator at Felixstowe in connection with the improved expansion of the port at Bathside Bay undertook W10 gauge enhancement from Ipswich - Peterborough via Bury St Edmunds, and from there to West Yorkshire terminals via the East Coast Main Line. This is effectively the southern half of the original Felixstowe to Nuneaton scheme that was put on hold in 2003 due to lack of funding.

The current scheme, which is just starting to be built, will extend the gauge enhancement from Peterborough to Nuneaton to enable the movement of W10 container traffic from Felixstowe to the WCML. From there it can access markets in the West Midlands, North West and Scotland without being routed via London and the busy southern section of the WCML. It also offers the potential to open up W10 access from Felixstowe to proposed new intermodal facilities in the Nottingham and Derby area. The number of trains would be limited by track capacity rather than height and this is the subject of a possible second stage.

### Components of the scheme

The scheme appraised in this report, Peterborough to Nuneaton (P2N), has three elements:

- W10 gauge enhancement between Peterborough and Nuneaton;
- construction of a new Northern Chord to W10 gauge at Nuneaton that links the Leicester - Birmingham Line to the Down Slow on the WCML, west of Nuneaton flyover; and
- moving the controls for track side signals in the Kennett to Bury area to reduce the signalling headways, so that more freight traffic can use the route at any one time. This results in the removal of the signal box at Kennett.

### Consideration in this report

The scheme's 2007 business case for Network Rail is assessed in similar terms to the other case studies:

- how well it considered alternatives
- how it dealt with climate change
- the impact of tax revenues on the benefit to cost ratio

In this case there are no passenger forecasts, so the impact of land use assumptions was not considered, and the appraisal was for the standard 60 years.

The case study reveals

- a thorough approach to preparing and testing alternatives;
- an averaged approach to assessing a range of impacts, rather than full modelling using the "Sensitive Lorry Miles" values;

- a relatively small financial impact for carbon reductions, but a significant contribution in terms of tonnes of carbon; and
- an already very high BCR which would be significantly increased if the NATA Refresh were applied.

Some of the key items in the case study are considered below.

### Alternatives

It is clear that the proposers looked at a range of rail alternatives in some detail. There were also alternative assumptions about the pattern of use of ports in the future, in particular whether a new facility at Shell Haven was built<sup>37</sup>. There were two scenarios for rail passenger growth since such services were also affected by the scheme. Thus four alternative demand scenarios were created to give full appraisal tables and BCRs. The amount of consumer surplus, in this case the benefit to freight users, was either included or excluded, and the BCR of the preferred scheme was robust to these changes.

The consideration of the mode alternative of using heavy goods vehicles is dealt with using the “Sensitive Lorry Miles” (SLM) values<sup>38</sup>.

### Sensitive Lorry Miles (SLM)

In fact, the use of SLM values covers a wide range of costs and benefits. These are the equivalent of traffic model outputs for a road scheme. Since the number of miles done by HGVs which would be replaced by the rail scheme can easily be calculated (in this case containers), a detailed network model covering all traffic is not required by the DfT. Instead, average costs and benefits for seven different types of road are applied to the reduction in HGV mileage on those roads that would be achieved by the rail freight scheme.

SLM includes the following categories:

- accidents
- noise
- pollution (mostly air quality apart from greenhouse gas)
- climate change
- infrastructure costs
- congestion costs
- unquantified (meant to represent a basket of environmental benefits not separately valued)
- indirect taxation (loss of VAT and fuel duty paid by HGVs)
- rail costs

These can be used to produce a Transport Economic Efficiency (TEE) Table similar to any other transport scheme. The precise values used in this case are reproduced below.

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<sup>37</sup> Shell Haven now approved

<sup>38</sup> To be replaced by the similar Mode Switch Benefits – MSB – in April 2010

Table 6 (B2). Contains the SLM values, pence per lorry mile

	Motorway			London & Conurbation		Rural & Urban		Weighted Average
	High Congestion	Medium Congestion	Low Congestion	Trunk & Principal	Other	Trunk & Principal	Other	
Accidents	1.5	1.5	1.5	3.8	3.1	3.8	3.1	2.9
Noise	4.0	4.0	4.0	11.0	9.0	2.0	4.0	3.8
Pollution	5.7	5.7	5.7	18.8	22.8	3.9	4.8	6.3
Climate Change	2.7	2.7	2.7	2.6	2.5	2.4	2.0	2.5
Infrastructure Costs	5.7	5.7	5.7	9.1	28.7	11.2	35.3	12.5
Road Congestion	79.0	37.0	6.3	121.9	135.5	45.8	10.6	43.9
Unquantified	8.0	8.0	16.0	8.0	9.0	21.5	22.0	16.9
Taxation	-29.0	-29.0	-29.0	-29.0	-29.0	-29.0	-28.0	-28.9
Rail Costs	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8	-8.8
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	68.8	26.8	4.1	137.5	173.8	52.8	45.0	51.1

### Indirect tax revenues

Given the level of detail available from the Business Case documentation, it is straightforward to reposition the tax gains and losses in accord with the NATA Refresh. This has a major impact, for example changing the BCR for Option 1 from 5.25 to 35.42.

However, this is partly because removing HGVs, which are responsible for most of the damage to road surfaces, causes a reduction in road infrastructure costs. This in turn reduces the cost to government of the rail scheme by 73%. Much of this saved expenditure in the SLM calculations will be maintenance.

