Mandy Walker - Warwickshire County Council
Rachel Prance - Chiltern DC.
John Savin - Wendover AG
Tim Mitchell - B'ham C.C.
Peter Tomlin - GLA
Tadd Efendowicz - Chiltern Society
Bruce Weston - HS2AA
Malcolm Griffiths - Bluespace
Sam Longman - London B. of Camden
Jim Steer - Greengage 21
John Hammon - Warks D.C.
Neil Hatton - Knotty Green AG.
Ged Pybus - Kenilworth AG
Windsor Thomas - Cholesbury
Tony Lovett - Staffs. C.C.
Chris Wragg - Northants C.C.
Simon Witter - Stalbridge House R.A.
Colin Allen - SNAG.
Donia Allen - South Northants Council

Demand Forecasting - Session 1

[Peter Grant]

2-part Consultation.

① Is HSR as a concept the way to go?
② Is the Y row detailed line of route the best way to go? } 1st half of next year. Decision towards end 2011.

▷ Materials will be available for several weeks in advance of consultation.

HS2 TECHNICAL SEMINARS

Meeting Room 4, 2nd floor, 55 Victoria Street, London, SW1H OEU

Modelling, Forecasting and Economic Appraisal
09:30-11:30

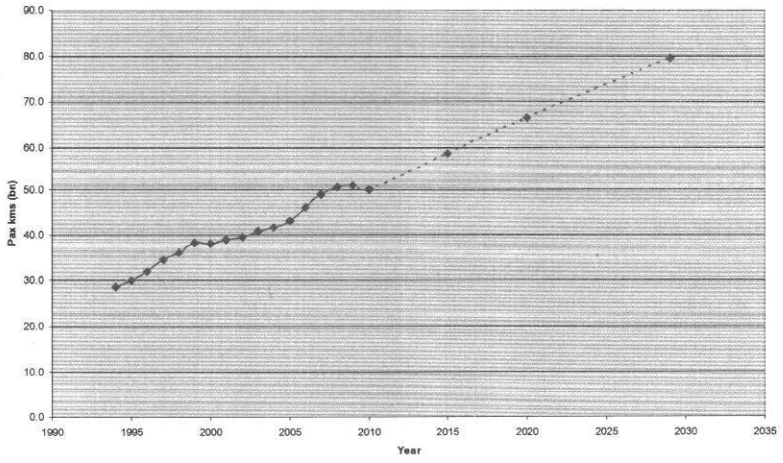
09:30 – 09:40	Welcome & introduction of the seminar	Ian Jordan (chair)
09:40 – 09:55	**The Department for Transport approach to demand forecasting**	Tom Worsley (DfT)
09:55 – 10:05	Comments and questions	
10:05 – 10:20	**HS2 demand forecasting**	Mark Weiner
10:20 – 10:30	Comments and questions	
10:30 – 10:45	**Principles of economic appraisal**	Tom Worsley (DfT)
10:45 – 10:55	Comments and questions	
10:55 – 11:10	**Appraisal of HS2**	Mark Weiner
11:10 – 11:25	Comments and questions	
11:25 – 11:30	Next steps and consultation	Ian Jordan
	ENDS	

