From: [redacted]
To: A303 Stonehenge
Subject: Re: A303 Amesbury to Berwick Down (TR010025) Ref 20020712
Date: 10 June 2019 15:19:32
Attachments: 80034-R0012-00.pdf

Many Thanks for your email

Although late notice, would it be possible for me to attend the meeting on Thursday the 13th? I understand that cost benefit issues will be briefly discussed under the Transport heading and would be interested to hear the Inquiry first hand.

I attach a preliminary response to the Deadline 3 response to give an idea of the particular issue that interests me.

It appears that there is further evidence which was not disclosed by the Freedom of Information request referred to in my submission. This may materially affect the Inquiry. If necessary, I can discuss or bring along the relevant files for review.

My kind regards

Jon Morris

Ir. BEng CEng FIStructE FICE EurIng MHKIE
Director: On behalf of One Engineering Ltd

Mobile: [redacted]

Contact information at: 1-mail.co.uk
Website: oneengineering.co.uk

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On 14/05/2019 16:32, A303 Stonehenge wrote:

> Dear Mr Morris
>
> Thank you for your email. I confirm receipt of your submission for Deadline 3 (Comments to Written Representations).
>
> Please note that the Planning Act 2008 regime is predominantly a

written process; Issue Specific Hearings are held when the Examining Authority needs to probe and test the evidence further. Not every Principal Issue will require further examination through ISHs.

Kind regards

A303 Amesbury to Berwick Down Case Team

National Infrastructure Planning
The Planning Inspectorate, Temple Quay House, Temple Quay, Bristol BS1 6PN

Helpline: 0303 444 5000
Email: A303stonehenge@planninginspectorate.gov.uk

Web: https://infrastructure.planninginspectorate.gov.uk/ (National Infrastructure Planning)
Web: www.gov.uk/government/organisations/planning-inspectorate (The Planning Inspectorate)

Twitter: @PINSgov

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From: Jon Morris [redacted]
Sent: 14 May 2019 11:25
To: A303 Stonehenge <A303Stonehenge@planninginspectorate.gov.uk>
Subject: A303 Amesbury to Berwick Down (TR010025) Ref 20020712

Dear Sir of Madam

Many thanks for your letter referenced TR010025 of the 7th May (pdf reference 000676). I notice that the Specific Hearings in Appendix A of that letter no longer include all of the original Principal Issues of Annex B of your letter referenced TR10023 of the 4th March 2019 (pdf reference 00511). In particular, Principal Issue 3 (Alternatives particularly sub-paragraph concerning policy and legal) and Principal Issue 12 (Socio Economic Effects and particularly Baseline assessment methodology and socio economic evaluation) do not appear to be covered by the Issue Specific Hearings.

The above issues are referred to in two representations (reference 2001870 “Valuing Heritage Impacts” and reference 20020712 “A303 Valuation Issues”) both published 07 May 2019. These representations query whether or not the type of financial model used for the above scheme is actually in accordance with Government Policy. Although the information supplied by Highways appears not to be complete, initial evaluations within the above Representations indicate that the method used to show scheme value may be innovative by comparison to other similar infrastructure projects.

If, on inspection, the method used to justify funding for this project proves to

be financially innovative, the scheme may set a precedent for methods by which similar publicly funded projects can be funded. I do not know if this type of consideration falls within the remit of the Inquiry, but thought it worthwhile flagging up for your consideration.

My kind regards

Jon Morris

Ir. BEng CEng FIStructE FICE EurIng MHKIE

On 07/05/2019 13:05, A303 Stonehenge wrote:

> **Planning Act 2008 and The Infrastructure Planning (Examination Procedure) Rules 2010 – Rule 13 and Rule 16**
>
> **Application by Highways England for an order granting development consent for the A303 Amesbury to Berwick Down**
>
> **Notification of hearings and Accompanied Site Inspection**
>
> Dear Sir/ Madam
>
> 20020712
>
> Please be advised that the hearings summarised in the table below will be held between 3 and 7 June 2019. **Registration for these events before the dates established is essential**. For more information and details about how and by when to register, please visit this link:
>
> http://infrastructure.planninginspectorate.gov.uk/document/TR010025-000676
>
> You can also view this notification on the project page of the National Infrastructure Planning website:
>
> https://infrastructure.planninginspectorate.gov.uk/projects/south-west/a303-stonehenge/?ipcsection=docs
>
> If you do not have access to the internet or are unable to visit public facilities, for example a local library, please contact us using the details below and a member of the Case Team will be able to provide you with the relevant details.
>
> | Even | Dat | Tim | Venu |
> |---|---|---|---|
> | **Issue Specific Hearing 1** – Draft DCO | **4 June 2019** | **10.00am** | |
> | **Issue Specific Hearing 2** – Heritage | **5/6 June** | **10.00am** | |

