



Worthwhile use of travel time and implications for modelling, appraisal and policy planning – the United Kingdom experience

Zero value of time

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- UK has been significant contributor to development and application of methods for valuing travel time savings.
- The values of travel time savings (VTTS) play a central role in DfT's web-based transport analysis guidance (WebTAG) on modelling and appraising transport schemes
- UK has also promoted the use of 'multipliers' of VTTS to represent wide range of time-related goods and bads
- In 2014, DfT commissioned Arup/ITS Leeds/Accent to undertake a major re-survey of VTTS, to completely update values last surveyed in 1994
- Many changes over the intervening 20 years – not only income growth, but also quality and comfort of travel, and working practices



1. The rationale for the investigation particularly around productive time use and the relationship with VTTS;
2. The approaches investigated and the reasons for the selected willingness-to-pay (WTP) approach;
3. The key findings from the 2014/15 study;
4. The approach to implementation and lessons for other countries; and
5. Modelling, forecasting, appraisal and land use policy implications due to distance-based VTTS and potentially time-varying VTTS if the disutility of travel time changes with technological innovations over time.



- To provide recommended, up-to-date national average values of in-vehicle travel time savings, covering business and non-work travel using willingness-to-pay.
- To investigate the factors which cause variation in the values, e.g. by mode, purpose, income, trip distance or duration, productive use of travel time etc.
- To improve our understanding of the uncertainties around the values, including estimating confidence intervals around the recommended values.
- To consistently estimate values for other trip characteristics for which values are derived from the values of in-vehicle time savings.

Scope of the 2014 study



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		Trip Purpose				SP Experiments	Covariates
		Commute	Other Non-Work	E'ee Business	E'er Business		
Mode of travel	Car	SP	SP	SP	SP	SP1: Time SP2: Time & Reliability SP3: Time & Quality (e.g. crowding, congestion and other types of time)	Income Distance & Duration Productive Time Trip Type etc.
	Bus	SP	SP	N/A	N/A		
	Rail	SP & RP	SP & RP	SP & RP	SP		
	Other PT	SP	SP	SP	SP		
	Walk & Cycle	SP	SP	N/A	N/A		

1. Productive time use

- rationale for the investigation



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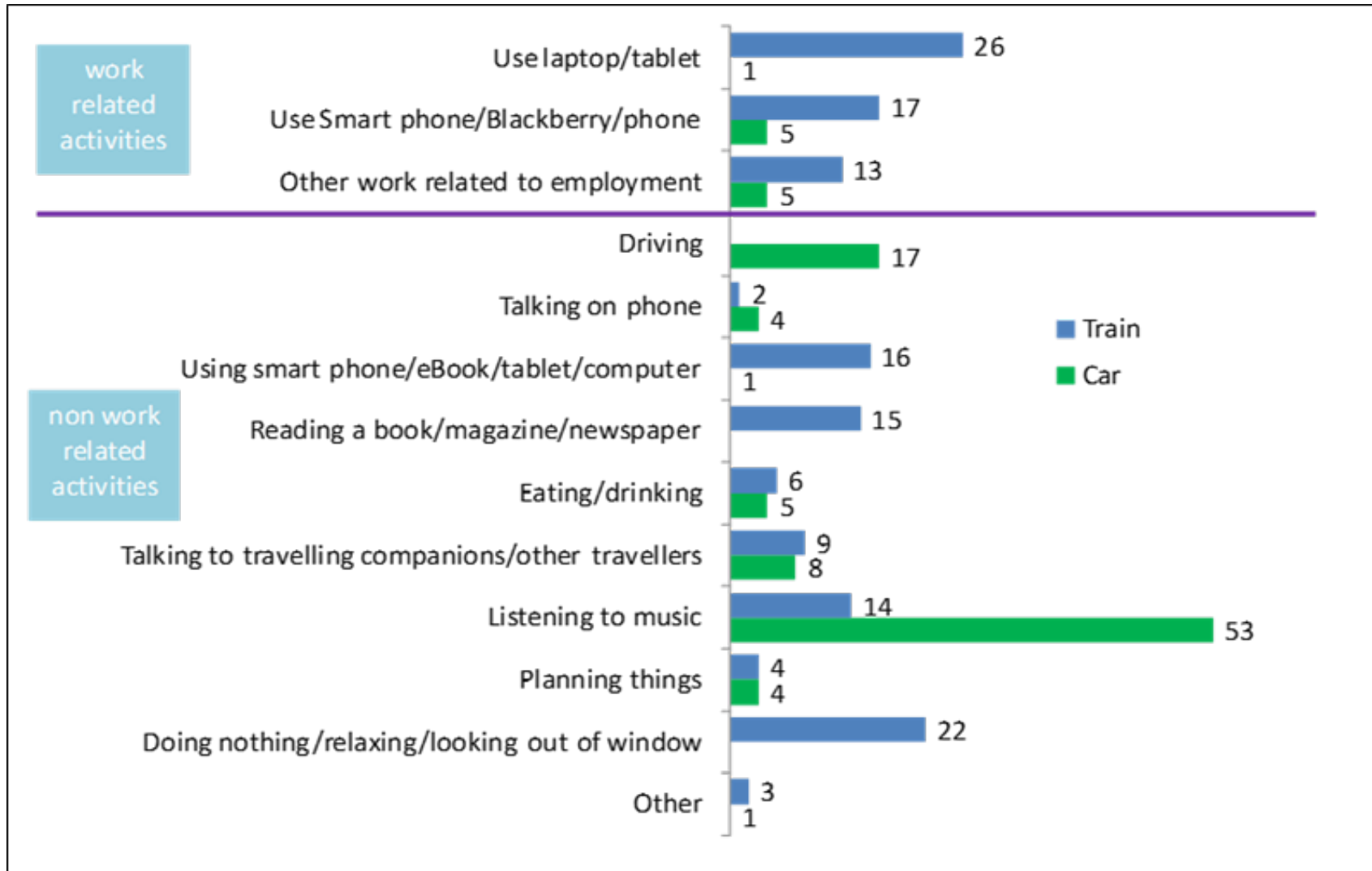
- Arup/ITS Leeds/Accent study investigated extent to which VTTS influenced by features of the traveller and/or trip – such as the traveller’s income or the length of the trip.
- Focussing here upon employees’ business travel:
 - Respondents were reminded of their reported “reference trip”
 - Asked approximately how much of that time was spent undertaking work and non-work related activities.
- This data was then modelled as a covariate of VTTS.