Even if this saving is not applied to the scheme costs, but added to user benefits instead, the BCR still rises to 10.40. This reveals the overall robustness of the case, but also a strong sensitivity to the positioning of tax revenues. The table of SLM values above confirms this impact, the value of reducing lorry miles is itself reduced by 36% because of lost taxation.

In a passenger based NATA approach, the taxation lost to government could be found as a benefit in terms of lower costs to users. When SLM values are used, there is no immediate balancing impact. This was partly addressed by the calculation of “consumer surplus” to freight users, which represented savings to them. This raised the benefits and further improved the BCR. The example given above did not include consumer surplus.

Overall this indicates that rail freight schemes are likely to see their BCRs rise very significantly as a result of the NATA Refresh tax change. It will be important to reposition the tax loss to government, and ensure that the gains to users through not paying it are also fully represented in the appraisal.

### Climate change

The value of carbon savings over the 60-year period is put at £30million, again valued through the SLM averages.

## Cambridge busway case study

### Description of scheme

Earlier proposals to increase road capacity on the corridor between Huntingdon and Cambridge were remitted to one of the first multi-modal studies (MMS) entitled CHUMMS, which finished in 2001. This put forward a preferred package for the corridor which included new road capacity on the A14 (see Case Study 3), the Cambridge busway and strong demand management. The latter was modelled as a road user charge. The busway is guided and uses a former rail track between Cambridge and St Ives, with further on road links to Huntingdon. This is shown on the map below.

Figure 2: Map of guided bus route



Cambridgeshire County Council promoted the busway scheme as part of its Local Transport Plan in 2002. Public consultation on proposals for the scheme was held in summer 2003. A public inquiry was held and completed in December 2004. Construction is now under way.

### Available material

The original CHUMMS results for the package are available, but differ significantly from the results for the individual components which are being pursued separately from one another. This issue is discussed further in this report and in the results for the other CHUMMS case study, the A14. The latest figures for the busway are those provided by Cambridgeshire County Council.

## Latest Assessment

Using the later model results it is possible to compare the results of the busway and derive the following comparative table. This shows key results under original NATA assumptions, refresh changes and possible further changes as outlined in this report.

**Table 7: Comparative results under different NATA assumptions**

	LTP 2002	NATA Refresh	Further reform
BCR	4.8	6.4	7.9*
Greenhouse gas	-2777tonnes a year in 2016	Full data N/A	Data N/A
Emissions policy fit	Positive	Positive	Unknown

Note:

None of the BCRs include carbon costs and annual summary data is not available to make an estimate. The first two BCRs would rise as a result of valuing carbon, in the reformed process, the BCR may fall, since the reduction in carbon may not meet the target. This is also the reason for the “Unknown” policy fit result. The final result, as with many public transport schemes, depends on the major expenditure items in the region and the associated demand management policies.

\* Loss of parking revenue was also added to the capital costs and in this case it is treated as a loss of benefit, as is done for fuel tax loss

## Key issues

The key issues for the busway can be assessed in more detail in similar terms to the other case studies:

- how well it considered alternatives, and in this case its relationship with the earlier corridor study (CHUMMS);
- the impact of tax revenues on the benefit to cost ratio;
- how it is dealing with climate change; and
- its current relationship with other schemes in the corridor.

The case study reveals

- time savings to bus users dominate the appraisal, amounting to over £225million (1998 prices);
- time savings to road users are still significant, at over £86million;
- analysis of viable alternatives is weak because CHUMMS is somewhat out of date, and focussed on Cambridge rather than the whole corridor;
- NATA Refresh proposals for repositioning tax losses would improve the BCR significantly, although it was already in the “very high” category;
- a low impact from the valuation of carbon emissions is seen (updated since CHUMMS); and
- there is a lack of integration between the appraisals of the constituent elements of the CHUMMS package, especially demand management.

Some of the key items in the case study are considered below.

## Alternatives

CHUMMS considered a wide range of alternatives and put forward a preferred package with three main elements:

- Cambridge busway linking to St Ives and improved services to Huntingdon;

- A14 capacity increases at dual 2 or 3 lanes mostly on the existing route but with a new section South of Huntingdon; and
- demand management, initially focussed on Cambridge, which was undefined but modelled as a £3 charge to enter the city.

This is set out in more detail in the 2001 CHUMMS Final Report, paragraph 5.2. Currently the guided busway (CGB) is being built, the road scheme has draft orders published and demand management does not appear to be planned to the extent recommended. There has been very considerable policy development and pilot schemes in the field of demand management through “Smarter Choices” since 2001.

The differences between the CHUMMS report and the individual assessments were discussed in detail in the previous case study. The key points were the major decrease in the predicted switch to the CGB from car, and thus the lower relief to the A14. Cambridgeshire have suggested the following possible explanations.

- The modelling for the CGB Business Case had of necessity to be more robust than the CHUMMS modelling, and to consider the impact of the scheme in greater detail. One thing that it did show was that a considerable amount of the gross reduction on the A14 was taken up by the transfer from other minor routes back onto the A14.
- The scrutiny given to the CGB model by TRL on behalf of DfT led to reductions in the forecasts of CGB patronage. In particular, assumptions about how far people will walk to a guided bus stop made a significant difference to patronage forecasts; this was much debated at the time.
- The CGB Business Case did not include an assessment of the demand management measures in Cambridge, as at the time of the submission, there was no detailed understanding of what these might be. Therefore, any additional patronage that might accrue (or drop in trips on the A14) due to this is not included in the Business Case.
- The CGB Business Case and subsequent inquiry documentation deliberately assumed a conservative case in terms of patronage and diversion away from the A14.
- The County Council considers it quite likely that the CGB will achieve a greater level of patronage than is shown in the Business Case.