etc	**2019**		City Hall Malthouse Lane Salisbury SP2 7TU
Issue Specific Hearing 3 – Landscape/visual etc	**7 June 2019**	**10.00am**	
Issue Specific Hearing 4 – Water/geology etc	**11 June 2019**	**10.00am**	
Issue Specific Hearing 5 – Noise/vibration etc	**12 June 2019**	**10.00am**	
Issue Specific Hearing 6 – Traffic/transport	**13 June 2019**	**10.00am**	
Issue Specific Hearing 7 – Biodiversity etc	**14 June 2019**	**10.00am**	
Compulsory Acquisition Hearing 1	**9/10 July 2019**	**10.00am**	
Accompanied Site Inspection 2	**29 August 2019**	**8.00am**	**Meeting place**: Stonehenge Visitor Centre Salisbury SP4 7DE

Please do not hesitate to contact the Planning Inspectorate's Case Team if you require any further information.

Yours faithfully

A303 Amesbury to Berwick Down Case Team

National Infrastructure Planning
The Planning Inspectorate, Temple Quay House, Temple Quay, Bristol BS1 6PN

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A303 Valuation Issues

Addendum to 80034-R0011-01
Representation 20020712 on A303 proposals

80034-R0012-00

Reference: 20020712

INDEX

1.0 Preliminary response to Applicant's response

1.1 This representation relates purely to one issue (of disagreement) as described in representation *20020712 referenced 80034-R0001* (revision 1 at time of writing). It is prepared as a preliminary response to *"TR010025-000977-Highways England - 8.18 - Comments on Written Representations"*.

1.2 Rather then go through each response, this addendum document focuses on only one response. That issue and subsequent response are summarised in the applicant's response document as below:

1.1.2 Extract from report 80034-R0011 rev 1:

> 50.1.26 On this basis, and accounting for negative impacts listed above, the tunnel appears to have inadequate cost-benefit. However, it has not been possible to identify if this lack of benefit is extensive.

1.2.2 Applicant's response:

> 50.1.27 Highways England response It is important to note that the work around the contingent valuation report (CVR) was primarily relevant to the Department for Transport's (DfT) investment decision in the Scheme, not the planning merits of the Scheme.

1.3 However, the "*National Policy Statement for National Networks as Presented to Parliament pursuant to Section 9(8) and Section 5(4) of the Planning Act 2008 in December 2014*" states:

> 4. Assessment principles
>
> 4.5 Applications for road and rail projects (with the exception of those for SRFIs, for which the position is covered in paragraph 4.8 below) will normally be supported by a business case prepared in accordance with Treasury Green Book principles. This business case provides the basis for investment decisions on road and rail projects. The business case will normally be developed based on the Department's Transport Business Case guidance and WebTAG guidance. The economic case prepared for a transport business case will assess the economic, environmental and social impacts of a development. The information provided will be proportionate to the development. This information will be important for the Examining Authority and the Secretary of State's consideration of the adverse impacts and benefits of a proposed development. It is expected that NSIP schemes brought forward through

I have highlighted the section of the above guidance which applies to this scheme. It appears to me, from reading this document, that the Business Case is relevant to, and a consideration of, the Inquiry.

1.4 It has since come to my attention that the information made available on the CVR by a Freedom of Information request was subsequently re-issued after it was discovered that the FOI documents supplied had missing (redacted) segments. Already referenced in report R0011, the known documents were:

> a) HE551506 AA GEN SWI RP JX 000025 Redacted.pdf [62 pages] and;
> b) HE551506 AA GEN SWI RP JX 000026.pdf [39 pages]

1.5 Another Interested Party (Suzanne Keene) has since supplied me with documents from the second FOI. The documents are named as follows:

c) HE551506-AA-GEN-SWI-RP-JX-0025 28apr2017.pdf and;
d) HE551506-AA-GEN-SWI-RP-JX-0026 28apr2017.pdf

1.6 At the time of writing submission 20020712 "*A303 Valuation Issues; Representation on A303 proposals*" (Internal reference 80034-R0011-01), I was unaware of the existence of the second Freedom of Information request described in 1.5 above.

