Royal Automobile Club Foundation for Motoring

Rates of Return on Public Spending on Transport

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The Royal Automobile Club Foundation for Motoring Limited is a charity established to promote the environmental, economic, mobility and safety issues relating to the use of motor vehicles.

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1. INTRODUCTION

This report is concerned with the returns from investments in the surface transport sector in the United Kingdom. This issue was considered in detail in the Eddington Report, which included a detailed analysis of the returns from different transport schemes (Eddington, 2006a, see in particular chapter 3.1, pp.121-142). The relative returns from different sectors are charted in the RAC Foundation report *Roads and Reality* (RAC Foundation, 2007, pp.36-38). Eddington concluded that some transport interventions offer very high returns to government spending, and that the case for targeted transport intervention is compelling. While there is a strong case for ensuring that transport users pay the true costs associated with their trips and that there is potential for options such as road pricing to ensure better use of existing infrastructure, some infrastructure projects do offer very good returns. These include schemes targeted at the worst bottlenecks, and relatively small-scale interventions such as walking and cycling schemes and junction improvements. But returns from interventions in urban areas appeared to be relatively low.

The Eddington report's recommendations have subsequently been incorporated in the Department for Transport's objectives as set out in the document *PSA Delivery Agreement 5.* This PSA Agreement notes (HM Treasury, 2007, p.11) that a "key recommendation of the Eddington Study was the need for a rigorous and systematic policy process for transport spending: defining the problems; considering the full range of options across all modes; and using appraisal techniques that include full costs and benefits to ensure spending is focused on the best policies. In response the Government is developing investment plans for transport focused on supporting sustainable economic growth (and other transport challenges and goals), through robust problem definition and appraisal of options. Alongside this, the Government will continue to facilitate private investment to deliver the required outcomes and meet future challenges."

One of the four indicators against which progress in the transport sector will be measured is the average BCR over the Comprehensive Spending Review 07 period.[1] This indicator will "help demonstrate how government is implementing recommendations from the Eddington Study to ensure that spending is focused on the projects with the highest returns" (HM Treasury, 2007, pp.5-6).

The basis of appraisal of public sector projects in the transport sector is the New Approach to Transport Appraisal (NATA). Where possible, impacts of projects are assessed in monetary terms using social cost-benefit analysis techniques, with impacts valued according to values recommended for use by the DfT in their WebTag website. Use of common values, for example for travel time savings and improved safety, should ensure consistency across projects in different parts of the transport sector.

[1] The other three indicators relate to: journey times on main roads into urban areas; journey time reliability on the strategic road network; and level of capacity and crowding on the rail network.

Not all impacts can be expressed in monetary terms,[2] and the Appraisal Summary Table (AST) for each project compares different impacts, including those that cannot be valued.

The major consideration is Value for Money (VFM). The Department's guidance on VFM (DfT, 2005) indicates that submissions for projects should include a VFM section which:

- Sets out the estimated BCR;
- Assesses whether the project has any significant impacts which cannot be expressed in monetary terms; and
- On the basis of this analysis, describes the project as 'poor', 'low', 'medium', or 'high'.

A project will generally be regarded as:

- 'poor' if the BCR is less than one;
- 'low' if the BCR lies between 1 and 1.5;
- 'medium' if the BCR lies between 1.5 and 2; and
- 'high' if the BCR is greater than 2.[3]

However, consideration of the impact of any non-monetised impacts might shift a project into a different category to the one implied by its BCR so choice of project is not just determined by the measured BCR. The DfT's April 2009 NATA Refresh document provides some details on how the adjustment from initial BCR to final VFM category is to be made through consideration of those impacts where some monetary valuation can be made (the 'adjusted BCR') and assessment of the sensitivity of the final results to the impact of non-monetised impacts (DfT, 2009a, pp.50-60).

DfT guidance indicates that DfT would normally expect to fund: no projects with poor VFM; very few projects with low VFM; some, but by no means all, projects with medium VFM; and most, if not all, projects with high VFM. No submission should recommend agreement to a project with low VFM without the agreement of the relevant Director General. No submission should recommend agreement to a project with poor VFM without the agreement of the Accounting Officer.

The Department's aim in its PSA agreement is to maintain the same proportions of expenditure in the high VFM category as was achieved in the Comprehensive Spending Review 04 period. Success is to be judged over the three year CSR period, but progress is to be reported annually.

[2] Impacts assessed in monetary terms are: risk of death or injury; time savings; operating costs; costs to the Exchequer; noise; carbon emissions; physical fitness; and costs and revenue to the private sector. Impacts where there is some valuation evidence are: reliability; some wider benefits; regeneration; landscape; air quality; and journey ambience. Impacts not currently valued include: townscape; water environment; accessibility; social inclusion; biodiversity; and heritage.

[3] From April 2009 a further 'very high' category is being introduced for schemes with a BCR above 4.

The baseline CSR 04 proportions are ‘high’ VFM 95 per cent, ‘medium’ VFM 4 per cent, ‘low’ VFM one per cent, ‘poor’ VFM zero per cent (DfT, 2008).

2. PROBLEMS IN INTERPRETING BENEFIT-TO-COST RATIOS

2.1 Problems Identified

There are a number of problems in interpreting and comparing published benefit cost ratios:

- Recommended methodology for valuing costs and benefits in the public sector changed as a result of the publication of the latest version of the Treasury Green Book in 2003;
- The definition of the benefit cost ratio used by DfT changed around 2003 when the definition of cost was changed to include net cost to the public sector rather than overall social cost;
- Benefit cost ratios are likely to vary over the period during which a project is being planned;
- Benefit cost ratios estimated after a project has been implemented may differ from those anticipated before construction is finally approved; and
- BCRs only include monetised impacts of projects.

2.2 Impact of the Green Book Changes

The most recent revisions to the Green Book in 2003 involved a number of changes which would alter the BCR value for a particular project:

- The standard project appraisal period was increased to 60 years, which would increase the stream of benefits for longer-lived projects and hence increase their BCR;
- The standard discount rate was reduced to 3.5 per cent, which would reduce the extent to which future benefits were discounted, and hence increase the BCR; and
- Standard allowances were to be added to capital costs to allow for optimism bias, which would increase total costs and hence reduce the BCR.

2.3 Revision of the Definition of the BCR

The second problem in interpreting BCR values is that the definition of the BCR recommended to be used in transport appraisals has changed over time. The issue of the appropriate definition of the BCR was raised in the report that Professor Robert Sugden provided for DETR on cost-benefit analysis methodology in 1998 (Sugden, 1998, see especially pp.18-21). The Department adopted Sugden’s methodology, and the definition of the BCR recommended for use in NATA changed around 2003 to take account of the net subsidy cost to the public sector. BCR was defined as the present value of benefits (PVB) divided by the net present value of costs to the public sector (PVC).

Thus the Department's Autumn 2008 Performance Report notes that the "NATA benefit cost ratio is currently defined as net benefits (benefits minus costs) to users, business and private sector providers divided by Public Sector Cost where benefits and costs are measured in present value terms (i.e. measured over 60 years and then discounted" (DfT, 2008). Concern was expressed (see for example Green Alliance, 2008, pp.23-29) that this tended to favour road schemes, since these may lead to increases in vehicle-mileage (for example, a by-pass may save time, but distance travelled may increase) and increases in fuel consumption and hence tax revenue. This also appears to conflict with government objectives to reduce greenhouse gas emissions caused by use of fossil fuels. In addition, BCR values under this definition can be very sensitive to small changes in revenues, and in the limit BCRs will rise rapidly as revenue gains approach total scheme costs.

DfT have taken such concerns into account and in their NATA Refresh document published in April 2009 propose to change the definition of the BCR again, to exclude indirect tax changes from present value of cost calculations and include them in the present value of benefit calculations (DfT, 2009a, pp.41-49). Selecting projects with the highest BCRs would then ensure maximisation of benefits from a DfT budget which did not take account of any changes in overall government indirect tax revenue. This change would take effect from 2010, so obviously none of the BCRs to be detailed below have been calculated on this new basis.

2.4 Changes in BCR Values Will Vary Over the Planning Period for a Particular Project

One would expect as a project passes through the planning stages, from feasibility planning, to programme entry, to initial approval, to final approval, that the value of the BCR would be revised. For example, as a scheme is worked up, the capital cost estimates are likely to be firmed up, and contingency requirements reduced. Also as new information becomes available, traffic forecasts may be revised and the benefit estimates on which they are based may need to be modified. Some care may therefore need to be exercised in comparing BCR estimates from different stages of different projects' lives.

2.5 Ex Post BCRs from Evaluations May Differ From Ex Ante BCRs from Appraisals

Many of the BCR values available have been calculated in order to secure approval for construction, but the expectations of the project planners may not be realised. Ex post evaluation is increasingly being used in the transport sector,[4] so for projects that have been implemented it is important to compare ex post estimates of the BCR realised with the ex ante expectation of the BCR that the project will realise.

[4] See for example guidance on evaluation of major local transport projects published by DfT (NERA *et al*, 2006).

2.6 BCRs Only Include Monetised Impacts of Projects

BCRs only include the monetised impacts of projects, whereas projects will have other, non-monetised, impacts that may be identified and sometimes quantified in the project Appraisal Summary Table (AST). As noted in Section 1, DfT appraisal methodology makes some allowance for this because the overall VFM rating from a project ('poor', 'low', 'medium', or 'good') may vary from that implied by the range in which the BCR lies.