1. Productive time use

- time spent on activities (mins) for business travel



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1. Productive time use

- interaction with VTTS



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- However, VTTS did not vary with productive time use
- This is not to say that time use is unimportant:
 - Possible confounding with other factors, such as time and distance
 - Perhaps insufficient variation in (opportunities to use) travel time productively across surveyed trips.
 - The importance of time use may not have fully captured by the SP exercise.
 - Also possible that travellers, when completing hypothetical choice tasks, did not relate these back to the real-world journey which these choice tasks related to (simple time-cost trade-offs).

2. WTP approach

- arguments for the different approaches



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Valuation approach	Pros	Cons
Cost Saving Approach (CSA)	Easy to implement and minimises survey costs	Not all travel time unproductive and not all time savings convertible into productive use to benefit of firm.
Employer WTP	Could be argued that employers should be the focus, since it is they who will actually be purchasing the time savings.	Data collection onerous.
Employee WTP	Credible proxy for employer provided employee has knowledge of company travel policy.	Data collection less onerous than employer
Hensher Equation	Deemed to be outside core scope of 2014/15 study (although data collected on key parameters)	

All things considered, preference for WTP-based approaches, using different methods for corroborative and interpretive reasons.

2. Alternative approaches

- Hensher parameters



Simplified Hensher equation: $VBTTs = (1-r-pq)MPL + rVL$

Stated Preference	Car		Rail			All
	Out	Return		Out	Return	
p* (proportion of BTT working)	0.07	0.07		0.45	0.33	0.24
r* (proportion of BTT in own time)	0.12	0.1		0.19	0.21	0.16
residual	0.81	0.83		0.36	0.46	0.6
p (proportion of BTTs at expense of work)	0.4			0.45		
q (relative productivity of work in transit)	0.92			0.87		
value of $1-r^*-p^*q$	0.82	0.84		0.42	0.50	

Revealed Preference	Out	Return	
p*	0.5	0.35	
r* (excluding re-imbursed)	0.25	0.35	
residual	0.25	0.3	
	Fast	Slow	SPURT (2009) study
p	0.16	0.09	0.41
r (proportion of BTTs used for leisure)	0.6	0.56	0.52
q	0.98	1.04	0.97
value of $1-r^*-p^*q$	0.26	0.29	
value of $1-r-pq$	0.24	0.35	0.08