Overall there is a serious discrepancy between the results of the multi-modal modelling and appraisal done for CHUMMS, and the individual, mode by mode, scheme by scheme, modelling and appraisal which has followed. In addition, the CHUMMS study, if undertaken today, would probably consider a wider range of approaches to demand management, including Smarter Choices.

### Climate change

There is also a change between the CHUMMS package and the A14 as currently proposed in relation to greenhouse gases. The original CHUMMS package would have reduced emissions by 46,100 tonnes per year by 2016, compared to a Do Minimum (low level road or public transport improvements).

The busway was estimated to make a small reduction of 2,777 tonnes of CO<sub>2</sub> emissions by 2016<sup>39</sup>. This is low because of the lack of mode switch, itself associated with the lack of demand management and the other reasons given above.

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<sup>39</sup> See Table 1, Appendix H, Cambridgeshire LTP 2002

### Lack of integration

While the original CHUMMS study had a very limited area of interest, strongly influenced by the A14 road proposals and access to Cambridge, it did attempt to take an integrated, multi-modal approach. The evolution of separate schemes in the same corridor has moved away from the CHUMMS package, which relied upon demand management to achieve many of its objectives. This has led to a position where the integrated package, which was the product of a review of a wide range of alternatives, is no longer being implemented.

The above analysis shows that this separation has revealed key differences, for example between mode choice predictions and greenhouse gas emissions, for the current appraisals compared to CHUMMS. It is possible that CHUMMS would have reached a different conclusion on the balance of the strategic package if the modelling results for the two individual case studies had been used.

### Conclusions

As stated in the previous case study, and reinforced here, it is clear that this corridor has significant transport investment but even the limited integrated framework from 2001 has been seriously undermined. The various individual cases and TEE tables, which are intended to be NATA compliant, have turned out to be extremely difficult to compare.

In these circumstances, whether or not the original analysis which considered alternative solutions was fit for purpose is no longer relevant. The appraisals of the individual elements are simply not consistent with it. In the case of the busway, the benefits appear lower but the case remains robust.

## Cycling Case Study

### Available material

The best documented schemes available were the case studies published as an Appendix to the *Webtag Guidance on the Appraisal of Walking and Cycling (Unit 3.14.1)*. This sets out the costs and benefits of three cycling schemes. The results are available from the July 2008 appraisal and the revised April 2009 version. All the BCRs are very high, but the 2009 version gives even higher value for money, led by a trebling in the physical fitness benefits. Neither include the repositioning of the changes in tax income, but this is straightforward to adjust in the summary Transport and Economic Efficiency (TEE) table. This is set out later in this section.

### Description of schemes

There are three case studies in the Webtag Appendix and all have been included since they provide a range of scheme types:

- short traffic free route
- longer traffic free route with a commuter focus
- single point intervention.

Summaries of the scheme descriptions are provided as follows.

#### Scheme 1

A 1 kilometre stretch of “Greenway” route of “modest quality” in Stoke on Trent which was lightly used. The scheme provided a series of upgrades including resurfacing. Before and after studies were undertaken (2001 and 2004) and these were used as a base for the appraisal. Capital cost was £26,756 (2002 prices).

#### Scheme 2

A canal towpath in North West London, linked to the Park Royal major industrial and business park. Again the existing route was of “modest quality” but with higher levels of existing use. The finished route was 6 kilometres long and again included resurfacing. The emphasis was on convenience for commuters and this is reflected in the appraisal impacts. Before and after studies were undertaken (2002 and 2004) and these were used as a base for the appraisal. Capital cost was £139,130 (2002 prices).

#### Scheme 3

This provides a new Toucan crossing on an existing traffic free cycle route in the Grantham area. Before and after studies were undertaken (2000 and 2003) and these were used as a base for the appraisal. Capital cost was £60,870 (2002 prices).

### Latest Assessment

Using the TEE tables from 2008 and 2009, and repositioning the tax revenues, gives the following comparative results.

**Table 8: Comparative results under different NATA assumptions**

	NATA 08	NATA 09	NATA Refresh	Change Refresh/09
BCR Scheme 1	13.0	21.8	23.2	+6.4%
BCR Scheme 2	22.1	38.4	75.0	+95.3%
BCR Scheme 3	11.7	18.5	22.0	+18.9%

Source: Wehbag Unit 3.14.1, 2008 and 2009, MTRU calculation

As can be seen, the impact on the BCR of moving the position of the tax revenues has very different impacts across the three schemes. In Scheme 2, there is considerable congestion relief and thus fuel savings. This means that the fuel tax loss is significant, and changing this to a disbenefit rather than increasing the capital cost of the scheme in turn has a major impact. Again it is worth noting that the effect is significant (in one case extreme) but also very variable.

The greenhouse gas emissions were a very small contributor to overall benefits in all cases – between 0.06 and 0.27%. This issue is explored further later in this case study (see Table 9).

### Key issues

The key issues for the cycling schemes differ slightly from other case studies. One obvious difference is that it is not clear how relevant the preparation of alternatives based on other modes would be, given the focussed nature of the schemes. This is not just because they are supporting the non-motorised modes of transport, it is because the key objective of health (expressed here as physical fitness benefits) is surfacing in the appraisal in a way that it does not in other modes. A cross check against other methods of achieving the exercise required could be undertaken to demonstrate cost effectiveness.