The Eddington Report (Eddington, 2006a, pp.129-131) provides some information on the effects of moving towards a more complete assessment of VFM in two sectors, 'roads' and 'bus and interchange' schemes. Including environmental, social and what Eddington calls 'missing GDP effects' reduces BCRs for road schemes but increases them (according to Eddington "the impact is minimal but slightly positive") for bus and interchange schemes (Eddington, 2006a, p.130). As noted above in Section 1, the recent NATA Refresh document provides some information on how the overall assessment of VFM is to be made.

3.0 SOURCES OF INFORMATION ON BENEFIT-TO-COST RATIOS

3.1 The Eddington Report and Subsequent Detailed Information on the Projects Included

DfT have published information on the individual projects and their BCRs which appear in the Eddington Report. This information also indicates the Value for Money (VFM) category where this was assessed. Schemes, a total of 184, are divided into the following categories:

- Highways Agency schemes (90 schemes);
- Local roads (43 schemes);
- Local public transport schemes (20 schemes);
- Rail schemes (only 2 schemes, the Crossrail hybrid scheme and the Thameslink upgrade);
- Schemes from external sources (14 schemes, of which three were local roads, two light rail, six rail, one a Highways Agency scheme, and two walking/cycling schemes); and
- Results from additional modelling commissioned by the Eddington Study on a further set of transport schemes (15 schemes, of which two were Highways Agency roads, two were local roads, eight public transport, and three heavy rail).

Results from these schemes are presented in full in Table 1, and summarised in Table 2. Both tables reclassify projects into the following six categories: Highways Agency roads; local roads; local public transport schemes, excluding light rail; heavy rail schemes, now 11 schemes (including the Jubilee Line which the DfT file classified as a light rail scheme), light rail schemes (five projects), and walking/cycling schemes (only two).

Table 1 shows each scheme in each category, provides a brief description to identify the scheme, and tabulates the BCR value and the VFM category. Within each category of scheme projects are ranked according to (increasing) BCR values. The final column of the table shows the relationship between BCR values and VFM values. In the case of 90 of the schemes (just over half of the total) there is no VFM classification, while in another 78 (42 per cent, or 85 per cent of those for which a VFM classification does exist) considerations of VFM do not alter the BCR classification (as 'poor', 'low', 'medium' or 'good').

Table 1: Benefit cost ratios from the Eddington Report

Route no.	Description of project	NATA BCR	BCR cat	VFM cat	VFM and BCR categories
M6	Carlisle to Guards Mill	Negative	1	4	VFM good, BCR poor
A64	Colton Lane	1	2	0	No VFM value
	Leeds to Sheffield highway Improvements	1.3	2	0	No VFM value
A2	Bean to Cobham Phase 1	1.5	2	0	No VFM value
A500	Basford, Hough, Shavington Bypass	1.7	3	0	No VFM value
A63	Castle Street Improvement-Cut and Cover Tunnel Option	1.7	3	0	No VFM value
M6	Active Traffic Management	1.8	3	0	No VFM value
A120	Stansted to Braintree Improvement	2	3	0	No VFM value
A2/A282	Dartford Improvement Scheme	2	3	4	VFM good, BCR medium
A6	Clapham Bypass	2	3	0	No VFM value
A6	Great Glen Bypass	2	3	0	No VFM value
A66	Long Newton Grade Separated Junction	2	3	4	VFM good, BCR medium
M1	Widening Junctions 30 to 42 Northbound Collector Distributor	2	3	4	VFM good, BCR medium
A21	Flimwell to Robertsbridge-HA preferred route	2.1	4	4	VFM and BCR the same
A249	Iwade to Queensborough Improvement	2.1	4	0	No VFM value
A30	Temple to Higher Carblake	2.1	4	0	No VFM value
A500	City Road & Stoke Junction Improvement	2.1	4	0	No VFM value
A1033	Hedon Road Improvement	2.2	4	0	No VFM value
M25	Rapid Widening DBFO section 5	2.2	4	0	No VFM value
A303/A358	A303/A30 Option	2.3	4	1	VFM poor, BCR good
A650	Bingley Relief Road	2.3	4	0	No VFM value
A66	Temple Sowerby Bypass & Improvements at Winderwath	2.3	4	4	VFM and BCR the same
M25	J12-15 Widening	2.3	4	0	No VFM value
A5	Nesscliffe Bypass	2.4	4	0	No VFM value
M25	Rapid Widening DBFO section 4	2.4	4	0	No VFM value
A2	Pepperhill to Cobham widening	2.5	4	4	VFM and BCR the same
A46	Newark to Lincoln Improvement	2.6	4	0	No VFM value
M27	J11-12 Climbing Lane	2.6	4	4	VFM and BCR the same
A21	Kippings Cross to Lamberhurst bypass	2.7	4	0	No VFM value
A14	Haughley New St-Stowmarket Improvement (Q2 2000)	2.8	4	0	No VFM value
A27	Polegate Bypass	2.8	4	0	No VFM value
A303/A358	A358 Option	2.8	4	4	VFM and BCR the same
A43	Whitfield Turn-Brackley Hatch Improvement	2.8	4	0	No VFM value
M1	J10 to J13 Widening	2.9	4	0	No VFM value

Route no.	Description of project	NATA BCR	BCR cat	VFM cat	VFM and BCR categories
M1	J19 Improvement	2.9	4	4	VFM and BCR the same
A11	Attleborough Bypass Improvement	3	4	0	No VFM value
A41	Aston Clinton Bypass	3	4	0	No VFM value
	Access to Port of Liverpool Improv (new route from M57/M58)	3	4	0	No VFM value
A3	Hindhead	3.1	4	4	VFM and BCR the same
A6	Rothwell-Denborough Bypass	3.2	4	0	No VFM value
M4	Junction 18	3.4	4	4	VFM and BCR the same
A180	Interchange	3.5	4	0	No VFM value
A43	M40 - B4031 Dualling	3.5	4	0	No VFM value
A6	Alvaston	3.5	4	0	No VFM value
M1	J6A to J10 Widening	3.5	4	4	VFM and BCR the same
A590	High and Lower Newton	3.6	4	2	VFM low, BCR good
A66	Stainburn & Great Clifton Bypass	3.6	4	0	No VFM value
A1(M)	Ferrybridge-Hook Moor	3.7	4	0	No VFM value
M5	Hallen Hill	3.7	4	4	VFM and BCR the same
A30	Carland Cross to Chiverton Cross	3.8	4	0	No VFM value
A34	Chieveley/M4 J13 Improvement	3.8	4	0	No VFM value
M60	J5-8 Widening	3.8	4	0	No VFM value
A63	Melton Grade Separated Junction (Q2 2000)	3.9	4	0	No VFM value
A1	Willowburn to Denwick Improvement	4.1	4	0	No VFM value
A428	Caxton Common to Hardwick Improvement	4.1	4	4	VFM and BCR the same
M5	J19-20 N/B Climbing Lane (Tickenham Hill)	4.1	4	4	VFM and BCR the same
A1(M)	Wetherby-Walshford	4.2	4	0	No VFM value
A21	Lamberhurst By-Pass	4.2	4	0	No VFM value
A595	Parton to Lillyhall	4.2	4	4	VFM and BCR the same
A10	Wadesmill-Colliers End	4.5	4	0	No VFM value
A43	Siverstone Bypass	4.5	4	0	No VFM value
M25	Rapid Widening DBFO section 2	4.6	4	0	No VFM value
M62	Route 2 Junction 25 to 28	4.7	4	4	VFM and BCR the same
A63	Selby Bypass	4.8	4	0	No VFM value
M40/A404	Handy Cross Junction Improvement	4.9	4	0	No VFM value
A38	Derby Junction	5.2	4	4	VFM and BCR the same
A30	Bodmin to Indian Queens	5.5	4	4	VFM and BCR the same
M25	Rapid Widening DBFO section 1	5.5	4	0	No VFM value
A11	Fiveways to Thetford Improvement	5.6	4	0	No VFM value
A30/A382	Merrymeet Junction	5.7	4	4	VFM and BCR the same
A419	Commonhead Junction	5.7	4	0	No VFM value
M40	Junction 15 Longridge Bypass	5.8	4	0	No VFM value
M20	J10A	5.9	4	0	No VFM value
A160	Improvements	6.1	4	0	No VFM value
A23	Handcross to Warninglid Improvement	6.1	4	4	VFM and BCR the same
A5	M1 Link Road (Southern Route Strategic)	6.5	4	0	No VFM value
M25	J1b-3 Widening	6.5	4	0	No VFM value
M27	J3-4 Widening	7.1	4	4	VFM and BCR the same
A160/A180	Improvement Feasibility Study	7.2	4	0	No VFM value
M25	J28/A12 Brook St Improvement	7.2	4	4	VFM and BCR the same
A27	Southerham to Beddington Improvement	7.5	4	4	VFM and BCR the same
A453	Widening M1 J24 to A52	7.8	4	0	No VFM value
A421	Great Barford Bypass	7.9	4	4	VFM and BCR the same
M5	J19-20 S/B Climbing Lane (Naish Hill)	9.3	4	4	VFM and BCR the same
A6	Rushden Higham Ferrers Bypass	9.5	4	0	No VFM value
A47	Blofield to North Burlingham	9.6	4	0	No VFM value