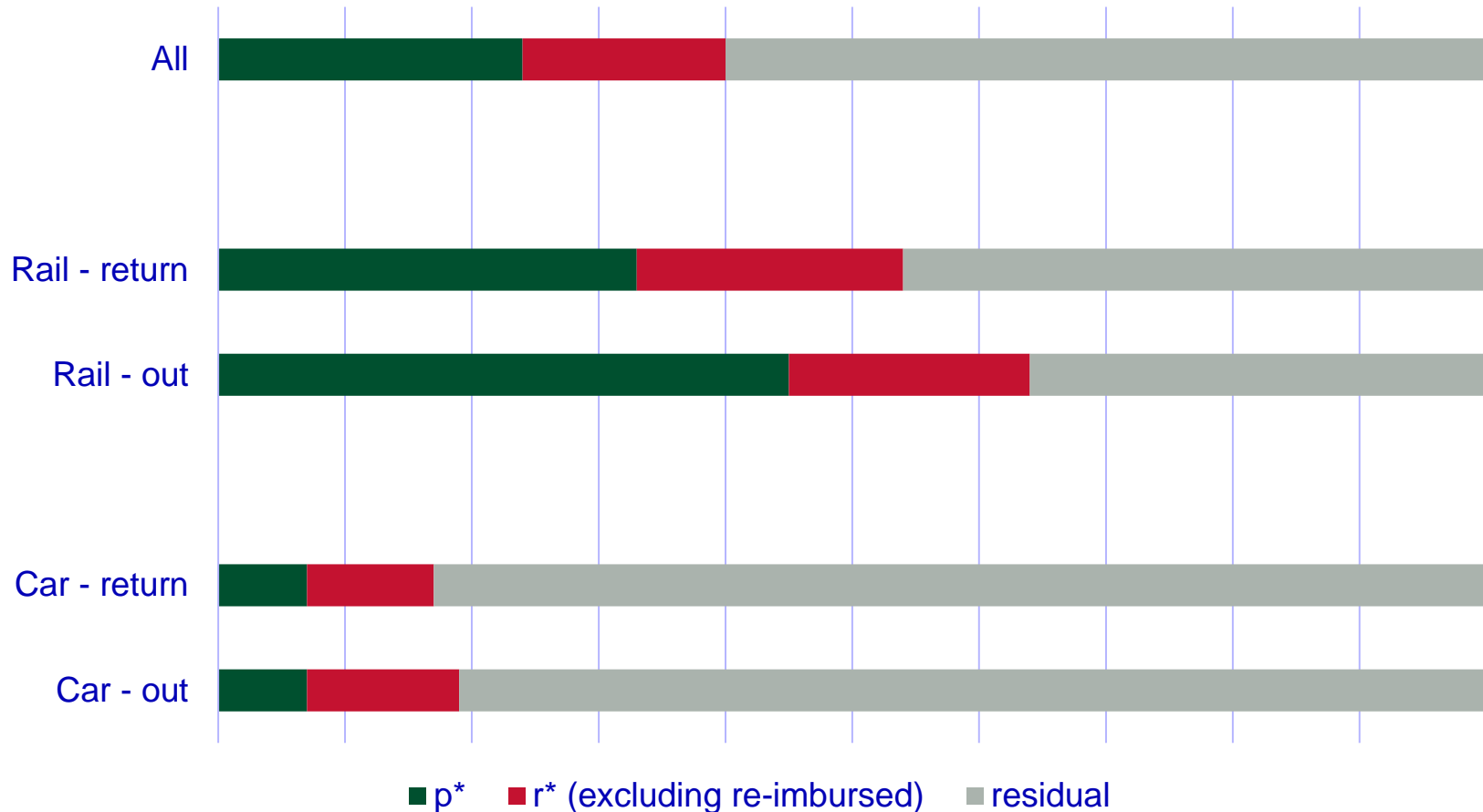
2. Alternative approaches

- Hensher parameters



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SP: breakdown of time use



2. Alternative approaches

- Hensher parameters



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RP: breakdown of time use (rail)



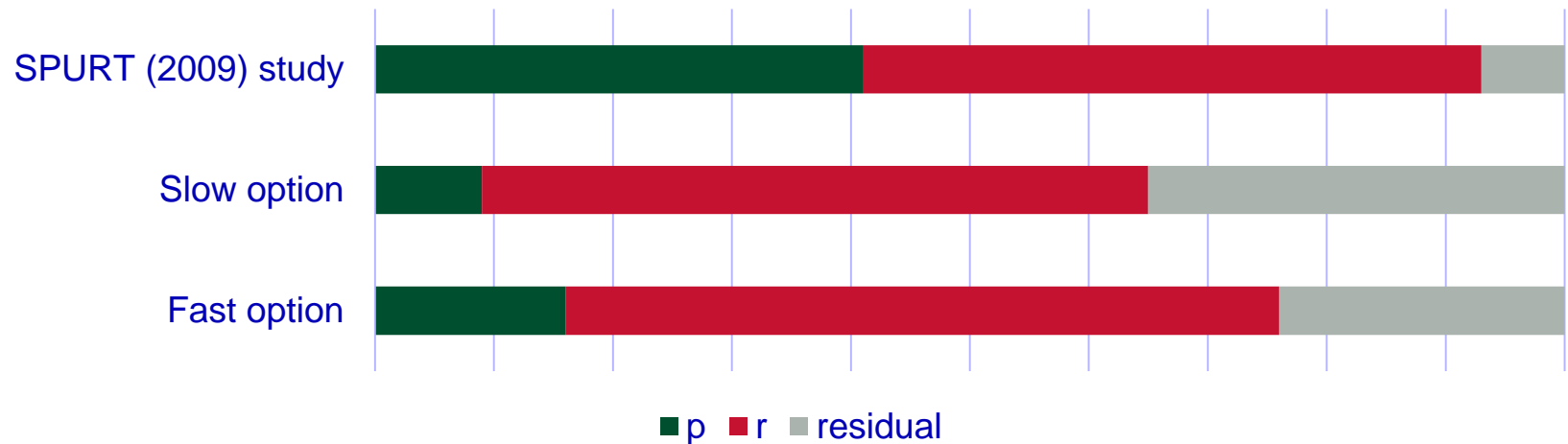
2. Alternative approaches

- Hensher parameters



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RP: breakdown of marginal time use (rail)