Department for Transport

Department for Transport -
Approach to Demand Forecasting

Department for Transport

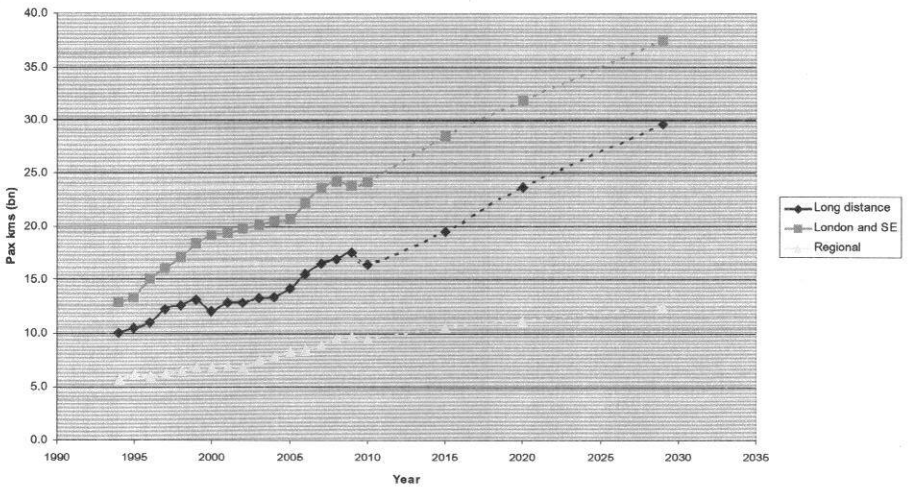
Total Rail Passenger Kilometres (bn) - Historic Trend and Forecast



Source: Department for Transport

Total Rail Passenger Kilometres (bn) - Historic Trend and Forecast, by sector

Department for Transport



Source: Department for Transport

Forecasts and Uncertainty

Department for Transport

- Transport infrastructure has a long life – need to forecast to understand capacity requirements and to inform business case
- Uncertainty about the future; identify main causes and effects of uncertainty and assess sensitivity of the proposal to plausible range of uncertainty

Questions:

1). HSI experience – Taken into account!
2). Technology + Business Pressure
3). DfT role to stimulate travel? (not asked)

Forecasting Methods

Department for Transport

- Expert / Consensus view
  - Review past trends – modify using other knowledge
- Evidence based approaches

  Either trends over time – past relationships will continue
  - Identify causes (demand drivers) and relationships (elasticities)
  - Forecasts of demand drivers, combined with elasticities to forecast demand
  - Forecast changes in demand starting from observed base year flows

  Or differences between people and places observed now – people's responses to change can be predicted
  - Data on people, places, trips and costs
  - Estimate the routes and modes they will use – check to validate
  - Forecast demographic, land use, employment and income changes
  - Forecast changes in travel opportunities and responses to them
- Data and Objectives determine method used

"not obvious that technology will make a big change"

Data Sources for Rail and Other Long Distance Travel

Department for Transport

Objective – Travel in London to West Midlands corridor

- Household surveys – e.g. National Travel Survey
  - Rail is 1.6% of all trips - 8% of all passenger miles – so rail use isn't covered in the required detail in household surveys.
  - Long distance trips are 2% of all trips – again difficult to cover in household surveys
- Data on all rail tickets sold in aggregate over the past 20 years and since 1995 giving full details of origin, destination, and ticket type
- Similar data on air passenger flows
- Good data on rail and air flows – for road long distance trips rely on one-off roadside surveys

attempt to de-emphasise NTS data – even though they use this for salary data!

Rail Industry Forecasting Method - Passenger Demand Forecasting Handbook

Department for Transport

- Large sample of flow groups – annual ticket sales by ticket type between origin and destination over 1995-2002
- Identify potential causes of demand growth – employment growth at destination, regional changes in GDP per capita, fares, competition from other modes. Test for significance.
- Estimate relationship – elasticity – change in rail patronage for a change in demand driver
- Compile forecasts of demand drivers – e.g. trend based GDP form HMT, population, employment on OD basis. DfT's NTEM database, used for all modes
- Take base year observed demand, forecasts of demand drivers and elasticities to forecast OD rail patronage – unconstrained by capacity

Is the relationship between the Drivers and Rail Demand changing?

Department for Transport

- For road traffic evidence of a saturation effect – car ownership, a major influence on car traffic, is now growing more slowly. Other factors – congestion, costs affect demand but not the direct relationship between income and road travel.
- For rail no evidence of reduced impact of demand drivers from the econometric analysis of trends over time.