Route no.	Description of project	NATA BCR	BCR cat	VFM cat	VFM and BCR categories
A21	Tonbridge to Pembury	11.1	4	0	No VFM value
A55/A483		11.2	4	4	VFM and BCR the same
	Stansted Surface Access	11.7	4	0	No VFM value
A14	Ellington to Fen Ditton Improvement	12.3	4	0	No VFM value
A180	Widening	13	4	0	No VFM value
A46	Newark to Widmerpool Improvement	14.7	4	4	VFM and BCR the same
A1	Peterborough to Blyth GSJ	20.5	4	4	VFM and BCR the same
Local Road Schemes					
	Rotherwas Access Road	1	1	1	VFM and BCR the same
A35	Codford to Heytesbury Improvement	1.5	2	1	VFM poor, BCR low
	Owen Street Level Crossing Relief Road Tipton	1.5	2	3	VFM medium, BCR low
	Beverley Integrated Transport Plan	1.9	3	3	VFM and BCR the same
	Southend Major Scheme	2.2	4	3	VFM medium, BCR good
A31	Hickley's Corner Underpass	2.3	4	4	VFM and BCR the same
A228	Main Road to Ropers Lane	2.4	4	0	No VFM value
	Burnt Tree Junction Improvement	2.7	4	4	VFM and BCR the same
	Scarborough Integrated Transport Scheme	2.7	4	4	VFM and BCR the same
	Selly Oak New Road Major Scheme	2.8	4	4	VFM and BCR the same
	South Lowestoft Relief Road	2.8	4	4	VFM and BCR the same
	Leeds to Bradford Improved Highway Connections	2.8	4	0	No VFM value
	East Leeds Link Road	2.9	4	4	VFM and BCR the same
	Sheffield Northern Inner Relief Road phases 2 & 3	2.9	4	4	VFM and BCR the same
A36	Wylye Valley Relief Road, Salisbury area	3	4	2	VFM good, BCR medium
A41/A4031	Expressway/All saint Way Junction Improvements	3	4	4	VFM and BCR the same
A58	Blackbrook Diversion	3	4	4	VFM and BCR the same
	Bexhill Hastings Link Road	3.1	4	4	VFM and BCR the same
	Edge Lane West	3.2	4	4	VFM and BCR the same
A66	Tees Valley Gateway Study	3.2	4	0	No VFM value
	Burgh Le Marsh Bypass	3.3	4	4	VFM and BCR the same
	Pleasley Bypass Extension	3.3	4	4	VFM and BCR the same
	Tunstall Northern Bypass	3.5	4	4	VFM and BCR the same
	Leeds Urban Area Highway Improvements	3.6	4	0	No VFM value
A429	Barford Bypass	3.9	4	4	VFM and BCR the same
A228	Leybourne and West Malling Bypass	4	4	4	VFM and BCR the same
	East Kent Access Phase 2	4.1	4	4	VFM and BCR the same
A4146	Stoke Hammond	4.2	4	4	VFM and BCR the same
A507	Ridgmont Bypass	4.3	4	4	VFM and BCR the same
	West Midlands Urban Traffic Control	4.3	4	4	VFM and BCR the same
	DETC	4.4	4	4	VFM and BCR the same
	W2EMMS	4.5	4	4	VFM and BCR the same
	Pegswood Bypass	5	4	4	VFM and BCR the same
	Greater Manchester Urban Traffic Control	5.2	4	4	VFM and BCR the same
	Taunton Third Way and Northern Inner Distribution Road	5.2	4	4	VFM and BCR the same
A1073	Spalding to Eye Improv. Scheme	5.4	4	4	VFM and BCR the same
	Barnstaple Western Bypass	5.6	4	4	VFM and BCR the same
	Brierley Hill Sustainable Access Scheme	5.6	4	4	VFM and BCR the same
	Earl Shilton Bypass	5.6	4	4	VFM and BCR the same
	SEMMS New Relief Road Scheme	5.7	4	4	VFM and BCR the same
	Sittingbourne Northern Relief Road	5.8	4	4	VFM and BCR the same
A167	Chilton Bypass	5.9	4	4	VFM and BCR the same
	Waverley Link Road	6.2	4	4	VFM and BCR the same

Route no.	Description of project	NATA BCR	BCR cat	VFM cat	VFM and BCR categories
	Heysham to M6 Link	7.4	4	0	No VFM value
M4	J11 Mereoak Reading	7.7	4	4	VFM and BCR the same
A631	West Bawtry Improvements	8.5	4	4	VFM and BCR the same
	Carlisle Northern Development Route	8.6	4	4	VFM and BCR the same
A13/A138	Sadler's Farm Junction	11.3	4	4	VFM and BCR the same
Local Public Transport Schemes (excluding Light Rail)					
	Altrincham Interchange	1	1	3	VFM medium, BCR poor
	Bradford Interchange	1	1	2	VFM low, BCR poor
	Newcastle - Eldon Square Concourse	1.2	1	2	VFM low, BCR poor
	Surrey Pegasus, Guildford Area	1.4	2	2	VFM and BCR the same
	Doncaster QBC	1.7	3	3	VFM and BCR the same
	North West Taunton Package	1.8	3	3	VFM and BCR the same
	Leeds to Sheffield Highway Improvements + Leeds Urban Area Bus Fares and Frequency Enhancements	1.8	3	0	No VFM value
	Coventry Rapid - Preferred Scheme	1.9	3	4	VFM good, BCR medium
	Cambridge Guided Bus	2	3	0	No VFM value
	Warrington Interchange	2	3	4	VFM good, BCR medium
	Wolverhampton Town Access and Interchange	2.2	4	4	VFM and BCR the same
	Intra Leeds Bus Fare Reduction (30%) & Frequency Increase (20%)	2.6	4	0	No VFM value
	S and W Yorkshire County Bus Fares Reduction (30%) and Frequency Increase (20%), Leeds to Sheffield and Leeds to Bradford Highway Improvements	2.6	4	0	No VFM value
	Leeds Urban Area Major Public Transport Investment	2.7	4	0	No VFM value
	South and West Yorkshire County Bus Fare Reduction (30%) and Frequency Increase (20%)	2.7	4	0	No VFM value
	SPARK Leamington Spa and Warwick Integrated Public Transport Improvement	2.8	4	4	VFM and BCR the same
	Haxby Station	3	4	4	VFM and BCR the same
	West Yorkshire County Bus Fare Reduction (60%) and Frequency Increase (20%)	3	4	0	No VFM value
	Bletchley Link 2 Public Transport Scheme	3.1	4	4	VFM and BCR the same
	Greater Bristol Bus Network	3.2	4	4	VFM and BCR the same
	South Yorkshire County Bus Fares Reduction (30%) and Frequency Increase (20%)	3.2	4	0	No VFM value
	MyBus, West Yorkshire	4	4	4	VFM and BCR the same
	Leeds to Bradford Public Transport Improvements	4	4	0	No VFM value
	Mansfield Interchange	4.4	4	4	VFM and BCR the same
	Coleshill Multi Modal Interchange	4.8	4	4	VFM and BCR the same
Heavy Rail Schemes					
	Glasgow Airport Rail System	1.1	2	0	No VFM value
	ECML 2a (additional interpeak services to 5 trains per hour Leeds-London)	1.3	2	0	No VFM value
	Jubilee Line Extension	1.7	3	0	No VFM value
	High Speed Line London-Glasgow	1.9	3	0	No VFM value
	High Speed Line London-Manchester	1.9	3	0	No VFM value
	High Speed Line London-West Midlands	1.9	3	0	No VFM value

Route no.	Description of project	NATA BCR	BCR cat	VFM cat	VFM and BCR categories
	ECML 2b (additional WAGN peak commuter capacity)	2.2	4	0	No VFM value
	TfL Rail Vision	2.5	4	0	No VFM value
	Crossrail Hybrid Scheme	2.6	4	0	No VFM value
	Thameslink Upgrade	3	4	0	No VFM value
	Midland Main Line Time Savings	11	4	0	No VFM value
Light Rail Schemes					
	DLR Woolwich Extension	1.1	2	0	No VFM value
	DLR London City Airport	1.7	3	0	No VFM value
	Nottingham Express Transit Extension	2	3	4	VFM good, BCR medium
	Leeds Supertram	2.3	4	4	VFM and BCR the same
	South Hampshire Rapid Transit	3.6	4	4	VFM and BCR the same
Walking and cycling					
	Improved Walking and Cycling Facilities	2.6	4	0	No VFM value
	Canal Towpath	24.5	4	0	No VFM value

Source: DfT, Data from Investment Returns from Transport Schemes Considered by the Eddington Study

Table 2 provides a summary of the results, showing the number of schemes in each category, the average BCR value, and the relationship between BCR and VFM results within categories.

Table 2: Summary of BCR Results from the Eddington Report, by Sector

Sector	No. of projects	Ave BCR	Relationship between BCR and VFM categories				Total
			No VFM value	BCR & VFM the same	VFM > BCR	VFM < BCR	
Highways Agency Schemes	93	4.66	61	26	4	2	93
Local Road Schemes	48	4.23	5	39	2	2	48
Local Public Transport Schemes	25	1.71	9	11	5	0	25
Rail Schemes	11	2.83	11	0	0	0	11
Light Rail Schemes	5	2.14	2	2	1	0	5
Walking and Cycling	2	13.55	2	0	0	0	2
Total	**184**		**90**	**78**	**12**	**4**	**184**

Source: Table 1 of this report

With the exception of walking/cycling schemes, of which there are only two examples in the sample, average BCR values are highest for highway schemes (4.66 for Highways Agency roads, and 4.23 for local roads), next highest for heavy rail schemes (2.83), next for light rail schemes (2.14), and lowest for local public transport schemes (1.71). If light rail schemes were to be included in the local public transport category the average BCR would increase from 1.71 to 1.78.