This raises the question of why lack of physical fitness is not currently valued as a disbenefit in other schemes, given that health is one of the five transport objectives which should guide appraisal. Should schemes which reinforce a lack of physical activity have a set of costs associated with them? This would apply particularly to the case where short distance motorised journeys by car or bus were encouraged. In the case of bus, this will be affected most strongly by fares policy.

If appraisals are to be consistent across all modes, this issue of health disbenefits, as well as benefits, needs to be addressed.

The other issues are similar to other case studies:

- the impact of tax revenues on the benefit to cost ratio;
- how they deal with climate change; and
- how benefits to non-motorised users are assessed and their relationship with the appraisal of other schemes.

### Indirect tax revenues

As can be seen from Table 8, the impact on the BCR of moving the position of the tax revenues has very different impacts across the three schemes. None of them alter the value for money category, because the schemes are so far in excess of the value needed to achieve “very high” status. However, the variability of the impact is remarkable, and supports the

conclusion that the impact can be very substantial, and all schemes need to be reviewed on these grounds alone.

### Climate change

The greenhouse gas emissions were a very small contributor to overall benefits in all cases – between 0.06 and 0.27%. This may seem a surprising result but fits with the general picture of time savings far exceeding carbon values. In this case the values were for a general congestion saving to drivers. The Table below shows the carbon benefits compared to car users. It also shows how the largest single element in the cycling scheme benefits was physical fitness, and the next most important contributor was journey ambience for cyclists and walkers.

### Physical fitness and journey ambience

These two elements represent the equivalent for the unmotorised modes of time savings. One key difference is that undertaking the journey by these modes is in itself a benefit (up to the daily amount required for fitness) whereas for motorised modes the objective is to minimise the time spent using them.

**Table 9: Proportion of benefits from different elements in the 2009 appraisal**

	Scheme 1	Scheme 2	Scheme 3
Greenhouse gas	0.06%	0.27%	0.18%
Driver benefits	3.7%	16.4%	11.4%
Physical fitness	76.6%	52.5%	64.9%
Journey ambience	18.0%	23.6%	19.6%

Source: Webtag Unit 3.14.1 April 2009 version

To a degree, the proper representation of health as a major benefit in money terms ensures that the policy objective is fully represented.

### Conclusions

These case studies introduce a new issue for this report. It is clear that the health objective is being well represented in the cycling case studies. It is not being similarly represented in most other appraisals. This may be because so few outside specific walking or cycling schemes make any reasonable attempt to improve the health of the public. The infamous AST entry that making pedestrians walk further to cross the road was a marginal health benefit does not seem to fulfil this requirement. Walking and cycling is very difficult to represent in current transport models, at least partly because it is related to land use planning and choice of destination.

The reinforcement or “locking in” of reduced physical activity in transport needs to be addressed across all appraisals.

As with other case studies the effect of moving indirect tax revenues is very variable but significant. This suggests a thorough review would cause changes in the value for money of schemes sufficient to alter their likelihood of being approved and implemented.

The final point is that the importance of carbon reduction is very small in the appraisal. In these cycling case studies, the new, higher values would not make a difference since carbon

makes a contribution of less than half a percent to the benefits. In terms of policy fit however, there would clearly be a positive score.

This raises the issue of how to deal with the impact smaller schemes on whole area emissions. Major schemes represent the effect of large scale investment over a large area.

In the case of small schemes that reduce carbon locally, they clearly cannot be expected to reduce area wide emissions. This is illustrated by the cycling case studies but could equally apply to small local safety proposals. In this case the reductions should be valued at the current rate.

However, the lower requirements for appraisal of small scale schemes would also assist, and the smallest would not be put through the full NATA process even in the present system. It is still the case that an overall package, with a number of small as well as large scale schemes, is the preferred way forward to address this issue.

## 5 Issues arising from the case studies

There are a number of cross-cutting issues that the case studies have highlighted which are considered in the sections which follow. These are:

- public sector versus private sector costs and the impact of tax revenues;
- greenhouse gas emissions; and
- values of time now and in the far distant future.

Before doing so, some conclusions are drawn about how dealing with these issues would affect appraisal.

### General conclusions from case studies

The first observation to be made is that the 2008 MTRU report probably underestimated the extent to which the practical implementation of even the 1998 NATA process had been so inconsistent. This occurred both within single scheme appraisals (with different entries in the AST filled in by different people with varying levels of detail) and between appraisals. The wider trawl of schemes and those considered for the 2008 report confirmed that this was a widespread and serious problem.

Over a decade after NATA was introduced, it is clear that many very large schemes are being appraised in a way that would be completely familiar to pre-NATA practitioners. Favourite local schemes, sometimes with origins both obscure and historical, are still being promoted without a hint of a strategic context or going back to consider real objectives or real alternatives<sup>40</sup>. The way in which these should have been prepared has been clearly set out in guidance, but there has been little monitoring of whether it was being followed. Small time savings to motorists, despite the precarious justification (and little evidence) for a few seconds being of any value whatsoever, still dominate scheme benefits, including some for public transport. Greenhouse gas emissions currently have hardly any impact on most transport appraisals.