Department for Transport

Scope for further growth of rail demand

- People from households in the top 20% of the income distribution travel more than twice as much by rail as the average person but only 50% more than the average person by other modes – scope for growth as other households get richer (as has occurred with car use).
- Rail is used more in the L&SE region. People in these regions make roughly three times more rail trips than those living in other regions.
- Alternatives to travel have always existed and continue to improve – nothing to indicate a step change in their cost/convenience/quality.

|| Attempt to dismiss broadband developments

Department for Transport

All Trips By Socio-Economic Group; trends 1995/7-2004

	Trips per person and year			Index		
Year / Socio-economic Group	1995/ 1997	1999/ 2001	2004	1995/ 1997	1999/ 2001	2004
Professional/Managerial	1332	1271	1181	100	95	89
Intermediate non-manual	1345	1289	1226	100	96	91
Junior non-manual	1267	1266	1155	100	100	91
Skilled manual	1192	1128	1060	100	95	89
Other man. & other SEG	1159	1139	1087	100	98	94
Retired	842	842	837	100	100	99
Other econ. inactive	1052	1011	1009	100	96	96

Source: Department for Transport

Rail Trip Rates By Socio-Economic Group; trends 1995/7-2004

Department for Transport

	Trips per person and year			Index		
Year / Socio-economic Group	1995/ 1997	1999/ 2001	2004	1995/ 1997	1999/ 2001	2004
Professional/Managerial	26	39	37	100	151	144
Intermediate non-manual	29	37	34	100	129	118
Junior non-manual	24	26	29	100	110	121
Skilled manual	8	9	13	100	115	160
Other man. & other SEG	8	9	11	100	110	133
Retired	4	5	5	100	125	138
Other econ. inactive	10	10	15	100	100	151

Source: Department for Transport

Effects of service improvements on demand - generated demand

Department for Transport

- Initially the forecasting method provides forecasts of unconstrained demand
- Capacity – crowding, service frequency, etc. - influences demand as estimated in the unconstrained forecast.
- Need to specify service provision for a forecast appropriate to that service
- Increases in capacity and improvements in quality generate additional demand and revenues and can shift demand from other modes
- Leaving capacity fixed as demand increases has the effect of reducing unconstrained growth forecast

Example of demand growth from service improvements

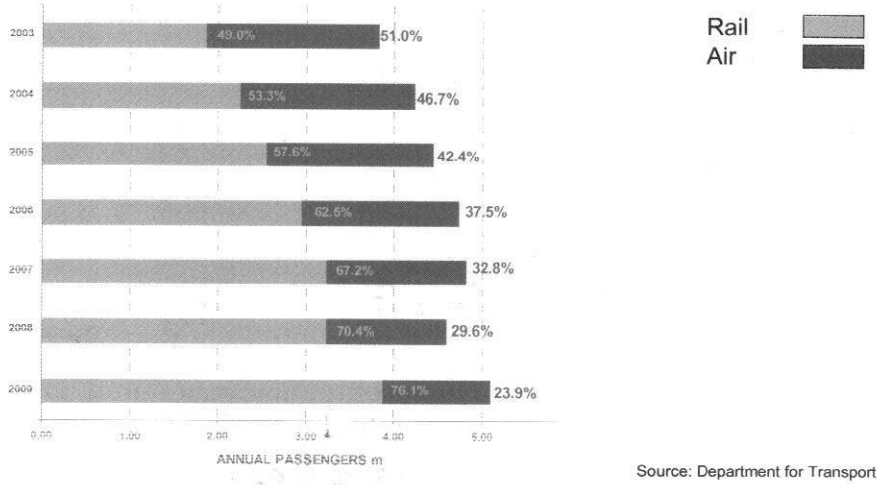
Department for Transport

- Manchester- London WCML 2004/5-2008/9
- 88% more revenue
- 59% more passenger journeys
- 71% more passenger km

- 34 minute journey time saving – now just over 2 hrs.
- Approx 1600 extra peak hour seats on WCML