It is possible that additional consideration of VFM could improve the position of local public transport schemes compared with road schemes because of the consideration of benefits that are not measured in monetary units.

Table 2 shows that four of the Highways Agency schemes had a better VFM classification than their BCR classification while two had a worse classification, while in the case of local roads the changes were evenly matched (two schemes had improved VFM classification, and two worse). But in the case of local public transport schemes (including light rail) consideration of overall VFM increased the overall rating category in six out of the 19 schemes for which overall VFM was identified, and did not reduce it for any scheme. However we cannot make any judgement about the impact of wider VFM considerations for any of the 11 schemes that we have classified as heavy rail because a VFM score was not provided for any of these schemes.

Given the limited number of rail schemes included in Eddington it is worth looking at them in more detail. As noted above, only two schemes, Crossrail and Thameslink, were included in the main Eddington list. Both are major schemes in central London which will primarily impact on commuter traffic, and which are both going ahead. In both cases estimation of wider economic benefits (WEB) in the form of agglomeration economies has proved important in making the overall case.[5] The DfT file shows the BCR for the Crossrail hybrid scheme as lying between 1.6 and 2.6, where the lower figure excludes WEBs and the higher figure includes them. This result is consistent with the cost-benefit study published for Crossrail (Crossrail, 2005). The BCR for the Thameslink upgrade is shown as lying between 2.1 and 3.0, where the lower figure excludes WEBs and the higher figure includes them. One major difference between the schemes is that Crossrail is largely new construction whereas Thameslink is a major upgrade of an existing route. We understand that a major problem in estimating the BCR of Thameslink has been to separate out the element of the project cost that can be regarded as enhancement from that part that can properly be charged to renewal.

Of the other nine rail schemes included in the DfT's Eddington file: three are new high speed lines (London-Glasgow, London-Manchester, and London-West Midlands, all of which are shown as having the same BCR value of 1.9) for which there is a published but essentially preliminary cost-benefit study (see text box for details); two are other major schemes in London, the Jubilee Line Extension (BCR 1.7 but likely to be WEBs to add to this) and what is listed as 'TfL Rail Vision' (BCR 2.5); two are programmes of service enhancements on the East Coast Main Line (increase to five inter-peak trains

[5] The Department now refers to WEBs as 'wider benefits', and published draft guidance on their incorporation in project appraisal in April 2009 (DfT, 2009b). Where appropriate, the benefits are to be measured under three main headings: (1) agglomeration benefits arising where economic activities are located closely together (2) benefits that arise where markets are imperfectly competitive so that transport user benefits do not necessarily accurately measure final benefits to the economy from a transport cost reduction (3) benefits from widening of labour markets that are not currently measured by user benefits to commuters. However, my own view is that the evidence base for measuring these types of effect is still quite weak. There has been good work on the measurement of agglomeration effects, while researchers at the LSE have identified an approach to estimate impacts of transport investment on total factor productivity (TFP) that could in principle be applied in practice. But while DfT has commissioned work on assessing impacts of previous transport investments on TFP, we do not yet have any clear evidence on the scale of effects that actual transport investments have had on costs and productivity in transport-using industries.

per hour to Leeds, BCR 1.3, and service enhancements on the former WAGN franchise, BCR 2.2), one is time savings along the whole of the Midland Main Line (BCR, 11.0), and the final one is a Glasgow Airport Rail System (BCR only 1.1, but going ahead). This is a rather mixed bag of projects, but fortunately there is more evidence on BCRs from rail schemes that we can consider later in this report (see Sections 3.3 and 3.4).

BCR Estimates from Feasibility Study of High Speed Rail (HSL)

Atkins led a consortium which undertook a feasibility study of new north-south high speed rail line (HSL) options for the Strategic Rail Authority between August 2001 and February 2003. A summary version of their report is available on the DfT website (Atkins, 2003).

The study considered traffic forecasts primarily for the years 2016 and 2031 on the three existing north-south rail routes (ECML, MML and WCML) and the highways network, and developed a number of route options (most with a London-West Midlands core route section) based on city centre rail stations (accessed in the early stages by existing rail routes). The summary report concludes that HSL is capable of delivering economic benefits to the UK with a BCR between 1.9 and 2.8. It is the lower of these figures that is quoted in the Eddington file, and the summary report does not split out BCRs by route. The main impact of the HSL would be to divert traffic from overcrowded 'classic' rail routes (mode source estimates for Option 8 in 2031 are: classic rail 58 per cent; air 4 per cent; car 20 per cent; generation 18 per cent).

The report concludes there would be minimal effect on overall road traffic levels and on highway congestion. Environmental effects are likely to be negative: "In environmental terms it is difficult to construct a new railway without adverse effects upon the natural and built environment – these would need to be carefully managed and appropriate actions taken to minimise and mitigate adverse impacts where possible" (Atkins, p.ii), while "some of our current HSL options affect a number of important natural and heritage resources, such as the Chilterns AONB, the Peak District National Park as well as several SSSIs and blocks of ancient woodland. The HSL would also cause disturbance over a considerable distance of hitherto undisturbed open countryside" (Atkins, pp.6-12).

Construction costs, based in particular on CTRL costs, varied between £9.9 billion for Option One and £33 billion for Option 8, which would take the HSL up to Central Scotland. The study estimates large revenue losses to the Train Operating Companies, varying between £300 million and £1,700 million according to the HSL option. Overall NPV would be particularly vulnerable to low growth in the economy and higher fares charged on HSL, where a premium is built into traffic forecasts. Atkins were subsequently asked to revise their BCR forecasts to take account of changes in the CBA methodology set out in the Green Book (this increased BCR from Option 1 from 1.41 to 2.07 and from Option 8 from 1.44 to 2.04) the impact of the re-scoping of the ECML upgrade (which increased HSL BCRs because the re-scoping of the ECML upgrade would provide less good service on the ECML than had been anticipated in the original study), and the effect of introduction of national road charging (which also increased BCRs, though not by all that much – from 2.62 to 2.78 in the case of Option 3, the example given in the summary report).

We might note that Eddington warns against *grand projects* with speculative returns, and advises that the government should only pursue high speed rail options where they have been demonstrated to give the highest VFM to relieve congested corridors (Eddington, 2006a, p.141).

3.2 The Department's Answers to a 2004 Parliamentary Question

Another raft of scheme BCRs in different parts of the transport sector was provided in an answer to a Parliamentary Question in 2004. Mr Graham Brady, MP for Altrincham and Sale West, asked the Secretary of State for Transport if he would publish the cost to benefit ratios of all the transport schemes he had approved in principle in the previous three years, including those agreed for implementation by TfL. The list was provided but excluded TfL schemes on the grounds (with two exceptions, the East London Line, and the Thames Gateway Bridge) that decisions were the responsibility of the Mayor.

The list contains 50 strategic road schemes, 50 local major road schemes costing over £5million, 4 major maintenance scheme, 25 local public transport schemes (nine of which were interchanges, 12 bus schemes, three integrated transport schemes, and one Smartcard scheme), only four heavy rail schemes, three light rail schemes, four PFI street lighting projects, and the Thames Gateway Bridge. This gives a total of 141 schemes.

The list simply includes BCR values, and does not contain any additional information on VFM. There is no explanation of how the numbers were calculated and a warning that BCRs may not be comparable between projects as Government's appraisal methodology was changing over the three-year period to which the BCR values relate. As well as because of the changes in the Green Book, we believe that BCR values would have changed because the basis on which BCR values were calculated was changing because of the implementation of the Sugden methodology (to change the denominator from total cost to net cost to public sector). It is therefore not sensible to compare these BCR numbers to the later Eddington values in Tables 1 and 2, but we still believe it is worthwhile to look at BCR values by sector.

Table 3: BCRs Produced by DfT in 2004

Road no.	Description of Project	BCR	BCR category
Strategic Roads			
A30	Temple to Higher Carblake Improvement	1.2	2
A64	Colton Lane Grade Separated Junction	1.2	2
A64	Rillington Bypass	1.3	2
A66	Long Newton Junction	1.4	2
A66	Temple Sowerby and Improvement at Winderwath	1.4	2
A69	Haydon Bridge Improvement	1.4	2
A1	Dishforth-Leeming	1.5	2
A1	Leeming to Barton	1.5	2
A453	Widening (M1 J24 to A52 Nottingham)	1.5	2
A21	Tonbridge to Pembury	1.6	3
A14	Elington-Fen Denton Improvement	1.8	3
M1	J19 Improvement	1.8	3
M1	J6a-10 Widening	2.1	4
A1	Morpeth to Felton dualling	2.2	4
M25	J23-27 Widening	2.2	4
M5	J19-20 Northbound Climbing Lane	2.3	4
A1	Adderstone to Belford Dualling	2.4	4
A1/A19/1068	Seaton Burn Junction Improvement	2.4	4

