Institute for Transport Studies
FACULTY OF EARTH AND ENVIRONMENT

Appraisal of transport projects – the British approach

Chris Nash

Discounting for time

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- Suppose the project yields 100k euros of net benefit per year for 3 years. With a discount rate of 3.5%:

		net benefit		discount		discounted benefit	
Year				factor			
1		100		0.966184		96.6	
2		100		0.933511		93.4	
3		100		0.901943		90.2	
Present value of benefits						280.2	
If the project costs 200, then the net present value is 280.2-200=80.2							

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Outline

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- Development of appraisal methods
- Current approach
- Key issues
    - Appraisal optimism
    - Value of time
    - Value of environmental impacts
    - Wider Economic Benefits
    - Scarcity of investment funds

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Transport Appraisal in the 1960s

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- Pioneering studies of the Victoria Line (London Underground) and the M1 Motorway
- By the end of the 1960s, cost benefit analysis routinely applied to main road schemes (financial appraisal the norm on rail, although the Cambrian Coast study was a pioneering study of a rail closure)

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Transport Appraisal in the early 1970s

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- Solely concerned with economic efficiency – simply presented an NPV
- Nothing about who gained and who lost
- Concentrated on construction and maintenance costs, time and accident savings: neglect of environment, planning and wider economic impact
- 10% discount rate and 30 year horizon so emphasis on the short run
- Much criticised as narrow and mechanistic

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The Leitch report (1977)

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- Framework approach
- Nested CBA in a broader multi criterion approach in which much material (e.g. environmental impacts) was presented in physical rather than in money terms
- Problem of volume of information; no formal way of trading off costs and benefits expressed in different units

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New Approach to Transport Appraisal (NATA) 1998

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Revised the framework

To be applied to all decisions:

- Road investment
- Public transport investment
- Subsidies

Move to 3.5% discount rate and 60 year time horizon

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NATA objectives

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Environment

Economy

Safety

Accessibility

Integration

Now replaced by a simple grouping of impacts into

Economic, Environmental, Social and Government Finance

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Current approach in TAG (transport analysis guidance)

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- Based on Treasury Green Book (2020)
- 5 cases approach to appraisal

- Strategic case
- Economic case
- Commercial case
- Financial case
- Management case.

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The Treasury Green Book: Appraisal and Evaluation in Central Government

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The purpose of the Green Book is to ensure that no policy, programme or project is adopted without first having the answer to these questions:

- Are there better ways to achieve this objective?
- Are there better uses for these resources?

Thus a shortlist of alternatives must be appraised.

The shortlist must always include the 'do minimum' option

(note – this may be problematic for instance if traffic is growing fast)

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Transport analysis guidance - GOV.UK

(www.gov.uk)

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- All projects should be compared with a do minimum base case

- Forecasts need to be made of costs and benefits throughout the life of the project (assumed to be 60 years in the case of major transport infrastructure but DfT caps benefits after 20 years)

- As far as possible all costs and benefits should be valued in money terms

- All costs and benefits should be discounted back to the present using a discount rate of 3.5% for the first 30 years and then 3% after that

- A benefit cost ratio is then calculated as the ratio of benefits minus costs to all excluding the government over net government transport funding

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TAG and appraisal systems worldwide

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International context:

- **many other countries have similar appraisal practice and guidance**
  - e.g. Netherlands, Sweden, Germany, USA, NZ, Australia (NSW), France, Denmark, Canada, Japan ...
  - international comparisons: see ITS (2013)
- **international level:**
  - EU: DG REGIO CBA guide (2014) ; DG Mobility & Transport 'HEATCO' guidelines (2006); Handbook on External Costs (CE Delft, 2019)
  - The World Bank (2005) http://go.worldbank.org/09MMD2C490

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Transport Economic Efficiency Table

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User Benefits

(time, operating costs, user charges, delays during construction)

Private Sector Provider Impact

(revenues, costs, grants and subsidies)

Other Impacts

Net Business Impact

Total

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Notes

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-Generated trips valued using ‘rule of a half’ i.e. given half the benefit figure of trips that would take place anyway.

-Users perceive costs and benefits in market prices (i.e. including tax). Government and firms perceive them at factor cost.