1.7 The second document of the second submission (item d above) contains information on the questions asked of the public whilst being shown images. Amongst other images, the respondents were shown this image of the whole Stonehenge World Heritage site :

Map: A303 removed into tunnel

1.8 At Q87 on page 69 (LXVII) of that questionnaire. Whilst showing pictures of the site such as shown above, respondents were told:

> "Removal of the A303 would reconnect the World Heritage Site to the north and south of the existing A303 allowing visitors to walk freely between Stonehenge and other archaeological sites in the World Heritage Site. "

1.9 As mentioned in previous Written Submission 20020712, referenced 80034-R0011-01; para 2.4.1.4, the above statement is not factually correct: Removal of the road will only give access to the "Stonehenge Landscape" of which most land is to the North of the A303. The remainder of the WHS to the South contains some bye-ways with public access. However, the monuments themselves can not be accessed except by trespass: the land is not defined as CROW accessible (for more information see previous submission).

1.10 The issue with this is that this statement was made immediately before asking the public to value the proposal (and this also applies to other groups surveyed). On the subsequent question B5 on page 71 (LXIX) it was asked:

> "Looking at the list of amounts below, what is the maximum you would be willing to pay per year, to support a tunnel route? This would be via an increase in your annual taxes in each year of the three-year construction period. Studies have shown that many people answering surveys such as this one, say they are willing to pay more than they would actually be willing to pay in reality. Please think about this question as if it were a real decision and you were actually making a payment for real....."

1.11 And on subsequent page 73, respondents were then asked to rate the importance of the benefits. One of the identified benefits was:

> "The ability to explore the whole Stonehenge World Heritage site and explore all its archaeological monuments without the land being divided by the road (6)"

1.12 The above question sequence demonstrates that the public were, when valuing the site, given the impression that they would have access to other monuments. As mentioned previously the whole Stonehenge World heritage site is largely private land and such access will not be available.

1.13 Given the weighting that respondents had given in the pilot to this issue (27.7%: refer to previous submission referenced 20020712 referenced 80034-R0001-01 for more information), the value of the scheme could have dropped by several hundred million pounds had the public been made aware that they would not get the access described.

1.14 I have focused on only one aspect of the issues brought up in the written submission (80034-R0011-01). On this basis alone, I am concerned that the survey is unreliable: The NPSNN refers to the Green Book for financial evaluation matters and this, in turn, refers to Valuation Techniques for Cost-Benefit Analysis by Daniel Fujiwara and Ross Campbell. The above described issues appear to conflict with the recommendations of that Treasury advice (in particular refer to section 4.2 of Fujiwara and Campbell). This type of conflict is known as an "Information Bias".

1.15 The National Audit Office, in their report "*Improving the A303 between Amesbury and Berwick Down" (HC 2104 SESSION 2017–2019 20 MAY 2019* named as "Improving-the-A303-between-Amesbury-and-Berwick-Down.pdf"), note under Key findings (Page 6):

> 9 The economic case relies on heritage benefits that are uncertain. The high cost of building a tunnel, compared with widening or moving the road, means that under the standard method for appraising transport projects, the project would only deliver 31p of benefit for every £1 spent. Highways England therefore expanded its appraisal to include a monetary value for cultural heritage, to reflect the project's wider objectives. At £955 million (2010 prices and discounted) these make up 73% of total monetised benefits. With these included, Highways England expects the project to deliver £1.15 of benefit for every £1 spent, which the Department considers low value for money. While Highways England used approved methodologies to do this, calculating benefits in this way is inherently uncertain and the Department advises decision-makers to treat them cautiously (paragraphs 2.5 to 2.7).

1.16 I have highlighted relevant parts of the above paragraph. When these issues are taken into account, from a cost-benefit ratio perspective, the project appears to deliver less than £1 of value for every £1 spent even accounting for the heritage benefits. If this is correct, the application should be rejected on this basis alone.