Road no.	Description of Project	BCR	BCR category
M25	J27-30 Widening	2.4	4
A1	Kippings Cross to Lamberhurst bypass	2.5	4
A30/A382	Merrymeet Junction	2.5	4
A30	Carland Cross to Chiverton Cross	2.6	4
M1	J21-30	2.6	4
M4	J18 Eastbound Diverge	2.6	4
A428	Caxton Common to Hardwick Improvement	3	4
A45/A46	Tollbar End Improvement	3	4
A5117/A550	Deeside Park Junctions Improvement	3	4
A590	High & Low Newton Bypass	3	4
M5	J19-20 Southbound Climbing Lane	3.1	4
A419	Blunsdon	3.3	4
M40/A404	Handy Cross Junction Imprvement	3.7	4
A419	Comonhead Junction	3.9	4
A421	Bedford to M1 J13	4.2	4
M20	J10A	4.2	4
A505	Dunstable Northern Bypass (A5 to M1 link)	4.3	4
M1	J10-13 Widening	4.3	4
A23	Handcross to Warninglid Widening	4.4	4
M25	J5-7 Widening	4.6	4
M25	J16-23 Widening	5.5	4
A19/A184	Testos Junction Improvement	5.6	4
A66	Carkin Moor to Scotch Corner Improvement	5.8	4
M40	J15 (Longbridge)	6	4
A1	Bramham-Wetherby (inc Wetherby bypass)	6.1	4
A1	Stannington Junction	6.3	4
A66	Greta Bridge to Stephen Bank Imprvement	6.9	4
A47	Blofield to North Burlingham Dualling	7.1	4
M5	J17-18 Northbound Climbing Lane	7.5	4
A27	Southerham to Beddingham Imrovement	7.7	4
A57/A628	Mottram in Longdendale, Hollingworth & Tintistle Bypass	9	4
M25	J1b-3 Widening	9.9	4
Local Major Roads (>£5million)			
	Markham Employment Growth Zone	-3.5	1
	Ilkeston-Awsworth Link Road	0.8	1
A391	St Austell to A30 Link Road	1.2	2
A34	Alderley Edge Bypass	1.3	2
	Darlaston SDA	1.4	2
	Sheffield Northern Inner Relief Road Stage 2 & 3	1.4	2
	Nar Ouse Regeneration Road	1.5	2
A1198	Papworth Everard Bypass	1.5	2
	Sedgefield-Wynyard Improvement (Durham)	1.5	2
	Biddulph Inner Bypass	1.8	3
A142	Fordham Bypass	1.8	3
	East Luton Corridor (South)	1.9	3
	Sunderland Central Route	1.9	3
A228	Ropers Lane Phase 1	1.9	3
	Kiln Lane Link, Epsom	1.9	3
	Ashton Northern Bypass Stage 2	1.9	3
A228	Leybourne and West Malling Corridor Improvement	2	3
	Upperton Road Viaduct Major Maintenance Scheme	2	3
	Oakham Bypass	2.1	4
	Hanley-Bentilee Link Road	2.2	4
	Northern Gateway (North Tyneside)	2.3	4
A505	Baldock Bypass	2.4	4
A58	Blackbrook Diversion	2.4	4
	Mansfield Ashfield Regeneration Route	2.5	4
	Pegswood Bypass (Northumberland)	2.7	4
	East Kent Access Phase 1	2.9	4
	Stoke Hammond/Linslade Western Bypass	2.9	4

Road no.	Description of Project	BCR	BCR category
	Wigan Inner Relief Road	2.9	4
	Bletchley Link	3	4
	Sunderland Southern Radial Route	3.1	4
	North Middlesborough Accessibility Improvement	3.2	4
	Brierley Hill Access Road	3.3	4
M4	J11 and Mereoak Roundabout	3.3	4
A43	Corby Link Road	3.4	4
A350	Semington-Melksham Diversion	3.5	4
	Rugeley Eastern Bypass Stage 2	3.6	4
	Selly Oak Relief Road	3.6	4
A158/C541	Coastal Access Improvement (Partney)	3.6	4
A509	Isham Bypass	3.8	4
	Chilton Bypass (Durham)	4	4
A24	Horsham-Capel Improvement	4	4
	Weymouth Relief Road	4.2	4
A57/A628	Cadishead Way	4.3	4
	Cradley Heath Relief Road	4.5	4
A612	Gedling Transport Improvement Scheme	6.1	4
	Scotswood Road Dualling (Newcastle)	6.2	4
	Burntwood Bypass Phase 3	8.1	4
	Tunstall Northern Bypass	8.9	4
	Rearsby Bypass	9.2	4
A24	Ashington to Southwater	10	4
Local Transport Schemes: Interchange			
	Ryde Interchange	0.4	1
	North Manchester Business Park	1.1	2
	Four Lanes Ends	1.2	2
	Norwich City Centre Interchange	1.4	2
	Coleshill Interchange	1.6	3
	Wolverhampton	1.7	3
	Barnsley Interchange	1.8	3
	Liverpool South Parkway	1.8	3
	Sheffield Station - Improved Pedestrian Access	2	3
Local Transport Schemes: Bus			
	Coventry Quality Bus Network	1	2
	Leeds A65 Kirkstall Road	1.5	2
	Luton Dunstable Translink	1.5	2
	Milton Keynes Quality Bus Network	1.5	2
	Getting Northampton to Work	1.7	3
	Hampshire A3 Bus Priority Corridor	1.8	3
	Cambridge to Huntingdon Rapid Transit	2.4	4
	Manchester Northern Orbital Scheme	2.6	4
	JETTS Quality Bus Corridor	2.6	4
	West Yorks Yellow School Bus	3	4
	A638 Great North Road Quality Bus	5.7	4
	South East Manchester (SEMMMS)	7.7	4
Local Transport Schemes: Integrated Transport			
	Luton Town Centre	1.8	3
	Masshouse Circus	3.4	4
	Walsall Town Centre Package	6.7	4
Local Transport Schemes: SMARTCARD			
	YORCARD	1.1	2
Heavy Rail Schemes			
	East London Line Extensions	1.1	2
	Thameslink Upgrade	1.7	**3**
	Crossrail	2	3
	West Coast Route Modernisation (Enhancement Element)	>2	4

Road no.	Description of Project	BCR	BCR category
Light Rail Schemes			
	Merseytram[6]	1.1	2
	Leeds Supertram	1.3	2
	South Hampshire Rapid Transit	1.6	3
Major Maintenance Schemes			
	Walton Bridge, Surrey	1.5	2
	Freckleton Street Bridge, Blackburn	2.1	4
	Upperton Road Viaduct, Leicester	2.2	4
	Undercliff Drive, Isle of Wight	2.9	4
London			
	Thames Gateway Bridge	9	4
Street Lighting Schemes			
	Streetlighting: Barnet PFI	3.5	4
	Streetlighting: Enfield PFI	4.8	4
	Streetlighting: Ealing PFI	5.5	4
	Streetlighting: Lambeth PFI	8.4	4

Source: Answer to Parliamentary Question

Table 3 shows the 2004 BCR values in detail, while Table 4 presents some summary information. Table 3 shows schemes by category, with schemes within each category ranked in (increasing) order of BCR. Table 4 shows average benefit cost ratios by category: strategic roads 3.64; local roads 3.13; local public transport 2.36; heavy rail 2.36 (this is a minimum value because one of the four rail BCRs, the enhancement component of the West Coast Main Line, is listed as greater than 2); light rail 1.33; major maintenance 2.18; and street lighting 5.55. As with the Eddington BCRs, those for road schemes exceed those for local public transport and rail schemes. Also, as with Eddington, the number of rail schemes is limited, with the two major cross-London schemes, Crossrail and Thameslink, joined by the East London route development and an estimate of the BCR from the enhancement component of the West Coast Main Line upgrade (believed to have been made by the Strategic Rail Authority, but with enhancement only accounting for about 20 per cent of the total spend of some £8.5billion on the upgrade).

Table 4: Summary of 2004 BCR Results

Sector	Number of projects	Average BCR
Strategic roads	50	3.64
Local major roads (>£5m)	50	3.13
Local transport schemes	25	2.36
Rail	4	>1.60
Light rail	3	1.33
Major maintenance schemes	4	2.18
Street lighting	4	5.55

Source: Table 3 of this report

[6] Information from MerseyTravel (Letter dated 30.06.09) states that the BCR between 2002 and 2005 was much higher, at 1.57:1 as contained in the authorities Addendum Report to Local Transport Plan 2006-2011. The Table 3 figure of 1.1 was abstracted from the reply on 13th October 2004 by Tony McNulty to a PQ asked by Mr Brady www.publications.parliament.uk/pa/cm200304/cmhansrd/vo041013/text/41013w02.htm#41013w02.html_wqn6 .The Hansard figure is used within the table for comparative purposes.

3.3 More Evidence on Rail Schemes: the Network Rail Utilisation Strategy Documents

We have seen in Section 3.1 above that evidence on rail schemes in the Eddington Report was limited, and it was largely confined to a few major schemes. However, BCRs have now been published by Network Rail as part of their programme to develop Route Utilisation Strategies (RUS). The reports include details of a range of schemes for each of the RUSs.

However, this exercise is currently (April 2009) incomplete, since 12 RUS's (see Table 5 for the list) have been published, with another seven to go (East Midlands, Great Western, Kent, Network, Sussex, West Coast Main Line, West Midlands/Chiltern).

We have reviewed the published reports and extracted information on BCRs where available. This gives a list of 157 schemes for which BCRs are available. From this list we have selected 57 schemes as representative of the better (in terms of BCR) rail schemes that have been identified. We have exercised a degree of discretion in this, but our main criteria have been (1) where a number of schemes provide alternative ways to achieve a particular objective, we select the scheme with the highest BCR, and (2) we exclude schemes with BCR values below 1 since these appear to represent very poor value for money (and are generally rejected in the RUS itself).