Need to use a common unit of account – conversion factor 1.19

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Public Accounts Table

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Local Government Funding

Central Government Funding

(inc. impact on tax revenues)

Total

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Analysis of Monetarised Costs and Benefits Table (other monetised effects)

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Noise

Local Air Quality

Greenhouse Gases

Journey Quality

Physical Activity

Accidents

NB Common values applied regardless of incomes

(equivalent of applying weights except for money costs – can have perverse impacts)

But values assumed to rise in proportion to GDP/head

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Appraisal summary table

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Economy

Business users

Transport providers

Regeneration

Wider Impacts

Environmental

Noise

Air Quality Greenhouse gases

Landscape Townscape Historic Environment

Biodiversity

Water Environment

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Appraisal Summary Table CTD

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Social

Commuting and Other users Time and Reliability

Accidents

Affordability

Option and non-use values

Public accounts

Cost to Broad Transport Budget

Indirect Tax Revenues

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Valuation of costs and benefits – key issues

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- Optimism bias
- Value of time (esp business travel and small time savings)
- Value of environmental impacts
- Wider Economic Benefits
- Scarcity of investment funds

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Recommended optimism bias uplifts for different projects at different stages of the life of a transport project

	Stage 1	Stage 2	Stage 3
Roads	44%	15%	3%
Light rail, Metro	66%	40%	6%
Conventional rail	64%	18%	4%

Stage 1 Strategic appraisal

Stage 2 Outline business case

Stage 3 Full business case

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Values of Time for rail travellers per hour (2010 prices) DfT 2015

	Previous	New
commuting	6.81	10.01
other leisure	6.04	4.57
Business (>100km)	31.96	36.19

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Why do businesses value time savings so highly?

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Ability to work effectively on the train should reduce value

But:

- Ability to fit more meetings into a day
- Reduced travel in unsocial hours
- Better productivity at destination

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Values of Time for rail travellers per hour (£2010 market prices)

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- Commuting 9.95
- Other non business 4.54
- Business <50km 10.02
- 50-100km 16.21
- 100-200km 28.23
- >200km 40.72

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Major changes

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- For working time, previously used the cost savings approach (wage rate plus overheads)
- This was much criticised (people work whilst travelling; but they get other benefits from time savings – can do more work on a single visit, avoid an overnight stay etc)
- Switched to valuing business time savings using willingness to pay studies
- Values depend on length of trip – much higher for long distance trips

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Multipliers for waiting, walking and late time

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- Walking and waiting revised from 2.5 to 2
- Late time revised from 3 to 2.4

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WHAT ELSE HAVE THE RAILWAYS VALUED?

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- Walking time (to and from station and at interchange)
- Waiting time (at departure and at interchange)
- Interchange penalties
- Headway and Displacement Time
- Reliability (Late arrivals and large delays)
- Crowding (Standing time and crowded while seated)
- Rolling stock improvements (new trains and specific attributes)
- Station improvements, staffing and security
- Information provision, purchasing and fare simplification
- On-board facilities (e.g. catering, wi-fi, toilets, cleanliness)
- Seating layout

See the Passenger Demand Forecasting Handbook

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Externalities

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- what are externalities?
  - not part of user cost (GC) or producer costs
  - externalities are effects for which no money compensation is paid
  - occur where markets are absent (e.g. no market for clean air, so when an HGV pollutes the air no compensation is paid)

The challenge:

- methods are needed to measure the value to people of these impacts so that they can be included in the CBA.

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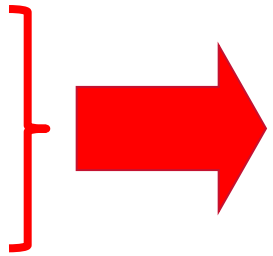
Typical costs imposed by transport accidents:

- material damage†
- police and fire service costs†
- insurance administration†
- legal and court costs†
- medical and healthcare costs*
- lost economic output*
- pain, grief and suffering*



Cost per fatality, serious or slight injury

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Safety:
Overall Casualty Values

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Table A 4.1.1: Average value of prevention per casualty by severity and element of cost £ (2010 prices and 2010 values)				
Casualty type	Lost output	Human costs	Medical & ambulance	Total
Fatal	534,983	1,020,342	919	1,556,244
Serious	20,611	141,781	12,486	174,878
Slight	2,178	10,379	924	13,481
Average, all casualties	9,318	35,386	2,299	47,003