1.17 It is likely that Interested Parties to the Inquiry will no longer have sufficient time in which to address these issues with the applicant. It may be possible for the Inquiry to refer the issues for a more detailed review to the National Audit Office: From reading their report, it is not clear that they are aware that there may be additional value issues with respect to the survey.

2.0 Summary

2.1 As previously requested in representation R0011 (Deadline 2 response), it would be useful to have the full Contingent Valuation Study made available for review. It may also be useful to incorporate all of the FOI requests (produced by Highways) into the examination process. The documents below, together with any Reports on the Final Surveys (as described for the pilots in Appendix C of document HE551506-AA-GEN-SWI-RP-JX-0026) would be particularly helpful:

c) HE551506-AA-GEN-SWI-RP-JX-0025 28apr2017.pdf and;
d) HE551506-AA-GEN-SWI-RP-JX-0026 28apr2017.pdf

2.2 My Preliminary Meeting informative document, Deadline 2 response and my Deadline 3 response requested that the CVR (CVA) should be made available and that it is an apparent requirement of the National Policy Statement for National Networks that the Business Case is justified. My deadline 3 response also noted that if the business case is not made available for inspection, it will be rather difficult for the Inquiry to review whether or not it complies with the NPSNN. These documents have not been made available to the Inquiry.

2.3 Although the above information is likely to be helpful, by not supplying information requested at deadline 3, the applicant has made further assessment difficult for Interested Parties (especially to allow effective responses in a timely manner).

2.4 Because the withheld information may not allow effective responses to the timetable required for the Inquiry, it may be worthwhile (assuming it is possible) to ask the National Audit Office to undertake a detailed evaluation of the CVR to so that an evaluation of the effect of the above discrepancies might be determined.

Jonathan Morris

A303 Amesbury to Berwick Down

TR010025

Volume 8

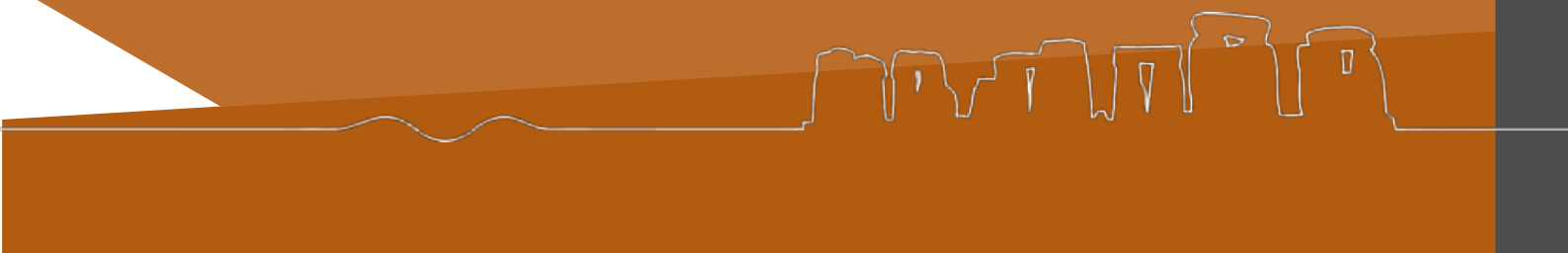
Deadline 3
8.18 - Comments on Written Representations

APFP Regulation 5(2)(q)

Planning Act 2008

The Infrastructure Planning (Examination Procedure) Rules 2010

May 2019



If protection of a national icon is required over the very long term, significant additional budget allowances may be required over the tunnel's lifespan.

50.1.25 **Of the above reasons to pay, only items 4 and 7 would be addressed by provision of a tunnel. This accounts for only 13.89% of the reasons to pay that have been produced in support of a tunnel.**

50.1.26 **On this basis, and accounting for negative impacts listed above, the tunnel appears to have inadequate cost-benefit. However, it has not been possible to identify if this lack of benefit is extensive.**

Highways England response

50.1.27 It is important to note that the work around the contingent valuation report (CVR) was primarily relevant to the Department for Transport's (DfT) investment decision in the Scheme, not the planning merits of the Scheme.

50.1.28 The pilot survey was designed to find out how people might react to different sorts of questions, to ensure the final surveys are well-understood, provide sufficient information, and focus only on the attributes of cultural heritage that Highways England was looking to value. The results of the pilot surveys (and therefore the percentages quoted here) are not, therefore, a reflection of the results of the final surveys.