Table 5 shows the results of this exercise. Route Utilisation Strategies are grouped in alphabetical order, then within each RUS the individual schemes we have selected are ranked in increasing order of BCR. The average value of the BCRs of the rail schemes selected is 2.89. Of the 59 schemes, 37 are 'good', 13 are 'medium, and nine are 'low'.

It should be noted that this rail sector evidence (and some more included at the end of the following section) primarily relates to the impact of enhancements to the present network. It cannot answer the question as to whether the size of the present network is justified. However, the Government has set out its requirements for the rail network in its High Level Output Statement (HLOS). This indicates that the Government wishes to preserve the present rail network. Consequently in this exercise we believe that it is legitimate to focus primarily on adjustments to the present range and mix of rail services provided, even though not all existing lines might pass the standard cost-benefit test.

Table 5: Rail Benefit Cost Ratios from Network Rail Route Utilisation Strategies

RUS	Pg ref	Project Description	BCR	BCR Cat	PVC (£m)	NPV (£m)	Notes
Freight	79	Gospel Oak-Barking rail gauge enhancement without passenger enhancements	1.88	Med	14.8	16.4	
Freight	77	Reduction of signalling headways in Birmingham area	1.93	Med	5.7	23.7	
Freight	77	Reactivation of Boldon east curve (Tyneside)	3.19	High	12.4	62.9	

RUS	Pg ref	Project Description	BCR	BCR Cat	PVC (£m)	NPV (£m)	Notes
Freight	79	Olive Mount chord & W10 Port of Liverpool to WCML via Earlestown & Runcorn	3.54	High	12.5	135	
Freight	77	WCML Carlisle-Preston growth capacity (electric traction)	3.94	High	13.7	941.3	
Freight	79	Southampton-WCML W10 enhancements	4.56	High	61	383	
Freight	77	Humber Ports/Immingham to Aire/Trent Valleys	4.6	High	91.6	474.1	
Freight	77	Nuneaton-Peterborough W10 gauge enhancements & incremental capacity	5.25	High	124.8	118.2	
North West	110	CLC corridor: Glazebrook additional up loop	1.5	Low	1.9	0.9	
North West	88	Bolton corridor:Blackpool line timetable recast	1.5	Low	3.6	1.6	
North West	98	Chat Moss corridor: Liverpool-Manchester additional off-peak services	1.8	Med	2.1	1.6	
North West	60	All corridors: increase peak capacity by train lengthening	2.1	High	155.5	167.6	
North West	83	Calder Valley corridor: increase Calder Valley line speed	2.3	High	5.4	7	
North West	118	St Helens corridor: Prescot headway and linespeed	2.5	High	1	1.5	
North West	74	Hadfield corridor: develop Guide Bridge as an interchange	3.4	High	5.8	14.1	
North West	101	Chat Moss corridor: develop Newton-le-Willows as an interchange	9.2	High	3.4	27.6	
Merseyside	92	Additional hourly inter-peak Liverpool-Wigan semi-fast	1.6	Med	9.4	5.3	
Merseyside	91	Quarter-hourly Liverpool-Chester mixed service pattern	1.8	Med	20.4	16	
Merseyside	88	Overall business case for train lengthening	3.14	High	40.7	86.9	BCRs range from 2.27 to 3.66 by corridor
Scotland	118	Highland Main Line capacity and journey time improvements	1.18	Low	69.5	12.2	
Scotland	83	Central Scotland: extend all platforms to 6-car length	1.3	Low	26.3	8.6	
Scotland	111	G&SW line: additional infrastructure to reduce headway Kilmarnock-Gretna	1.4	Low	42.6	18	
Scotland	117	Edinburgh-Glasgow via Shotts: additional trains with skip-stop pattern	8.5	High	23.4	175.1	Cost excludes investment cost
Cross London – Overground	79	Extension of PIXC buster concept (PIXC= passengers in excess of capacity)	2.9	High	54	10.2	Does not fully address crowding
Cross London - Overground	81	Longer trains on North and West London Lines	4.1	High	48.1	151	This is BCR from 'low cost' option, BCR from 'high cost' option is 1.8
Cross London - Overground	83	Extend Barking-Gospel Oak trains to Clapham Jnct & operate new service Stratford-Queens Park	7.1	High	75.1	461.9	This is BCR from 'low cost' option, BCR from 'high cost' option is 1.8
East Coast Main Line	124	Dunbar-Edinburgh hourly service	1.6	Med	23.7	13.6	Does not include cost of new track layout at Dunbar
East Coast Main Line	111	Increase line speeds on ECML to get one minute journey time reductions	2	Med	n.a.	n.a.	
East Coast Main Line	165	Additional peak services on Hertford Loop into Moorgate	2	Med	50.6	52	

RUS	Pg ref	Project Description	BCR	BCR Cat	PVC (£m)	NPV (£m)	Notes
East Coast Main Line	163	Alexandra Palace-Finsbury Park: additional third up line	2.1	High	24.6	27	
East Coast Main Line	141	Increase peak capacity into both Middlesborough and Newcastle by train lengthening	2.7	High	13.5	22.4	
East Coast Main Line	95	Extension of all inner suburban services to 6-car	2.7	High	9.4	16.3	
East Coast Main Line	157	Construction of a remodelled junction at Shaftholme	3.6	High	30.2	77.6	
East Coast Main Line	100	Increase inner suburban services to 4 trains per hour on Sundays	5.5	High	1	4.5	
Greater Anglia	141	West Anglia route: package of measures (train lengthening & increased frequency)	2.3	High	914	1223	BCR increased to 2.7 when WEBs added in
Greater Anglia	137	Thames-side route: train lengthening to 12 cars	3.3	High	252	591	
Greater Anglia	138	Great Eastern route: package of measures (new & additional trainsets, increase frequency)	5.7	High	300	1413	
South London	150	Sussex routes: train lengthening	2.64	High	204	335	
South London	153	Train lengthening: 12-car trains into Victoria	2.86	High	127	237	
South London	151	Kent routes: train lengthening	2.94	High	271	527	
South London	152	Train lengthening for services via Tulse Hill	3.36	High	51	120	Does not include depot & stabling costs of 10-car operation nor capacity costs at London Bridge
South West Main Line	Appendix 9.2	Extra passing loops on line to Exeter	1.7	Med	86.3	58.1	
South West Main Line	Appendix 1.2	Suburban train lenghthening to 10 coaches (low cost option)	4.5	High	217.6	769.5	
Wales	130	Taff Vale and Rhymney South Wales Valleys: longer-term growth	1.2	Low	n.a.	n.a.	
Wales	118	Reduced journey times and increased frequency between North Wales & South Wales	2	Med	5	4.8	
Lancashire and Cumbria	77	Cumbrian Coast: additional Sunday services: 2-hourly Carlisle-Barrow service	1.1	Low			Excludes extra signalling costs
Lancashire and Cumbria	80	Settle & Carlisle: 2-hourly Carlisle-Leeds service	1.5	Low			Includes limited additional frequency to address key issues
Lancashire and Cumbria	91	Full refurbishment of Preston station	>2	High			
Lancashire and Cumbria	86	Ormskirk-Preston hourly & reinstate Burscough chord for Ormskirk-Southport hourly service	2.2	High			
Lancashire and Cumbria	76	Cumbrian Coast: Barrow-Sellafield peak train lengthening	3.2	High			
Lancashire and Cumbria	83	Roses option: extend am and pm peak Manchester-Blackburn service to Clitheroe	3.4	High			To provide half-hourly peak service (BCR is 2.6 if service extended to Burnley not Clitheroe)

RUS	Pg ref	Project Description	BCR	BCR Cat	PVC (£m)	NPV (£m)	Notes
Yorkshire and Humberside	71	Harrogate line: Horsforth-Leeds peak shuttles	1.8	Med			
Yorkshire and Humberside	69	Airedale line: two-tier service from Skipton/Keighley	1.9	Med			
Yorkshire and Humberside	81	Hope Valley line: aditional peak Manchester-Sheffield services	2	Med			
Yorkshire and Humberside	77	Huddersfield line: lengthen stopping services Huddersfied/Brighouse-Leeds	2	Med			
Yorkshire and Humberside	79	Calder Valley line: Halifax-Leeds additional peak services	2.1	High			
Yorkshire and Humberside	74	Barnsley and Pontefract lines: Castleford-Leeds peak shuttles	2.7	High			
Yorkshire and Humberside	82	Sheffield-Doncaster line: peak train lengthening	3.1	High			
Yorkshire and Humberside	75	Wakefield line: Wakefield-Leeds and Doncaster-Leeds peak shuttles	3.4	High			

Source: Network Rail Route Utilisation Strategies, as at April 9th 2009
Note: financial figures are generally at 2002 market prices

3.4 Estimated versus Actual BCR Values

So far we have only considered BCR values calculated before a project is implemented. As we noted in Section 2.5, the actual results from any project are likely to differ from those anticipated when the project is approved, and so in this section we consider evidence as to how far actual returns (or at least estimates of actual returns estimated once a project has been completed and is carrying traffic) differ from anticipated returns and, in particular, whether there is any evidence of systematic bias in either under- or over-estimating actual returns.

While ex post evaluation of projects is encouraged, it is expensive and by no means easy to do, so there is so far relatively little evidence, except now for Highways Agency projects.