3. Key findings

- VTTS for routine appraisal of small and medium sized schemes (2014 perceived prices, £/hr)



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Source	Distance	Commute	Other non-work	Employees' business				
		All modes	All modes	All modes	Car	Bus	'Other PT'	Rail
WebTAG	All	7.62	6.77	25.47	24.43	15.64	24.72	30.07
Re-surveyed values	All	11.21	5.12	18.23	16.74	N/A	8.33	27.61
	<20 miles	8.27	3.62	8.31	8.21	N/A		10.11
	20 to 100 miles	12.15	6.49	16.05	15.85	N/A		28.99
	>= 100 miles		9.27	28.62	25.74	N/A		

Notes: Distance weighted, 'all distance' values based on income option 1, for distance-banded values non-work based on income option 2 (household income = £49,684) and business on income option 1, VTTS imputed for PT trips with zero cost, SP1 VTTS, Δt=10, employers paying for EB trips, Tool version 1.1.

3. Key findings

- selected VTTS multipliers



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Mode	Multiplier	Commute	Other non-work	Employees' Business
Car	reliability ratio	0.33	0.35	0.42
	free-flow	0.51	0.47	0.42
	light traffic	0.72	0.83	0.68
	heavy traffic	1.37	1.89	1.26
Rail	value of early	-1.77	-2.34	-1.55
	value of late	2.86	3.21	2.76
	seated 50% load	0.73	0.72	0.75
	seated 75% load	0.79	0.72	0.76
	seated 100% load	1.00	1.00	1.00
	seated 1 pass per m2	1.09	1.14	1.13
	seated 3 pass per m2	1.31	1.39	1.36
	standing 0.5 pass per m2	1.16	1.21	1.29
	standing 1 pass per m2	1.19	1.27	1.38
	standing 2 pass per m2	1.32	1.57	1.56
	standing 3 pass per m2	1.57	1.79	1.61
	standing 4 pass per m2	1.86	2.17	2.03

3. Key findings

- some general points



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- Strong distance effect in VTTS, since longer trips are associated with higher reference times and costs
- Clear evidence of values of reliability and of variation in VTTS with traffic conditions and crowding.
- Significant differences between the VTTS of different trip purposes, even after controlling for the characteristics of the trip and traveller.
- Significant differences between the VTT of different trip purposes, even after controlling for the characteristics of the trip and traveller.
- An exception was business trips, where (except for very long distances) controlling for distance mitigated modal differences.

3. Key findings

- non-work



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- For non-work trip purposes, the evidence is that the average VTTS for 'other' non-work is significantly lower than the average commuting value, all else equal.
- Differences in values across modes cannot be explained solely by comfort differentials. A number of possible causes for model differences were posited:
 1. Variation in traveller characteristics by mode
 2. Variation in trip characteristics by mode
 3. Self selection into modes depending on individual preferences
 4. Journey quality attributes

3. Key findings

- business



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- Professional drivers were outside the scope of the present study
- For briefcase travellers, a fair degree of correspondence between employers SP survey and the much larger employees SP survey.
- Employee values, when controlled to NTS incomes and trip lengths, are on average around 60% of the values in the CSA.
 - Rising to 72% if this is restricted to travellers who are reimbursed for their trip.
- Longer distance trips yield VTTS close to the CSA while short distance trips VTTS are well below.
- VTTS for car and rail from the employees' business survey are quite different.
- Business values cover a wide range, and are sensitive to certain assumptions concerning the classification of business trips/travellers.

4. Approach to implementation

- stakeholder consultation



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- In October 2015, DfT consulted on proposals for updating WebTAG guidance on VTTS.
- Encompassed wide range of proposed changes, including:
 - updated values of travel time (VTTS) for use in appraisal across all modes and journey purposes, excluding freight;
 - segmentation of business values of time into three discrete distance bands (0-50km, 50-100km and 100km+), by mode;
 - revising the reliability ratio, which applies for car travel only, down from 0.8 to 0.4; and
 - revising the wait time multiplier down from 2.5 to 2.0;
 - revising the late time multiplier for non-rail public transport down from 3.0 to 2.4, in line with the revision to the wait time multiplier.