Manchester-London Rail and Air Volumes and Shares 2003-09

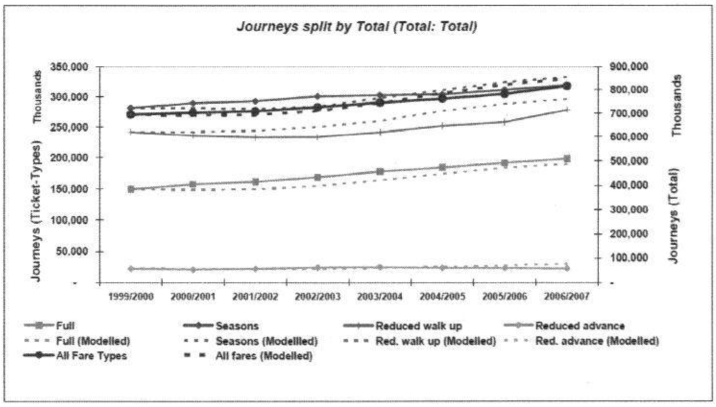
Department for Transport



Source: Department for Transport

How good are the rail forecasts?

Department for **Transport**



Historical track.

- Employment
- GDP.
- Fares

They say this proves their forecasts are valid.

Department for **Transport**

QUESTIONS?

:- DfT believe they have accepted input from PRC on HS1 forecasting cock-ups.

:- No answer to "possible" technology impacts

- Business not Pressure. Taken into a/c.

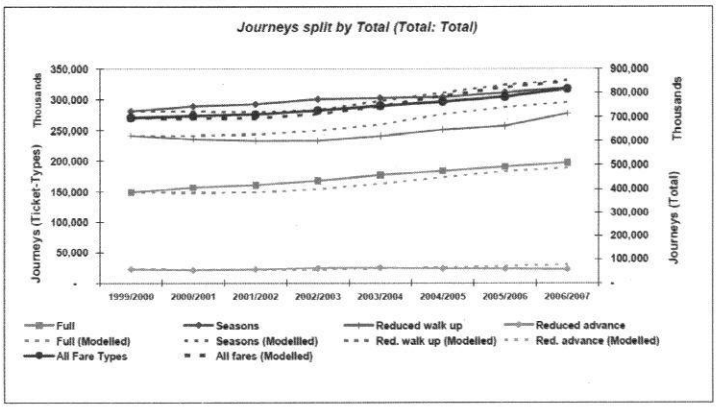
:- If DfT felt they were quick they would take into them e.g.
- Broadband
- Business Pressure.

:- Income & travel is the key determinant of travel.

= GDP Growth.

Department for Transport

How good are the rail forecasts?



Historical track.

- Employment
- GDP.
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They say this proves their forecasts are valid.

Department for Transport

QUESTIONS?

:- DfT believe they have accepted input from PRC on HS1 forecasting cock-ups.

:- No answer to "possible" technology impacts

:- Business not Pressure. Taken into a/c.

:- If DfT felt they were right they would look into Area e.g.

- Broadband
- Business Pressure.

:- Income & travel is the key determinant of travel.

= GDP Growth.

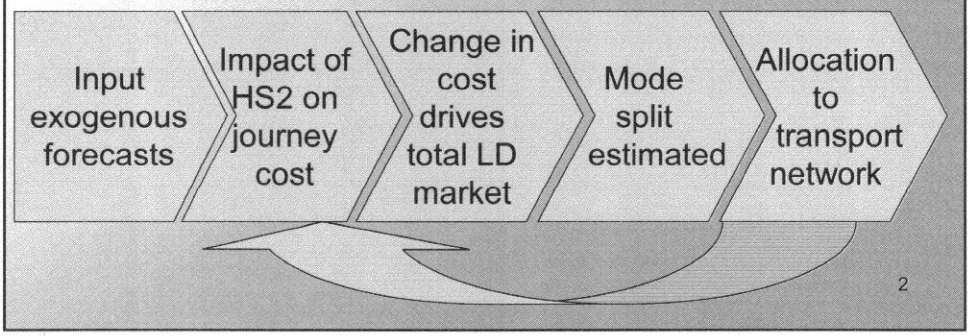
(Oft figures = 100% growth 2010 - 2030 only)