There has thus developed a major disconnect between the clear purpose of the original NATA and its impact on the world of transport appraisal. This report explores this further and the ongoing process of refreshing and reforming NATA. It also suggests a small number of important changes which would address some of the key residual problems. The main aim is to achieve better value for money, especially important in the current economic climate. In relation to some key objectives it is the case that many schemes which are not cost effective, and are even counter productive, have been or are being funded. The reforms are therefore not simply academic.

The key reforms relate to:

- greenhouse gas emissions;
- alternative means of achieving objectives;
- time savings; and
- dependence on far distant benefits to fund current costs.

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<sup>40</sup> This is clear in the CBT analysis of Regional Funding Allocations (RFAs) in 2009

## Which schemes would gain and lose in a revised system?

### Existing reforms

It is clear from this report that moving the position of tax revenues in the appraisal will improve the score of any scheme where there is a transfer from car to public transport, walking or cycling.

If the production of alternatives is ever genuinely implemented, value for money will be improved, with packages of smaller measures tending to gain. However, major schemes which do proceed would be less likely to be presented as individual “policy free” items, even when they dominate total transport expenditure in an area.

Reporting the size of time savings or their social distribution is unlikely to influence appraisal unless guidance is issued on how they should affect the decision on whether or not to proceed.

### Result of the reforms from this report

In relation to climate change, schemes for all modes that reduce carbon will achieve much higher priority than those that provide user time savings.

Time savings which are larger and more certain in value will be more important in appraisals.

The highest scores will be for schemes that both achieve carbon targets and produce user benefits.

The pattern of scheme design will change to one where an integrated package will produce better results than single schemes.

## 6 Taxation, Government income and the Benefit to Cost Ratio

### The BCR problem

It is still the case that the economic assessment of most schemes has a strong emphasis on the Benefit to Cost Ratio (BCR) overshadowing other elements of the appraisal suite.

### Impact of removing tax revenue

The effect of inclusion of tax in the BCR was discussed in Chapter Two. The impact on the case-study schemes varies widely. The A14 road scheme had its BCR reduced from 10.83 to 6.69 and the Highways Agency has already responded to the NATA Refresh and published this figure alongside the original<sup>41</sup>. Less impact appeared on the Merseytram case study simply because the net tax element is surprisingly low. This in turn is because tram users are predicted to be mainly former bus users, rather than car-drivers and neither pay VAT on fares. The summary from the case studies is set out below.

**Table 10: Impact on BCRs of indirect tax adjustment**

	Benefit Cost Ratio (BCR) under original appraisal model	BCR under revised appraisal model (tax revenue)
Merseytram (original TWA data)	1.97	2.07
Grand Union Canal Cycle Path	38.4	75.0
A14 between Ellington and Fen Ditton	10.83	6.69
Guided busway Cambridge to St Ives	4.8	6.4
Expansion of rail freight (Felixstowe – Nuneaton)	5.25	35.42*

\* There is a major element of saved road maintenance that reduces capital costs. If this is also repositioned, it results in a BCR of 10.4.

<sup>41</sup> Although carbon costs are still not included in this revised BCR

## 7 Climate change and emissions

Climate change has now become the “elephant in the appraisal” for individual schemes. As the impact of climate change is supposed to be handled at either regional or national level, it is invariably ignored at the scheme level, but there is no mechanism for calculating the cumulative impact of the schemes on national totals. In the regions where this is done, there is no specific action recommended to address the problem.

The only work related to climate change undertaken for each appraisal is to measure the differences in emissions in the future with and without the proposed scheme, and that measurement then determines whether a scheme is given a positive (reduces or slows down emissions), negative (increases emissions) or neutral (no change) score. However as this is not measured against an absolute level of emissions, all targets are in effect rendered meaningless. This was a major concern of the respondents to the NATA Refresh consultation<sup>42</sup>.

It should be remembered that most of the schemes which are subject to a full NATA appraisal may be the major transport investment in the sub-region over the next decade, and are highly significant regionally, for example with capital costs in tens or even hundreds of £millions.

Therefore their impact on greenhouse gas emissions could be highly significant. Ways have to be found to deal with this in a rational and robust manner. The present system is still struggling to do so.

There are two broad issues with regards to addressing climate change in appraisals: how to handle climate change policy in the appraisal, and which emissions to cost.

### How should climate change be handled in the appraisal process - shared responsibility for emissions?

Under this approach individual transport schemes would have to demonstrate that, together with other committed schemes in their area of influence, they cause a reduction in emissions equivalent to that required to meet the national and regional targets. If they do not, they would be sent back to promoters as not currently in line with government policy and the legally binding targets. This is similar to a “pass/fail” test.

Under this approach, while one scheme may not reduce emissions, there may be a scheme in a nearby locality that does reduce emissions, and in effect has carbon reductions to spare. The two schemes could be associated, creating the equivalent of local trading. The problem with this is that the value of the extra carbon savings would be lost, so these would need to be included in the costs of the non-carbon reducing scheme.

This issue is addressed in a more conventional way in the next section.

### Emissions over or under target should be costed

In this section we address a simple but fundamental error in the way carbon is costed within transport appraisals that use the NATA format.

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<sup>42</sup> NATA Refresh Summary of Responses, DfT, June 2008 available on:  
<http://www.dft.gov.uk/consultations/archive/2008/consulnatatrefresh/responses/nataresponses.pdf>

The problem is not so much the actual value, or how it changes over the years, although both are important. The key is which element of the total transport emissions are counted in the analysis of costs and benefits.