4. Approach to implementation

- further development of distance-based business values



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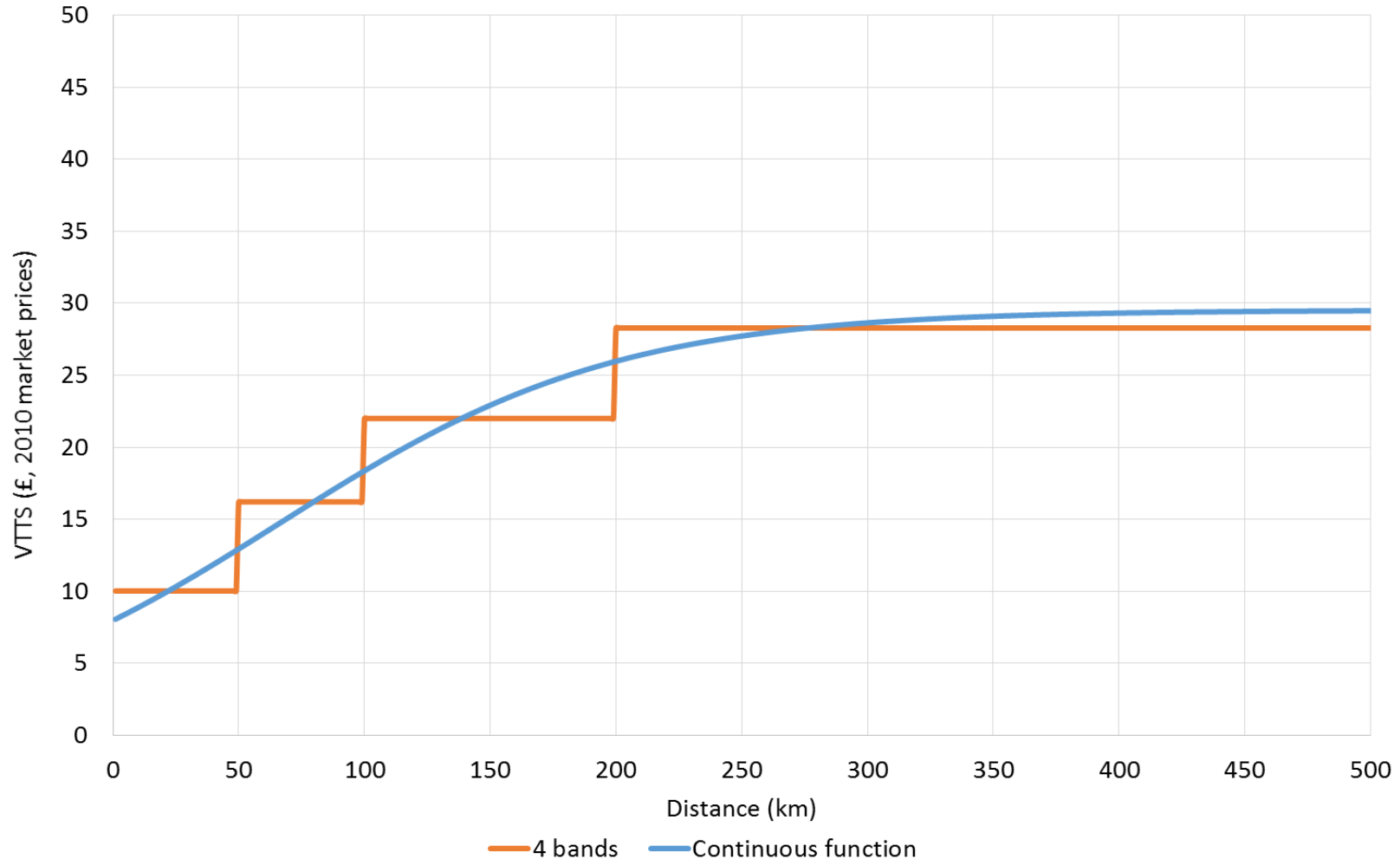
- Responding to consultation, DfT further developed distance-based business values, finally arriving at the following ‘three-tier’ hierarchy of approaches in its appraisal guidance:
 1. A continuous (logistic) valuation function fitted to the enumerated NTS VTT data.
 2. Adjustment of the three distance bands developed by Arup/ITS Leeds/Accent into four distance bands: 0-50km, 50-100km, 100-200km, 200km+.
 3. In the event that the above two approaches are infeasible or disproportionate, the application of distance-weighted average VTTS by mode.

4. Approach to implementation

- continuous function vs. four bands for car employers' business



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5. Policy implications of distance-based VTTS

- evolution of WebTAG



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- Updated WebTAG released in 2016 represented step-change in appraisal for the DfT.
 - For the first time, employers' business VTTS grounded in WTP.
- Implementation of updated values in live appraisal work has had material impact on Value for Money (VfM) of many major schemes
- Overall, given journey purpose split and different changes to VTTS for business vs. non-work purposes, updated guidance has led to:
 - moderate (around 10%) reduction in scheme benefits, but significant variation on scheme-by-scheme basis
 - more marked reduction in scheme benefits (sometimes up to 40%) where investments largely benefitted leisure or shorter-distance business travel
 - small-to-moderate positive impact on scheme benefits where the investments predominantly benefitted commuters and/or longer-distance business trips
 - pronounced modal pattern in the impacts, with larger reductions in benefits being more prevalent for road schemes, as compared with rail.