HS2 – Demand Forecasting

All figures in this presentation relate to work published in HS2 Ltd's March 2010 report

Steps in forecasting

- Follows principles previously set out
- Model is **incremental**
  - Forecasts without HS2 input into model
  - Model works out *change* in demand from *change* in journey 'costs' (time, crowding etc)



Base Demand: Key Drivers

- GDP assumptions – In line with 2009 Budget
- RPI + 1 for all rail fares to 2033 (reflecting government policy) – then RPI?
- Growth capped at 2033 (proxy for market maturation)
- Rail Industry approach applied
- Air forecasts – Published by DfT in 2009
- TEMPRO based road forecasts

Base Demand: Long Distance Rail Forecasts

- Long distance travel grows over time
  - Road growth slowing due to market maturity and congestion
  - Rail/Air at earlier market stage show higher growth (doubling to tripling of trips)
- Short distance market shows slower growth (40-50% more trips)

Rail trips per day (without HS2)

Rail trips (to Central London)	2007/8	2033
Birmingham	2848	6630
Manchester	2630	7095
Glasgow	401	1091

Source: Baseline Forecasting Report

Impact of HS2: The Model(s)

- PLD – Long distance demand
  - All modes (including air)
  - Domestic trips
  - Over 50 miles
- PLANET South/Midlands
  - Short distance rail focus
  - Impact of released capacity and local impacts of changes to classic line services
- Heathrow Model
  - All modes
  - Choice of access mode to Heathrow for people connecting to international flights
  - NOT people travelling to London via Heathrow

only

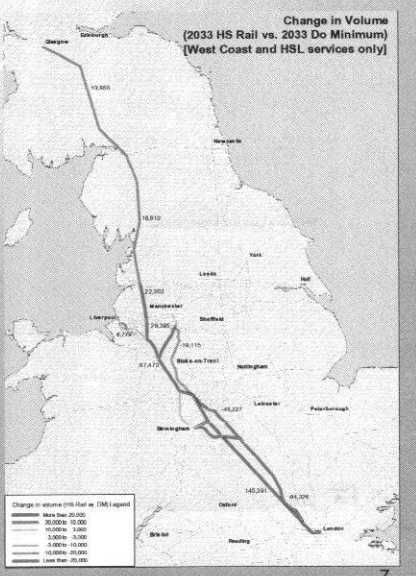
Costs and Behaviour

- Model is calibrated to reflect responses of transport users to different 'costs' such as
  - Time
  - Crowding
  - Interchange
  - Fares/Financial costs
- PLD based on surveys and observations of real travel choices (based of SRA research)
  - Evidence suggesting HSR viewed as relatively attractive (people like shiny new trains?)
  - HS2 Ltd conservative view – HS2 trains are treated just like any other train

? "No additional attraction".

Long Distance Market with HS2

- Relatively small increase in total long distance trips (0.5%)
- But much higher in areas served by HS2 trains (up to 30%)
- And more significant impact on rail market
  - 145,000 trips into London on HS2
  - 45,000 fewer long distance trips on West Coast Main Line (WCML)
  - And some fewer trips on other lines (e.g. Chilterns) not shown here



Source: HS2 March 2010 Report

Breakdown? Derivation of 30%?

impact on WCML not assessed! (Freed capacity vs trains cancelled as no longer viable!)