Put simply, there would be no **climate change** cost to emissions (there are other environmental pollution costs) if they were within an internationally agreed limit and everyone was on course to achieve that limit<sup>43</sup>. This limit for UK transport is essentially the targets for 2020 and 2050, plus the 5 year carbon budgets<sup>44</sup>, derived from the Climate Change Act.

If policies, packages or schemes are tested and exceed that target limit, **all the excess should count as a cost**. This would be consistent with the approach in the traded sector, where it is the cap (based on a target) that determines when trading is required.

### Only a fraction of emissions is currently costed

The problem is that transport appraisal does not do this at present. Instead, a “Do Minimum” is used as a basis for comparison. In fact, all the “Do Minimum” scenarios we have seen recently (road or public transport) have failed to meet the targets, as do all the “Do Somethings”. The “Do Something” scenarios may reduce or increase emissions slightly compared to the “Do Minimum” scenario, but are nowhere near the target.

The proposal here is that all appraisals should use the target level of reduction as the base against which all schemes are tested. To carry on as at present is against the logic of what the policy is trying to achieve, as well as being completely inconsistent with the cap and trade system.

As a simple example, let us assume that present day emissions in an area affected by a scheme are 100 million tonnes, and the target is 80 million by 2020 and 20 million by 2050. With the scheme, 120 million tonnes are estimated for 2020. Thus the amount of carbon costed should be 40 million (120-80).

Currently this is not done. Instead, the “Do Minimum” level of emissions is calculated for 2020, in this case let us say it is 122 million tonnes. In almost all cases for road schemes, the “Do Minimum” is very close to the “Do Something”.

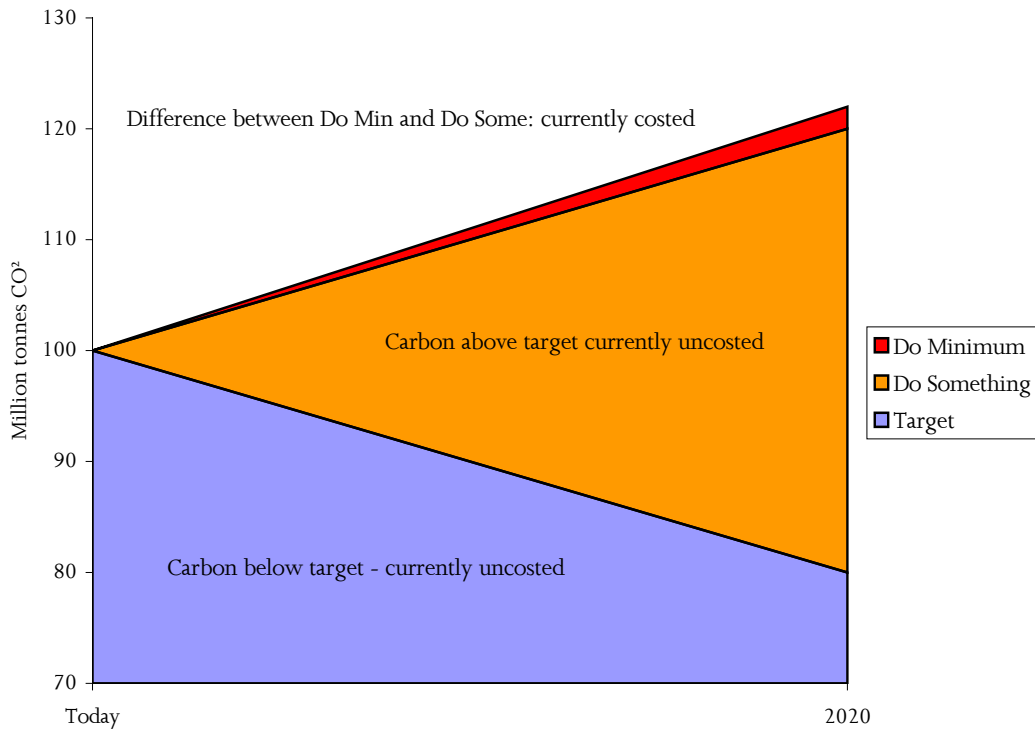
The appraisal counts the difference and puts the cost of only 2 million tonnes in the transport economy table, in this case as a benefit. This leaves 40 million tonnes in excess of target completely uncoded. This is illustrated in the chart below.

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43 This is not quite true, since there is a high level of risk that the target will not be achieved, and the target itself is based on damage limitation rather than eliminating damage. Thus there is some benefit from removing more greenhouse gas than the target although it is not considered further in this report.

44 For the latest targets see *Low Carbon Transport: a Greener Future*, DfT 2009.

Figure 3: Which carbon is costed in NATA?



Just because the “Do Minimum” scenario fails does not mean that the “Do Something” scenario should succeed because it fails slightly less severely. It simply suggests that the “Do Minimum” is not realistic.

### Effect of the missing carbon costs

The impact has been very significant. It means that all major scheme transport appraisals that have valued carbon have seriously underestimated the climate change cost. In turn that means that major schemes which reduce travel time have been favoured over schemes (or packages) which reduce emissions.

How did this occur? The answer is that current guidance suggests that the difference is what should be measured. This would work correctly, but only **if no schemes were permitted to proceed if they breached the target emissions reduction**. This is not clear earlier in the guidance where there is no specific recommendation on what to do if the scheme fails to any significant extent in relation to climate change. In practice, schemes that exceed the emissions target (and thus undermine Government policy) have been allowed to proceed without amendment. This has led to a serious underestimate of their real climate change impact. In all the case studies so far investigated, the impact is very powerful.