5. Policy implications of distance-based VTTS

- HS2 case study



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	Present value £bn (2015/16 price and discounting base year)			
Breakdown of impacts	Old VTTS, old multiplier	New VTTS, old multiplier	New VTTS, new multiplier	% diff
Transport User Benefits (Business)	56.6	63.5	61.2	8%
Transport User Benefits (Other)	20.0	18.3	17.1	-14%
Other quantifiable benefits (excluding Carbon)	0.4	0.4	0.4	0%
Loss to Government of Indirect Taxes	-4.1	-4.1	-4.1	0%
Net Transport Benefits (PVB)	73.0	78.1	74.6	2%
Wider Economic Impacts	16.3	18.3	17.6	8%
Net Benefits including WEIs	78.6	84.4	80.7	3%
Revenues	43.6	43.6	43.6	0%
Capital costs	55.8	55.8	55.8	0%
Operating costs	27.6	27.6	27.6	0%
Cost to the Broad Transport Budget	39.8	39.8	39.8	0%
Benefit-cost ratio	1.8	2.0	1.9	2%
Benefit-cost ratio (with wider economic impacts)	2.2	2.4	2.3	3%

5. Policy implications due to distance-based VTTS

- RIS1 case study



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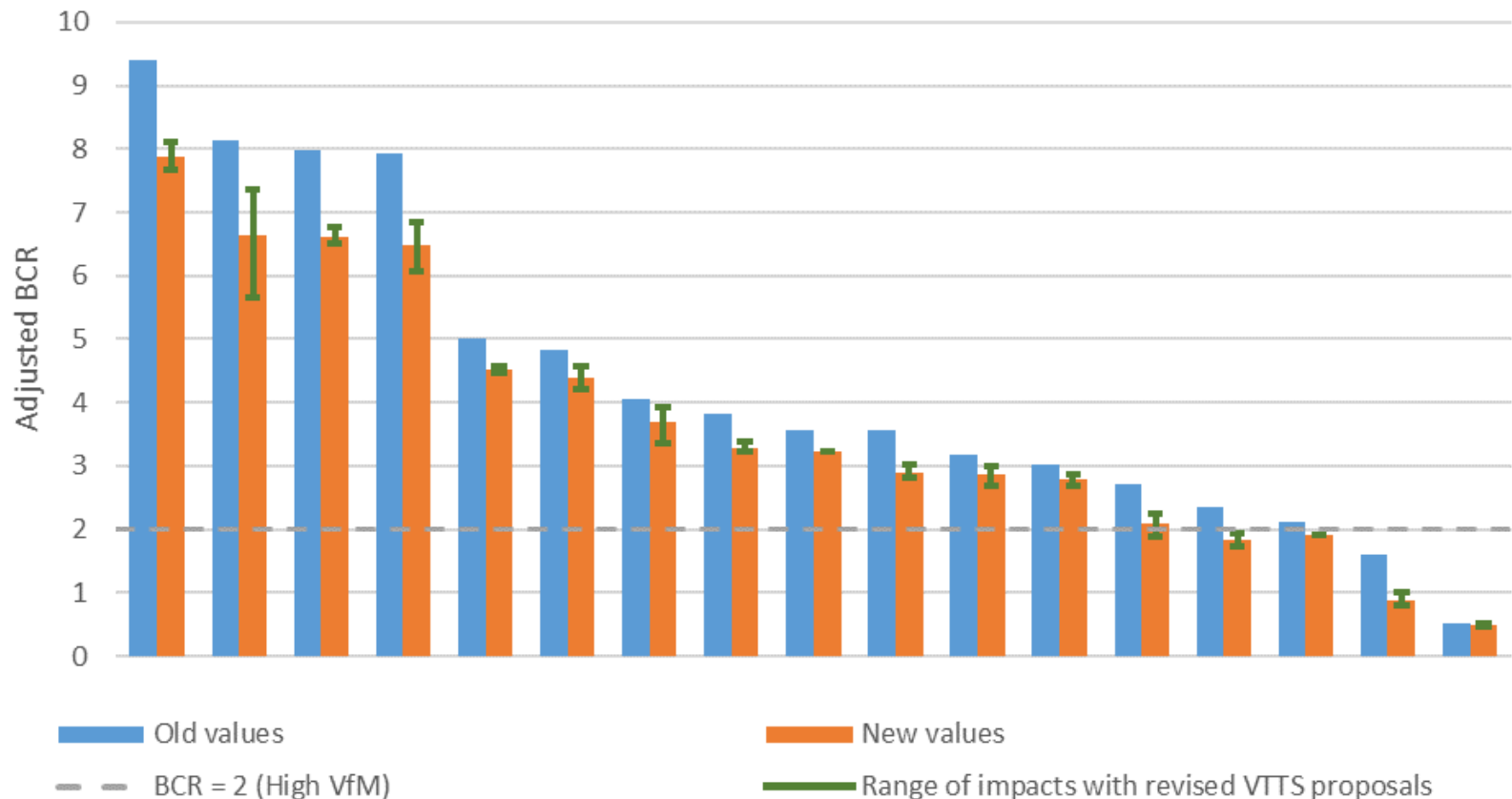
	Present value £m (2010 price and discounting base year)		
Breakdown of impacts	Old VTTS	New VTTS	% diff
Time savings: commuters	4,769	6,916	45%
Time savings: other non-work	12,830	9,568	-25%
Time savings: business	12,120	8,175	-33%
Time savings: freight	9,699	9,699	0%
VOCs	1,220	1,220	0%
Greenhouse Gases (CO2)	-758	-758	0%
Local Air Quality (NOx and PM10)	-23	-23	0%
Accidents	-386	-386	0%
Noise	-31	-31	0%
Wider Public Finances (Indirect Taxation Revenues)	902	902	0%
Present Value of Benefits (PVB)	40,342	35,282	-13%
Present Value of Costs (PVC)	8,757	8,757	0%
Initial BCR	4.6	4.0	-13%
Reliability: commuters	1,845	1,338	-27%
Reliability: other non-work	4,976	1,855	-63%
Reliability: business	5,070	1,710	-66%
Reliability: freight	3,749	1,875	-50%
Total reliability	15,640	6,778	-57%
Wider Economic Impacts	5,655	6,007	6%
Landscape	-339	-339	0%
Adjusted PVB	61,298	47,729	-22%
Adjusted BCR	7.0	5.5	-22%