Regional Rail Trips With HS2

- Growth in rail trips – generally less than 60% increase to/from London
- Biggest % change from Scotland (scope for air mode shift)
- More comparison needed – but not inconsistent with WCML upgrade figures (see earlier)

Trips to/from London	Increase in rail trips
West Midlands	26%
North West	33%
Scotland	57%

Source: HS2 Ltd analysis

43% increase in rail demand faster, less crowded

this is justified on the basis of historical uplifts in WCML (see RJT slides)

Heathrow and Air Travel

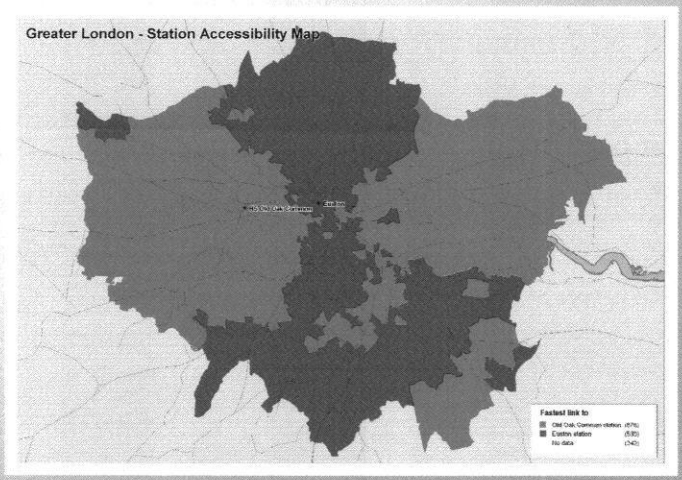
- Why is HS2 demand for Heathrow low while HS2 attracts mode shift from air?
- HS2 forecast to take 10,000 air passengers per day
  - Domestic passengers travelling to **London**
  - HS2 well placed for domestic trips (serve core area of demand in central London)
  - Airports require interchange and access time to city centre
- But HS2 not so strong for Heathrow access
  - Wrong market (main market is South East)
  - Ease of check in / transfer by air
  - Only 1-2,000 passengers per day forecast to go to Heathrow on HS2

All Airports
What % does this represent. (100 flights worth)
... This is what they get from their model

Euston and Old Oak Common

- Euston is the main HS2 station, handling around 95,000 per day passengers
  - Almost 90% of passengers going to London
  - Remainder travel on to East and South East
- Old Oak Common (OOC) serves many uses
  - Enhance accessibility for around 30,000 passengers per day to London (via Crossrail)
  - Also enhances links for around 17,000 passengers per day outside London (via GWML)
  - And link to Heathrow

OOC and London Access



Source: Baseline Forecasting Report

Questions?

Trips to London grow more rapidly with income (and ∴ are valued more highly than those trips from London)

- reinforces the fact that this will draw people / economic activity from the regions to London!

Department for Transport

Department for Transport - Principles of Economic Appraisal

Principles of Economic Appraisal – The Sources

Department for Transport

- Treasury Green Book
  - General principles
  - Cross departmental requirements – discount rate, appraisal period etc.
- DfT's WebTAG – Web based Transport Appraisal Guidance - Application of principles to transport projects

What is Economic Appraisal?

Department for Transport

- Financial appraisal looks only at the costs and revenues that feature in company accounts – the bottom line.
- Economic or Cost-benefit appraisal aims to identify **all** the costs and benefits of a proposed course of action.
- The DfT's standard appraisal – NATA -allows a decision to be informed by the size of the benefits of a proposed course of action relative to the costs incurred by government.
- It involves quantifying as many costs and benefits as possible and expressing these in monetary terms where feasible in the TEE table.
- Other impacts are identified and summarised in the AST or AoS.
- There are limited funds available for all Government expenditure. Economic appraisal is a tool to help Ministers to prioritise spending.