If this approach were reformed, it would focus attention on the emissions reducing aspect of schemes. It would also lead to the situation where a scheme in isolation which fails to meet the target would need to be associated with other policies, probably within the same region or sub-region, to ensure that the target was met. This might finally achieve the Government objective of integration.

### Should the emissions reduce the benefits or increase the cost?

The final issue is how the carbon cost is treated. Since transport has its own budget for carbon emissions, any failure to deliver the target by an individual scheme has to be balanced by savings **over target** elsewhere in the transport sector. Thus the DfT budget is said to be constrained by the target. In these circumstances emissions should be added to the capital cost of the scheme<sup>45</sup>. This would make it consistent with the current theoretical basis for NATA appraisals, and would further increase the impact of the carbon cost on any individual scheme.

### Summary

The threat of climate change is very significant, as is reflected by the Government's legally binding emission reduction targets, which have been set in order to minimise the potential dangers of climate change. A method to account for carbon emissions in a rational and robust manner must be introduced quickly if the Government is to meet its policy objectives.

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<sup>45</sup> For a detailed discussion of this issue see Chapter 4 of *NATA Refresh: Appraisal for a Sustainable Transport System* DfT, April 2009, especially paragraph 26 onwards.

## 8 Appraisal and the different values of time

### The overall impact of values of time (VOT)

Transport schemes today are mainly justified on the value of the time savings they produce, over a period of 60 years. For major infrastructure schemes this ends up being the dominant figure in cost-benefit analysis. For example, the cost of increasing accidents, increasing greenhouse gas emissions, and increasing fuel use added together, are almost always less than the value of time savings, and would not justify revising or cancelling the scheme.

For this reason, it is necessary to understand in more detail the way that values of time are estimated in appraisal. The issue of whether small time savings of a few minutes are really of value to road users was discussed in the 2007 NATA report<sup>46</sup>. What follows is a discussion of how time values are adjusted according to which mode is being used and the purpose of the journey<sup>47</sup>. This has a major impact on appraisals, particularly those for bus and light rail.

The first step is to categorise time saved by people into three basic purposes:

- during the course of their work;
- commuting to their work; and
- all other journeys.

### Commuting and other journeys

Commuting and ‘all other journeys’ are given an identical monetary value for their time, whatever mode of transport is being used: this equates to £5.04 per hour for commuting and £4.46 per hour for other journeys<sup>48</sup>. These values are derived from surveys of people’s willingness to pay to reduce their travel time.

Values are constant across the whole country. If this were not the case, more affluent areas would receive greater infrastructure investment rather than less well off areas, as there would be increased value attached to time savings in these areas. As webtag says,

*“Investment will then be concentrated into high-income areas, and the interests of those on lower incomes, who may already suffer from relatively lower mobility and accessibility, will be given less weight.”<sup>49</sup>*

For this reason, they are usually called “national equity values”.

Time spent waiting for public transport for these purposes is multiplied by 2.5, and walking and cycling as a means of interchange between modes is multiplied by 2. Again this reflects greater willingness to pay to avoid waiting and is also constant.

The value of this time in appraisal is estimated at the present time over 60 years. Clearly long-term modelling would be completely unreliable, so the benefits for the last modelled year are usually just repeated until the 60 years are up. However, the time value undergoes two important transformations.

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<sup>46</sup> Decision making for Sustainable Transport, MTRU, Green Alliance February 2008.

<sup>47</sup> Data is drawn from webtag, Unit 3.5.6

<sup>48</sup> These are deemed to include tax and are thus referred to as “market prices”

<sup>49</sup> (Unit 3.5.6, para 1.2.14)

The first is that it is assumed that as people get richer, they will value their time more. Thus assumptions about GDP growth are used to increase time values. For the non-work time, every 1 per cent increase in GDP per head produces a 0.8 per cent increase in value, for work time it's one to one (see section below).

The second adjustment is to use discounting so that future values decline over the 60 year period. The rate of decline is 3.5 per cent per year for the first 30 years, and 3 per cent for the next 30<sup>50</sup>. The concept of discounting has different elements, but these are not considered further in this section. The only point to make is that the GDP rise partly compensates for the discounting.

It should be noted that vehicle operating costs are not assumed to grow with GDP, but fall because it is assumed that vehicles will become much more efficient and thus cost less to run. They are also discounted. These assumptions reduce their importance in the economic assessment. It must be remembered that operating costs are “real” in the sense that they are based on maintenance and fuel used rather than costs derived from surveys of ‘willingness to pay’.

To summarise, non-work time has a modest value per hour based on willingness to pay, it rises in line with GDP per head but slightly slower, and is discounted. It is the same whatever the mode, whoever saves it and wherever they live.

### Work time

Work time values are derived from the national costs of employing people, which include wages, and overheads such as national insurance and pensions. It is assumed that all time saved can be translated into productive time. This is a very significant assumption but is put to one side for the rest of this section.

The work time value is varied according to transport mode, using survey data from the National Travel Survey. Different modes are used by employees on different pay scales and thus a car driver is deemed to have an average value of £26.43 per hour, a bus passenger £20.22, a rail passenger £36.96 and a cyclist only £17.00. The highest value is given for a taxi passenger's time, at £44.69. As can be seen, all of these values are significantly higher than those during non-work time.

These values are the same across the country. Thus schemes in low wage areas will have their value uplifted and those in high wage areas will be downrated. Again, this is a policy decision on equity grounds.