5. Policy implications due to distance-based VTTS

- Portfolio testing



Benefit-cost ratios for a range of strategic road network schemes (error bars indicate low/high range)



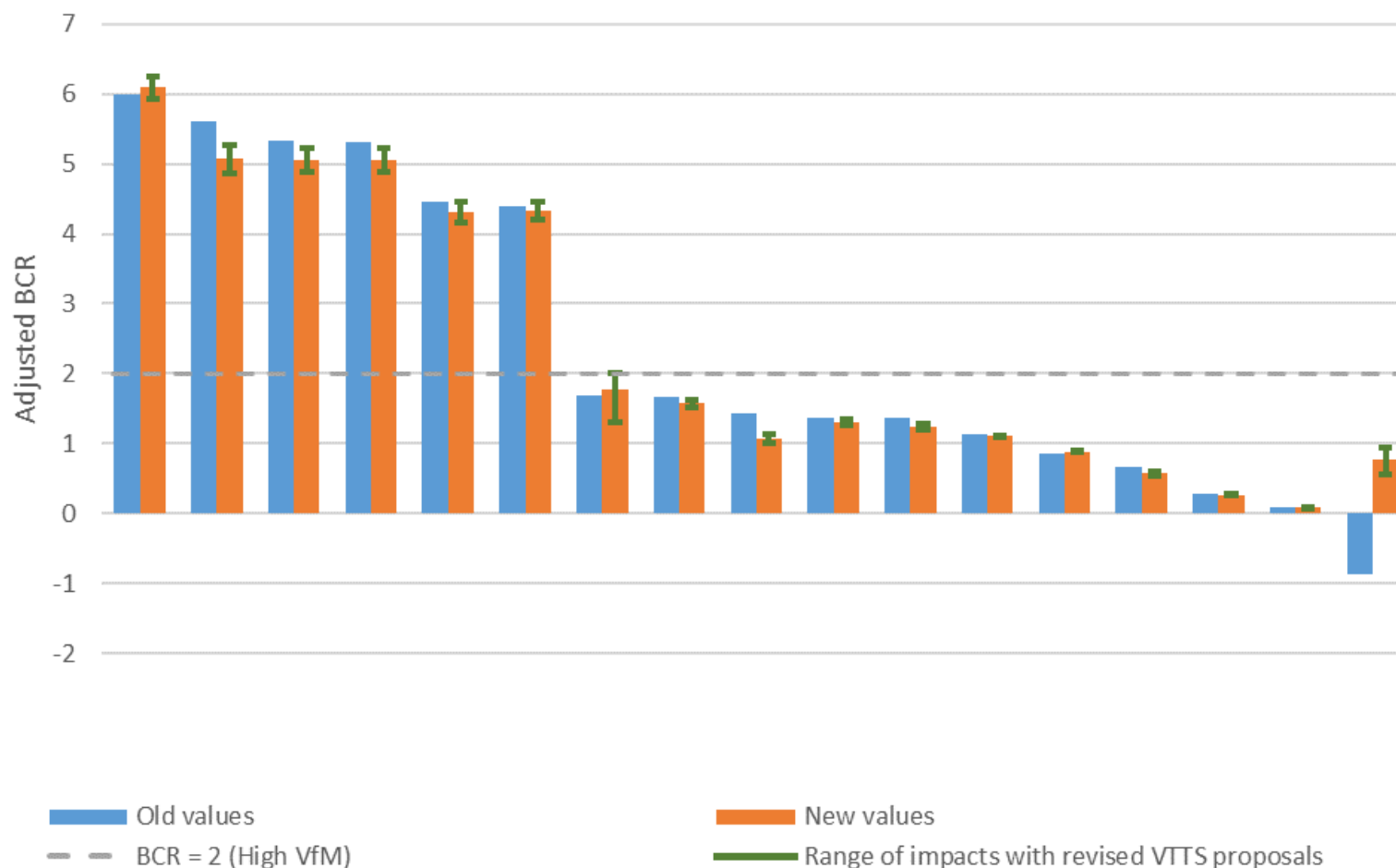
5. Policy implications due to distance-based VTTS

- Portfolio testing



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Benefit-cost ratios for a range of rail schemes (error bars indicate low/high range)