Comparison of do-minimum with the proposed scheme; the Process

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- Specify a do-minimum case and the option to be appraised.
- Identify from recent ticket sales data the passenger flows in the corridor.
- Set up a rail travel forecasting model for the corridor based on the inputs – e.g. demographic and income growth, fares etc. – and elasticities which show relationships between changes in these inputs and changes in rail demand.
- Include do-minimum capacity and services in the forecasting model to provide forecasts of patronage in do-minimum option.
- Include proposed scheme capacity in the forecasting model to provide scheme based forecast, reflecting impact of additional capacity and other changes on demand.
- Estimate impact on other modes from rail demand model or other sources.
- Compare the outputs and outcomes of the do-minimum case with the 'with project' option; estimate the change in benefits, revenues and costs compared with do-minimum.
- Sensitivities to changes in the assumptions.

11th October written answer re: DfT not asked to consider alternatives.

:- forecasts based on high demand by 2033

:- levels of demand are key. Rail Package 2.

The HS2 Business Case

Department for Transport

- The HS2 business case covers only costs and benefits that affect transport users, providers and funders.
- All transport users are covered – HS rail, existing rail, roads.
- All other impacts are assessed in the Appraisal of Sustainability (AoS).
- Transport User Benefits include;
  - Time savings – in vehicle and access/egress times (rail and road)
  - Reliability improvements

Comparing the Costs and Benefits

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- Costs and benefits occur at different points in time. Comparison of the effects is made by:
  - Discounting future year costs or benefits at a rate of 3.5% (3.0% after 30th year)
  - Deciding on an appraisal period (up to 60 years), beyond which costs and benefits are small or uncertain enough to be ignored
  - Expressing as many costs and benefits in money terms
  - Providing a result in terms of the Benefit-Cost Ratio (BCR)
- The DfT definition of the BCR is essentially benefits to society divided by costs to government:

$$\frac{\text{Present value of overall impact}}{\text{Present value of cost to government}}$$

- This use of the BCR helps to maximise returns to society for the total Government budget. If the BCR is greater than 1 then benefits exceed costs.

Agreement this may be wrong!

Value of Travel Time Savings (VoTTS)

Department for Transport

- Usually main element of any transport scheme.
- Standard approach for all transport modes.
- Non-working time savings (including commuting) around £6 per hour in current prices for all journeys.
- Derived from surveys – willingness to pay for journey time changes using examples such as tolling to add realism to the survey.
- Travel in the course of work – assumption that savings increase overall output by the amount of the time savings, valued at the wage rate plus a mark up for users of the mode - a realistic assumption for commercial drivers.
- Rail business time value based on the average earnings plus mark up of those who use rail in the course of work – source NTS. Value implies a current pre-tax wage rate of around £32 per hour.
- Walk/access/egress time savings value set at double the standard in-vehicle value for all non-business travellers. Business values as for in-vehicle values.
- Evidence suggests VoTTS increases with trip length/duration and hence savings for long distance trips undervalued but not part of DfT method.

* 2002 Webtag value inflated :- this may be wrong & needs to be checked.

100%

* £32 per hour.

100%

time saving Assumed!

Madness.

Unproductive when on a journey

Long-distance vs commuting.

Rail business time savings

Department for Transport

- The issue is how people would use the savings when compared to what they do now while travelling.
- We arranged for market researchers to survey business rail passengers – many replied that they would start the trip later or get up earlier, taking the working time saving as extra leisure.
- In the longer term this is not a plausible outcome – people perceive a given travel time, not a saving, and arrange business/leisure around this.
- Clearly business users attach some value to saving travel time - big response on WCML when services improved in 2008.
- Despite London - Glasgow rail offering around two extra hours of potential working time over air, rail has a very small share of the business market (<20% of all purposes).
- No immediate answer to the valuation of rail business time savings – so test the benefits for a range of assumptions.

We is this DfT or HS2 Ltd?