Source: TAG Data Book (DfT, July 2017)

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Environment: Noise

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- UK Noise values:
- benefit transfer from Birmingham study, 1997, gives UK values at 2002 prices

Noise Change in the Interval, dB(A)		£ per household per annum for a 1 dB(A) change within the stated interval
Low	High	
<45		0.0
45	50	13.7
50	55	26.9
55	60	40.1
60	65	53.2
65	70	66.4
70	75	79.6
75	80	92.8
>80		98.0

- *Source: Nellthorp, Bristow and Day, 2005/7*

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Environment - air pollution damage and abatement costs (2010)

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PM10 damage costs (£/household/1µg/m³)	92.7
NO_x damage costs (£/tonne)	955
NO_x abatement costs (£/tonne)	29000

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Values of carbon (£ per tonne of CO2e; 2010 prices)

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2010	52.3
2020	60.7
2030	70.8
2040	136.6
2050	202.3

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How to value impact of diverting passengers from other modes?

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- Ideally use a multimodal model
- If that is not possible, use diversion factors

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Diversion Factors (change in passenger km as a percentage of change in rail km) typical inter city values

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Walk	-0.47
Cycle	-0.46
Car Driver	-26
Car Passenger	-20
Bus	-7.4
Total km travelled	46

Source: WEBTAG

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Marginal external costs and indirect taxation (2010) (weighted mean for all roads and times of day)

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	cars	heavy goods vehicles
Congestion	10.1	52.4
Infrastructure	0.1	9
Accidents	1.6	2.8
Local Air Quality	0.1	2.5
Noise	0.1	7
Greenhouse gases	0.9	3.8
Other	0	6.4
Indirect taxation	-4.7	-34.1
Total	8.2	49.7

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Sources for previous table

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- Source:
- Cars: Department for Transport (2017 TAG databook
- Heavy Goods Vehicles Department for Transport (2009) Mode Shift Benefit Values: Technical Report
- Note: values for heavy goods vehicles are estimated 2015 values in 2010 prices

Note: dominance of relief of congestion over environmental factors controversial

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It is usually assumed that when a transport scheme attracts new economic activity to an area it is simply shifting it from somewhere else. But some additional benefits are now recognised.

1. Agglomeration externalities

- Productivity depends on effective density (i.e. accessibility to population) esp for business services

  (size of labour market

  Economies of scale in supply of services

  Speed of technological change)

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2. Imperfect competition in output markets

10% uplift in benefits (based on studies of price cost margins)

3. Labour supply

Reduced commuting costs generate increased labour supply (people entering the market or longer hours)

Benefits of extra trips already estimated (but value to user depends on post tax income)

But government benefits from extra tax revenue ('tax wedge')

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4. Move to more productive jobs due to land use changes

- If project attracts jobs to where productivity is higher.

Again net benefit is increased tax revenue.

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Two ways of dealing with scarcity of investment funds

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1. Shadow price public funds
2. Compute the BCR (benefits per pound of government funds) and require a value significantly above 1

Britain currently does the latter

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Value for Money (VfM) and BCR Categories

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•For most projects, which impose a net **cost** on the Broad Transport Budget:

VfM Category	Implied by…*
Very High	BCR greater than or equal to 4
High	BCR between 2 and 4
Medium	BCR between 1.5 and 2
Low	BCR between 1 and 1.5
Poor	BCR between 0 and 1
Very Poor	BCR less than or equal to 0

- *DfT (2017), Value for Money Framework*
-

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Conclusions

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British transport appraisal nests CBA within a wider assessment of impacts

It is state of the art on many issues e.g.

Value of time and environmental impacts

Wider economic impacts

But still much uncertainty on some issues

No formal method to combine quantitative and qualitative elements

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Questions for discussion

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- Are there important impacts still omitted from the British approach?
- Is it possible to value safety and environmental effects in money terms?

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References

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The general approach to appraisal of the British government is outlined in:

The Green Book (2020) - GOV.UK (www.gov.uk)

- The current British DfT guidance on appraisal can be accessed via the TAG website Transport analysis guidance - GOV.UK (www.gov.uk)

- Estimation of the new values of time is described at DepartmentforTransport(2015)Understanding_and_Valuing_Impacts_of_Transport_Investment

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/470998/Understanding_and_Valuing_Impacts_of_Transport_Investment.pdf

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