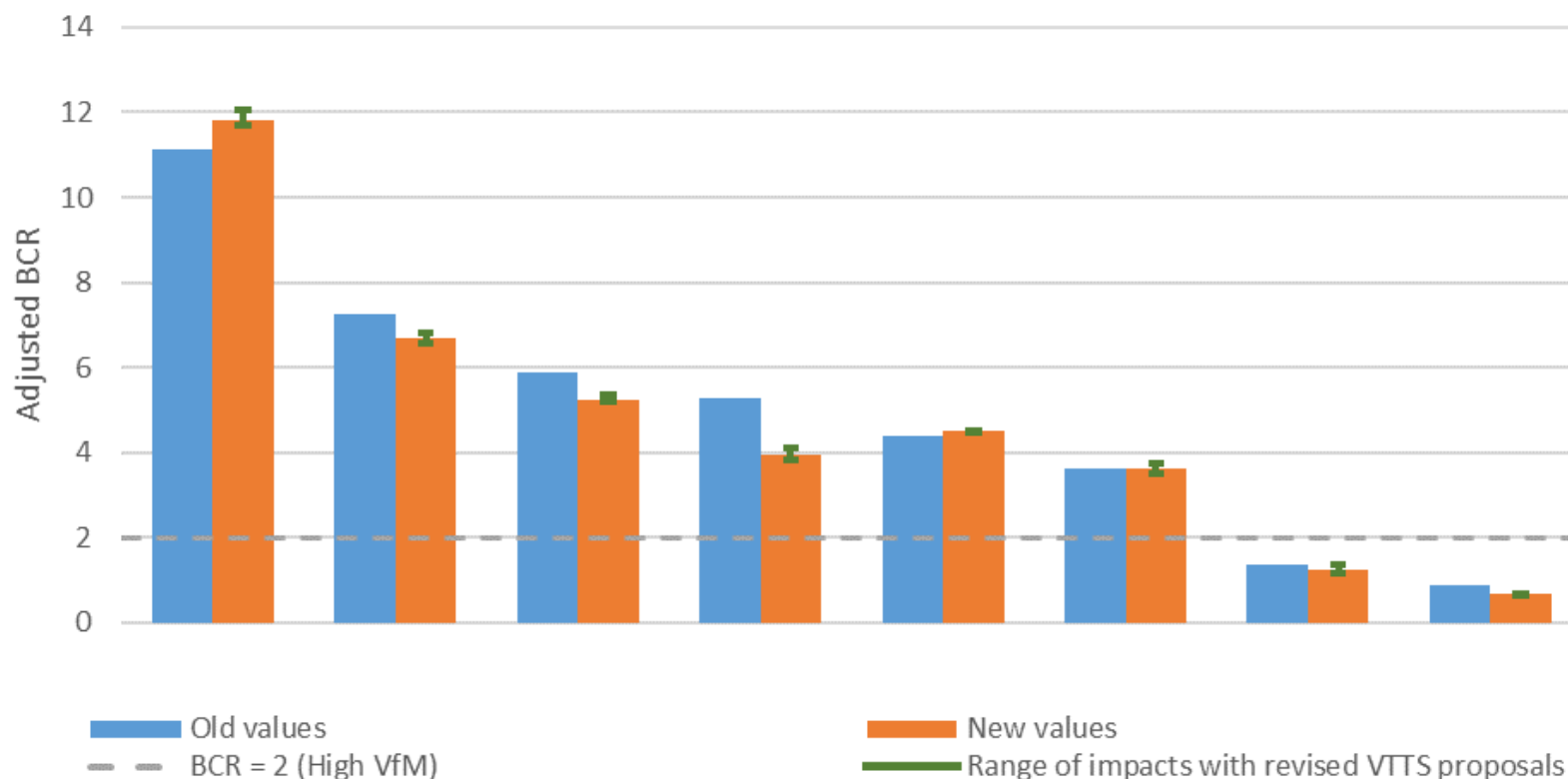
5. Policy implications due to distance-based VTTS

- Portfolio testing



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Benefit-cost ratios for a range of local authority road schemes (error bars indicate low/high range)





- DfT considers the 2014/15 study to represent major step forward in delivering robust and usable guidance on VTTS
- Overall, considering case studies and wider portfolio testing, apparent that distance-varying business VTTS has strengthened case for investment in long distance, inter-urban travel where business and commuting are the dominant trip purposes.
- Some grounds to challenge use of distance-based values in the absence of detailed testing of alternative dimensions of variation such as journey time and/or cost.



- In terms of the debate around productive or worthwhile time use, the updated guidance has perhaps not had the effect that one might have expected.
 - For long distance rail travel, where one might have expected the new valuations to be lower because of controlling for time use, valuations have actually increased.
- Moving forwards, with the dawn of autonomous vehicles (AVs) there is likely to be an increasing need to expand the evidence base around the impact of time use on VTTS.
 - Evidence to date thin on the ground and there is no authoritative figure to use in policy appraisal.
 - Concerted effort will be needed in the medium term to develop defensible VTTS estimates for policy appraisal involving AVs.

Thank you for your attention – any comments or questions?



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