Values are increased faster than those under non-work time, in direct relationship to increases in GDP per head. In other words a one per cent GDP rise causes a one per cent rise in the value of work time. These values are discounted in the same way as non-work time.

Far more important than the individual values are the assumptions about the proportions of time spent on work and non-work time on different modes. These are based on current use, without transfers.

Examples for key modes during the morning peak are given in table 11 below.

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<sup>50</sup> In line with the Treasury “Green Book” on appraisal

**Table 11: Percentage of travel distance by value of time category in morning peak**

	Car	Bus (PSV)	Rail
Work	15.4	3.9	14.1
Commuting	38.3	30.0	51.9
Other	46.4	66.1	34.1

Source: webtag, Unit 3.5.6

The implication of the values in the table above is that it is assumed that certain modes of travel are used more for work than others. In particular there is a huge difference between the amount of car travel (15.4 per cent) and bus travel (3.9 per cent) deemed to be for work purposes. This has the effect of reducing the value of a bus passenger's time even further.

This clearly has the potential to cause serious anomalies when people switch from a mode which is used more for work purposes, such as car, to one which is assumed to be more used for non-work purposes, such as bus or light rail. This is recognised by webtag, although the explanation as to why this may not matter is probably self-contradictory<sup>51</sup>. It goes on to say that:

*"In certain circumstances it may be appropriate to make the simple assumption of a common working value of time for all travellers"*<sup>52</sup>

However, this is only part of the problem. Changes in the proportion of work time will be a key influence on the benefits. For example, a public transport scheme based on serving a central business district is likely to have completely different patterns of use to the national average.

In addition, any time saving treated as a benefit assumes that time saved will translate perfectly into increased productivity. This is not always the case, and is strongly related to land use planning, for example faster travel time can actually just lead to longer distances being travelled, and more dispersed locational patterns. In that case there may be no savings.

## Summary

This report suggests that a greater emphasis should be placed on the actual changes in people's travel behaviour, rather than producing a single number for user costs or benefits based on assumed time savings.

If such a number is to be meaningful, a standard test should be at the average for all modes and all purposes. We should not be placing higher values on any one mode over another. This would at least provide a true national value of time which is both equitable and transparent and would allow for switching between modes and purpose of journey. It would also reveal the sensitivity of the analysis to assumptions about different values of time.

<sup>51</sup> In particular it ignores how the transfer of high earners onto a previously low earner mode will increase the average value for that mode – see para 1.2.6

<sup>52</sup> See para 1.2.6

## 9 Recommendations

### Further reforms to appraisal methodology

- 1 This report suggests four immediate further reforms to appraisal methodology:
  - costing of all greenhouse gas above target, not a comparison with a completely unrealistic “Do Minimum” scenario.
  - clear implementation of the objectives led process including the preparation of genuine alternatives and packages – if this has not been done schemes should be sent back to promoters.
  - pending further research, all appraisals should include a test for the sensitivity to the size of time savings, producing BCRs with small time savings omitted, publishing them in the AST and taking them into account in any decision.
  - all appraisals should publish a benefit profile in the AST, with BCRs at 20 and 40 years as well as 60, again taking them into account in any decision.
- 2 In the longer run the issues of uncertainty beyond 20 and 30 years, including time savings and real carbon values, needs further work. Simply continuing costs and benefits from early years over such long time periods is misleading. Research should be progressed including scenario testing.
- 3 The DfT needs to be more proactive in ensuring that people understand and implement appraisals consistently and follow guidance.
- 4 Attention needs to be given to producing a simple method to estimate public transport scheme benefits from mode transfer where multi-modal models are not available.

### Revisit and re-assess schemes

5 It is inevitable that some investment decisions, particularly in recent years, have been affected by the way that the previous NATA assessed certain influential elements such as the impact of tax.

Now that a new version, NATA 2, is proposed, one way to address this would be to review any schemes where the sensitivity is high, in other words where there is evidence of:

- carbon emissions over target;
- significant public transport use; and
- significant transfer from car to public transport.

This should be done for all schemes, including those which have passed the Major Business Case stage, which have not yet been finally approved.

- 6 The change should be made as soon as possible to include:
  - proper preparation of alternatives;
  - realistic costing of excess carbon; and
  - the undertaking of new, more meaningful, sensitivity tests.

In the majority of cases it should be possible to undertake this with existing data from the published appraisals.

## Annex 1

Change in BCR caused by repositioning tax revenues (all figures in £'000)

	NATA 1		Move indirect tax		BCR		NPV	
	Net benefits	Net costs	Net benefits	Net costs	NATA 1	Move tax	NATA 1	Move tax
Merseytram	426,466	215,997	407,734	197,265	1.97	2.07	210,469	210,469
A14	2,649,801	244,579	2,827,278	422,056	10.83	6.70	2,405,222	2,405,222
N2P	1,460,531	278,141	1,216,737	34,348	5.25	35.42	1,182,390	1,182,389
Cambs busway	321,959	66,506	302,422	38,442	4.84	7.87	255,453	263,980
GU cycle	73,475	1,911	72,530	967	38.45	75.01	71,564	71,563

Source: MTRU spreadsheet

Note: Cambridge busway includes additional minor adjustment (see Case Study)

As can be seen, the Net Present Value (NPV) does not change in 4 of the 5 cases. Despite this, the BCR changes in very different ways, sometimes to a very significant extent.