Revenues in the business case

Department for Transport

- Not a financial appraisal.
- Increases in net revenues help to reduce the costs to government or other provider of the scheme.
- The costs of providing the capacity needed to generate these revenues are part of scheme costs.
- A cost to passengers = a benefit to operators – a transfer between passengers and operators - not a change in resource use.
- We assume that, when people buy more rail travel and fewer widgets, the volume of widget production falls and costs of production reduce in line with the fall in revenues. No long term loss to widget producers. However, widgets are taxed, rail travel is not, so an adjustment is made to reflect this as a loss of tax revenue.

explanation of 'tax offset'

Department for Transport

QUESTIONS?

"BCR is not the basis of the decision - it informs Ministers on the decisions they have to make"

Appraisal of HS2

All figures in this presentation relate to work published in HS2 Ltd's March 2010 report

What are the benefits of HS2?

- Journey time and reliability improvements
- Relief of crowding on classic network
- Release of capacity on WCML
  - Benefits for short distance trips (e.g. commuting into London/Birmingham)
- Some decongestion on road network
- Some Wider Economic Impacts (WEIs)
- BUT also costs which must be captured
  - Costs of construction and operation
  - Environmental (not in this seminar but will be in AoS)
  - Some trips lose as a result of changing classic rail services

Assesment of Sustainability.

AoS includes

Com Impacts

Acc
Noise
Vibration
Air Quality
Carbon

Direct impact
Blight scheme

- published "in due course"

- Property values disruption not included
- ie. reduction in overall property values

"dis-benefits are captured"! - NOT.

'Transport User' Business Case

	£bn (2009 PV)
User Benefits	28.7
WEIs	3.6
Total (PVB)	32.3
Cost	25.5
Revenue	-15
Indirect tax	1.5
Total (PVC)	11.9
BCR (Excl WEIs)	2.4
BCR (Incl WEIs)	2.7

- Transport User and WEIs significantly greater than costs
- Returns £2.70 (incl. WEIs) in benefits for every £1 spent
- But Govt must also weigh up the non-quantified positives and negatives

Source: HS2 March 2010 Report

Wider Economic Impacts: Definition

- Wider Economic Impacts (WEIs or WEBs) used in different contexts
  - Regional economic growth
  - Regeneration
  - Agglomeration
- Appraisal guidance on this in development ('In Draft' WebTAG) and only covers some specific impacts
  - More people working
  - Labour productivity
  - Agglomeration
  - 'Imperfect Competition'
- Does not cover other issues e.g. regional growth disparities or regeneration

|| This seeks to defuse the argument about regional growth: 'Harder to capture'

pushing this towards a political argument!

WEIs and HS2

- HS2 has applied DfT draft guidance on WEIs to consider impact on business case
- 'Imperfect Competition' results in a further £1.6bn over and above time savings to business
- Agglomeration – firms gain additional benefits from closer proximity
  - DfT Guidance focuses on impacts over (relatively) short distances
  - HS2 to Birmingham is too long - but impacts of extensions northward would have bigger impact
  - The line to Birmingham still delivers agglomeration benefits of a further £2bn, mainly due to released capacity and road decongestion

Agglomeration – Further research

- DfT guidance is based on intra-regional evidence
- HS2 commissioned academic research to consider whether there was anything **additional** generated over longer distances
- Concluded that agglomeration may have impacts over longer distances
- But additional impacts likely to be small – and have not been included in the business case so far

Dan Graham Imperial College

£16 m max only!

Other wider impacts could be important

- WEIs measured by the appraisal is only part of the potential of HSR
  - Guidance measures for those things that can be measured
  - But may be other strategic benefits (e.g. regeneration, local and regional growth effects)
  - Effects are likely to be important for local people
- HS2 consider potential qualitatively based on experience around the world and discussions with academic experts
- International experience shows good and bad examples
  - Some very successful examples, some not
  - Key appears to be coordination and integration with local/regional spatial strategies
  - Certainly there is significant potential

"Needs more work"

"Will need to address"

Questions?

- £15 bn is revenue of total rail network "after HS2"
- Data on offset travel disbenefits is included in bus. plan but not identifyable.
- £28.7 bn in benefit across the network "unmonetised benefit is journey time saving"