Under the POPE acronym (Post-Opening Project Evaluation) the Highways Agency now commission studies of the impact of their schemes one and five years after the project has been opened and publish information on their website. These results compare the anticipated BCRs of the projects for which they are responsible with an estimate of the actual BCR taking account of revised estimates of construction costs and traffic measurements after opening that are compared with the traffic forecasts on which the original BCR estimates were based. This exercise is carried out both for major projects (defined up to now as projects costing more than £5million) and Local Network Management Schemes.

Table 6 shows results for both categories of schemes, compiled from the results on the Agency website and copies of reports listed but not on the website which have been supplied by the Highways Agency.

Table 6 shows road number and highway schemes, the estimated pre-construction BCR from the Appraisal Summary Table, the estimated BCR achieved one or more years after opening, the pre- and post- BCR categories, and a final column showing whether the BCR value rose or fell after construction.

Of the 24 major schemes listed for which we have both pre- and post-opening BCR values, the average pre-opening BCR was 3.00, while the average post-opening BCR was 3.28. (However, this result is influenced by the very big increase in the BCR for the A2 Bean-Cobham scheme – with this scheme excluded the average BCR goes down from 3.06 to 2.48.) Post-opening BCRs were greater than pre-opening BCRs in 12 cases and they were less than pre-opening schemes in 12 cases. Overall, we find it hard to see any evidence that projected BCRs have been consistently overestimated, neither that they have been consistently underestimated, though we would expect this exercise to improve future BCR estimation by highlighting the types of factors that can cause benefits to be overestimated or costs to be underestimated.

The Highways Agency publishes their own assessment of the results of POPE. For major schemes this is included in the documents Post Opening Project Evaluation 2002-2006: Lessons Learnt (July 2007) (Highways Agency, 2007a) and Post Opening Project Evaluation Meta-Analysis (Highways Agency, March 2009). A summary of Local Network Management Schemes is published in Post Opening Project Evaluation of Local Network Management Schemes Year 5 (2006/07) (Highways Agency, 2007b).

In regard to BCRs, the Highways Agency's 2002-2006 'Lessons Learnt' report concludes (Highways Agency, 2007a, p.3):

- "The outturn BCRs for 14 TPI (Targeted Programme of Improvements) schemes were available; of these four were consistent with projected values, six were higher than predicted and four were lower than predicted. Overall, the average of the predicted BCRs for the 14 schemes was 2.7, which was identical to the average of the outturn BCRs for these schemes."; and
- On the basis of all 20 LNMS schemes evaluated, the "20 LNMS as a whole had an aggregate BCR of 7.1, slightly lower than the predicted 8.2".

The most recent, 2009, report considers success in predicting particular components of road projects. Key finds are as follows:

- Only 40 per cent of bypass schemes have predicted traffic volumes within 15 per cent of outturn, whereas three-quarters of junction improvement and online widening schemes are within 15 per cent;
- Forecasting economic benefits is generally not accurate and only 38 per cent of schemes have predicted time benefits within 15 per cent of outturn, although there is no systematic bias towards under or over prediction;
- At the ‘year after’ stage there is a poor correlation between predicted and actual accident savings, though correlation improves once five years of data are available; and
- Generally environmental and accessibility / integration impacts are predicted well.

Table 6: Pre- and Post-Opening BCRs from Highways Agency Schemes

Road number	Scheme	Date opened	Forecast BCR	Post-opening BCR	BCR category: forecast	BCR category; post-opening	Did BCR rise or fall?	Notes
A2/M2	Cobham to J4 widening	**Jul-03**	0.31	0.39	Poor	Poor	Rose	
A6	Great Glen bypass	**Feb-03**	0.49	0.76	Poor	Poor	Rose	
A64	Colton Lane Grade Separated Junction	**Jun-05**	0.9	0.7	Poor	Poor	Fell	
A6	Clapham bypass	**Dec-03**	1.24	1.49	Low	Med	Rose	Land compensation claims still outstanding so costs could rise
A5	Nescliffe bypass	**Mar-03**	1.38	3.31	Low	High	Rose	
A500	Basford, Hough & Shavington bypass	**May-03**	1.7	Not in EST	Med	N/A	Not possible to tell	Cost unknown
A2	Bean-Cobham phase 1	**Mar-05**	1.77	21.8	Med	High	Rose	Original COBA files missing so "figures should be treated with some caution"
A14	Rookery Crossroads Grade Separated Junction	**Dec-05**	1.96	2	Med	Med	Rose	
A21	Lamberhurst bypass	**Jan-00**	2.3	2	High	Med	Fell	
A650	Bingley Relief Road	**Dec-03**	2.3	1 - 1.6	High	Low/Med	Fell	Actual BCRs estimated for corridor, which is narrower area than that for which predicted BCR was estimated
A46	Newark-Lincoln improvement	**Jul-03**	2.6	2.4	High	High	Fell	
M25	J12-15	**Dec-05**	2.65	3.1	High	High	Rose	
A1(M)	Ferrybridge to Hook Moor	**Jan-06**	2.73	0.94	High	Poor (or High)	Fell	BCR if maintenance benefits included: forecast 4.69; actual 3.19
A27	Polegate bypass (and A22 new route)	**Jun-02**	2.8	3.38	High	High	Rose	
A43	Silverstone bypass: Silverstone section	**Sep-02**	2.8	3.8	High	High	Rose	
A11	Roudham Heath to Attleborough	**Mar-03**	3	Not in EST	High	N/A	Not possible to tell	Outturn costs and BCR not available, pre- and post- benefits not comparable

Road number	Scheme	Date opened	Forecast BCR	Post-opening BCR	BCR category: forecast	BCR category; post-opening	Did BCR rise or fall?	Notes
A41	Aston Clinton bypass	**Oct-03**	3	3	High	High	Unchanged	
A6	Rothwell-Desborough bypass	**Aug-03**	3.16	0.58	High	Poor	Fell	
A6	Alvastan	**Dec-03**	3.48	4.03	High	High	Rose	
A6	Rushden and High Ferrers bypass	**Aug-03**	3.5	2.3	High	High	Fell	
A66	Stainburn & Great Clifton bypass	**Dec-02**	3.6	Not in EST	High	Med?	Fell	Two Year After report. Actual BCR not provided but appears to be lower than predicted
A34	Chieveley/M4 J13 improvement	**Sep-04**	3.7 - 6.4	2	High	Med	Fell	
A10	Waddesmill, High Cross & Colliers End bypass	**Oct-04**	4.5	2.3	High	High	Fell	
A43	Silverstone bypass: Syresham section	**Sep-02**	4.52	6.2	High	High	Rose	
A34	Newbury bypass	**Nov-98**	5.4	5.8	High	High	Rose	From Five Years After Report
A1	Stannington Junction	**Aug-04**	6.6	3.1	High	High	Fell	
A1033	Hedon Road Improvement	**Nov-03**	6.6	2.1	High	High	Fell	
BCRs from Large Local Network Management Schemes								
A14	Spittals Interchange	**Jan-06**	1.62	1.99	Medium	Medium	Rose	Two Years After Report
A45	Ryton on Dunsmore Junction Improvement	**Aug-05**	1.83	2.1	Medium	High	Rose	
M1	J25/A52 Safety and Capacity Scheme	**Oct-05**	3	2.8	High	High	Fell	
M1	J28 Capacity Improvement Scheme	**Mar-06**	3.56	1.59	High	Medium	Fell	Eighteen Months After Report
M40	J15 Improvement Scheme	**Sep-04**	7	<1	High	Poor	Fell	
A45/A46	Stivicall Junction	**May-04**	75.7	116	High	High	Rose	

Source: Highways Agency website, plus reports available from and provided by the Agency

Notes: AST = Appraisal Summary Table; EST = Evaluation Summary Table

We have only found one example where this type of ex post evaluation has been carried out for a programme of public transport schemes. The Strategic Rail Authority (SRA) oversaw a programme of relatively small rail improvement schemes that attracted outside funding, from local authorities. This fund was known as the Rail Passenger Partnership and was intended to encourage local and regional initiatives (see Gourvish, 2008, pp.20 and 41). Returns from projects funded under the RPP were reviewed by Halcrow in a study for the SRA (Halcrow Group, 2004).

Table 7 shows the results for the sample of 15 projects that Halcrow reviewed out of the 83 in the Rail Passenger Partnership and the 12 in the Rail Performance Fund (this fund provided a source of partnership funding for performance improvement projects). The table shows a brief description of the projects reviewed, the projected BCR as estimated by the project sponsor, the estimated BCR as adjusted by the SRA, and (where available) the estimated outturn BCR. Ex ante expectations were of total costs of £290 million, with expected benefits of £433 million and an aggregate BCR of 2.07. Of the ten projects for which it was possible to derive outturn measures, two generated lower levels of benefits than expected, four had much better performance than expected, and four were exceeding expectations by a more modest margin. But generalisation of the sample results to the overall programme was more difficult, since Halcrow noted that the overall results reflected the very good performance of one project, the East Anglia service improvements, and the very poor performance of another, the Edinburgh Crossrail project.

Table 7: Rail Passenger Partnership Benefit Cost Ratios

Scheme	Bidder BCR	SRA BCR	Outturn BCR
Filton Abbey Wood Train Strengthening	1.11	1	1.09 - 2.21 :depends on demand forecast
Sheffield-Hull Train Strengthening	1.66	1.44	2.6
Edinburgh Crossrail	1.07	1.09	0.55: initial demand much lower, but rising
Esk Valley Sunday Service	1.32	1.01	0.61: assumes 60% of forecast ridership
Bodmin Parkway	na	2	2.04
Anglia Service Improvements	2.4	1	0.99/3.0 (different components of package)
Brentford Station	3.4	1.3	1.8, though 'may be optimistic'
Waterbeach Station Car Park		1.2	Yet to be implemented
Hexham-Carlisle Passenger Info		1.25	1.43
Heart of Wales Sunday Service		3.49	Short of expectations
Kent Station Cycle Provision		2.98	2.1
South Hampshire Crossrail		1.5	1.43
Sheffield Station Masterplan		1.77	Not yet available
Swindon Platform 4		2.15	3.08
Class 321 Door Relays	2.14	3.2	2.94 or 3.71 (depends on cost of a delay min)

Note that BCRs are calculated over different periods of years
Source: Halcrow Group (2004)

3.5 Transport for London

The DfT VFM exercise does not cover the GLA Transport Grant for TfL which under the 1999 Greater London Authority Act may be spent as TfL sees fit. Nevertheless, TfL do calculate and publish some BCR values for the projects that they fund.

We have reviewed the projects in TfL's latest business plans (see Transport for London, 2009) under the categories of London Underground, London Rail (which covers the London Overground and the Docklands Light Railway), and Surface Transport (which covers both buses and the main road network).

Details are published for 196 individual schemes, which account for over £20 billion of expenditure. However, BCRs are not available for many of the TfL projects and programmes, in particular because the majority of expenditure involves asset management and replacement. Overall, BCRs are only available for 27 schemes, accounting for £4 billion, or 20 per cent of total expenditure. These schemes, and their BCRs, are listed in Table 8. The average BCR is somewhat misleading because there is one scheme (the A408 Hanger Lane bridges replacement) with a very high BCR of 43, and three with BCRs in the mid-teens. However, we may note that of the 27 schemes, 2 have BCR values in the DfT's 'poor' range, seven are 'low', five 'medium', and the remaining 13 'high'. But we do not have information on a VFM category for any of these schemes since TfL does not use DfT's categorisation (in addition, there are some detailed differences between the methodologies used by DfT and TfL in calculating BCRs)

Table 8: Benefit Cost Ratios for TfL Schemes

Project	BCR	Estimated final cost (£m)
Underground		
Sub Surface Lines on-train air cooling	2	21.8
Seven-car train project	2	147.2
Step-free access	1.4	
Green Park station step-free access	1.4	97
Baker Street station step-free access	1.4	75
Southfields station step-free access	1.4	17.4
Bank station congestion relief	1.3	800
Bond St station relief	4.9	300.5
Paddington station congestion relief (Hammersmith & City)	9	69.2
Tottenham Court Rd station congestion relief	3.7	516.3
Vauxhall station congestion relief	2.6	33.2
Train location information - line upgrades	2.8	21.9
London Overground and DLR		
East London line extension	2.54	988.9
North London Railway infrastructure project	17.1	240.1
London Rail Concession stations upgrade	17.1	40.9

Project	BCR	Estimated final cost (£m)
London Overground and DLR cont…		
DLR: Bank-Lewisham/three-car operation	1.4	266.3
DLR: East route (Custom House-Beckton)/three-car operation	2.9	18
DLR: Woolwich Arsenal extension	1.7	177.1
Refurbishment of Silverlink stations	1.8	27.1
Surface Transport		
A406 Hanger Lane bridges replacement scheme	43	27
Olympic Games cycling network	14.5	7.7
Low Emission zone	0.6	44.8
Congestion Charging scheme re-let excl DSRC	1.6	104.5
East London Transit Phase 1A	2.1	22.4
East London Transit Phase 1B	3	20.6
Greenwich Waterfront Transit	1.3	46.4
Cycle hire scheme	0.9	58.9
Total cost of schemes with BCRs		**4190**

Source: TfL Business Plans for London Underground, London Rail, Surface Transport *www.tfl.gov.uk/corporate/about-tfl/investorrelations/1462.aspx*

4. CONCLUSIONS

This report has reviewed evidence on BCR values from surface transport projects in the United Kingdom, set in the context of current DfT objectives and appraisal guidance. The report provides additional evidence on BCR values following Sir Rod Eddington's recommendation that government should prioritise public spending on transport to get the highest returns per £1 of expenditure (Eddington, 2006b). If this policy is to be implemented successfully, it is important that good information is available on BCRs from different projects, and this report has considered the state of the present evidence base.

Our main aim has been to document, in as much detail as possible, the BCR values from projects in different parts of the transport sector, but to do so in such a way as to highlight difficulties in interpreting these estimated BCR values. The problem that calculated BCR values do not cover all the impacts of transport projects, including all the environmental impacts, is dealt with in current DfT appraisal procedures by calculating a Value for Money (VfM) categorisation which adjusts the initial BCR categorisation to take account of non-monetised impacts. This difference between the initial BCR value and VfM BCR was also analysed by Eddington. In this report we have also considered the question of the relationship between ex ante BCRs calculated in appraisals and estimates of the BCR values realised after project implementation, primarily drawing on the Highways Agency's POPE evaluations but also on some evidence from the railway industry.

The Eddington Report's coverage of the rail industry was somewhat limited, in particular to major schemes, and we have extended coverage of the heavy rail sector by drawing on Network Rail's Route Utilisation studies. We have also looked in some more detail at the major projects covered by Eddington.

One of the difficulties of comparing BCR values, especially over time, is that the basis for calculating BCRs has changed, from the pre-2003 approach to calculate BCR as total social benefits divided by total social costs, to the present (but soon to be superseded) approach of calculating BCR as total social benefits divided by a government budget constraint that takes account of changes in indirect tax revenue, to the proposed approach of calculating BCR as total social benefits divided by a government budget constraint that excludes changes in indirect tax revenue.

There is now quite a lot of evidence available on BCR values. A major conclusion is that, even after accounting for non-monetised environmental impacts, highway schemes often give better value for money than public transport, including rail, schemes. This confirms the expectation in a paper by Affuso, Masson and Newbery (2003) that trunk road schemes might be expected to have better net returns than mainline railway schemes.

Nevertheless, there is still a need for more clarity. We hope that DfT and other organisations will continue to provide information on estimated BCRs from publicly-financed projects in the transport sector – the more that this information is provided for projects across the transport sector, the better the basis for decision-making. In addition even greater clarity than provided in the Department's April 2009 NATA Refresh document (DfT, 2009a) on how the final comparison is made between initial BCR and final VFM classification, perhaps through publication of case study examples, would be welcome. Finally, the switch between different methods of defining the budget constraint and the BCR itself has hindered the task of comparing BCRs between sectors over time. While we think that the proposed revised definition provides a better basis than the present one, it does make future comparisons between project BCRs, some of which will have been estimated on the present basis, and some of which will have been estimated (from 2010 onwards) on the new basis, more difficult. One answer would be a study that converted at least some of the present BCRs to the new basis, so that it is possible to get a better understanding of how much difference the proposed change makes to recorded BCRs from projects of different types.

5. APPENDIX: THE SUGDEN REPORT

As noted in Section 2.3 above, the issue of the appropriate definition of the BCR was raised in the report that Professor Robert Sugden provided for DETR on cost-benefit analysis methodology in 1998 (Sugden, 1998, see especially pp.18-21). The report is entitled 'The Treatment of Taxation in the Cost-Benefit Analysis of Transport Appraisal', and the main concern of the report is to review the Department's methodology in respect of the 'indirect tax correction factor' which is (in Sugden's view, largely correctly) used by the Department to ensure that all costs and benefits included in COBA are measured in the same unit of account, namely factor prices. This issue is not of concern in the present report, but Sugden's report also considers the comparability of cost-benefit appraisal of transport projects in the public sector and financial appraisal of transport projects in the private sector.
Given that the conditions under which the two criteria will give the same result are unlikely to be met (these conditions include perfect price discrimination by the private operator to extract all the consumer surplus, and equal rates of indirect taxation on all goods), what solution might be imposed to ensure consistency of decision-making?

Sugden admits that he knows of no fully satisfactory solution to this problem of ensuring consistency between public and private sector appraisals. However he suggests that one approach would be to apply a shadow price of public funds greater than one on expenditure by the public sector to reflect the fact that each £1 of expenditure by the private sector will extract more benefits than each £1 of expenditure by the public sector. But he notes that this approach is equivalent to ranking public sector projects by the ratio of their net present value of benefits to the government subsidy required, where this public subsidy takes account of any changes in tax revenue occasioned because the tax rates on new and displaced outputs vary.

Thus, for example, because road fuel is taxed at a relatively high rate, and public transport fares are not subject to VAT, a project that diverts traffic from road to rail would lead to a loss of government indirect tax revenue which increases the subsidy required (that is, the denominator in the BCR, so BCR goes down), while a project that increases road traffic will lead to an increase in fuel tax revenue and hence a reduction in the subsidy required (so BCR goes up). This conclusion depends on the assumption that the fuel tax levels do not reflect real additional costs of resources used up, and Sugden points out that where, for example, fuel tax is a (Pigovian) tax on the real resource cost of pollution/greenhouse gases, such a tax adjustment in the subsidy calculation is **not** required.

The Department adopted Sugden's methodology, and the definition of the BCR recommended for use in NATA changed around 2003 to take account of the net subsidy cost to the public sector. BCR was defined as the present value of benefits (PVB) divided by the net present value of costs to the public sector (PVC). As noted in Section 2.3 above, the definition is now being revised to exclude changes in indirect taxation from the budget constraint.

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