Key Issue

50.1.29 **The definition of a tunnel within the valuation documentation**

50.1.30 **The respondents were not informed that a choice exists between a cut and cover tunnel and a bored tunnel: Only "a tunnel". A cut and cover tunnel, which is significantly less expensive, would achieve the same description given to the correspondents. Correspondents do not appear to have been given preference choices to opt for the low-cost method of achieving the same aim:**

50.1.31 **Therefore, even if a tunnel could achieve the benefit aims of the CVA (see section 2.4.1 above), a different type of tunnel appears to be able to achieve those benefits at a lower cost.**

Highways England response

50.1.32 At the time of undertaking the research, the precise design and location of tunnel portals was yet to be determined. The survey therefore focused on the removal of the A303 and provided only limited information on precise alignment and design aspects of the tunnel. A cut and cover tunnel was not under consideration.

50.1.33 The appraisal process aims to capture only the change in values as a result of the intervention and not the overall values. In this case the contingent valuation was designed to elicit responses that were focussed on the impact of removing the road from the landscape; to that end they it is neutral on the

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Department for Transport

National Policy Statement for National Networks

Presented to Parliament pursuant to Section 9(8) and Section 5(4) of the Planning Act 2008

December 2014

4. Assessment principles

General principles of assessment

4.1 The statutory framework for deciding applications for development consent under the Planning Act 2008 is set out in paragraph 1.2 of this NPS. This part of the NPS sets out general policies in accordance with which applications relating to national networks infrastructure are to be decided.

4.2 Subject to the detailed policies and protections in this NPS, and the legal constraints set out in the Planning Act, there is a presumption in favour of granting development consent for national networks NSIPs that fall within the need for infrastructure established in this NPS. The statutory framework for deciding NSIP applications where there is a relevant designated NPS is set out in Section 104 of the Planning Act.

4.3 In considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:

- its potential benefits, including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits;
- its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

4.4 In this context, environmental, safety, social and economic benefits and adverse impacts, should be considered at national, regional and local levels. These may be identified in this NPS, or elsewhere.

4.5 Applications for road and rail projects (with the exception of those for SRFIs, for which the position is covered in paragraph 4.8 below) will normally be supported by a business case prepared in accordance with Treasury Green Book principles. This business case provides the basis for investment decisions on road and rail projects. The business case will normally be developed based on the Department's Transport Business Case guidance and WebTAG guidance. The economic case prepared for a transport business case will assess the economic, environmental and social impacts of a development. The information provided will be proportionate to the development. This information will be important for the Examining Authority and the Secretary of State's consideration of the adverse impacts and benefits of a proposed development. It is expected that NSIP schemes brought forward through

the development consent order process by virtue of Section 35 of the Planning Act 2008, should also meet this requirement.

4.6 Applications for road and rail projects should usually be supported by a local transport model to provide sufficiently accurate detail of the impacts of a project. The modelling will usually include national level factors around the key drivers of transport demand such as economic growth, demographic change, travel costs and labour market participation, as well as local factors. The Examining Authority and the Secretary of State do not need to be concerned with the national methodology and national assumptions around the key drivers of transport demand. We do encourage an assessment of the benefits and costs of schemes under high and low growth scenarios, in addition to the core case. The modelling should be proportionate to the scale of the scheme and include appropriate sensitivity analysis to consider the impact of uncertainty on project impacts.

4.7 The Department's WebTAG guidance is updated regularly. This is to allow the evidence used to inform decision-making to be up-to-date. Where updates are made during the course of preparing analytical work, the updated guidance is only expected to be used where it would be material to the investment decision and in proportion to the scale of the investment and its impacts.[48]

4.8 In the case of strategic rail freight interchanges, a judgement of viability will be made within the market framework, and taking account of Government interventions such as, for instance, investment in the strategic rail freight network.

4.9 The Examining Authority should only recommend, and the Secretary of State should only impose, requirements in relation to a development consent, that are necessary, relevant to planning, relevant to the development to be consented, enforceable, precise, and reasonable in all other respects.[49] Guidance on the u*se of planning conditions* or any successor to it, should be taken into account where requirements are proposed.

4.10 Planning obligations should only be sought where they are necessary to make the development acceptable in planning terms, directly related to the proposed development and fairly and reasonably related in scale and kind to the development.[50]

[48] See also WebTAG guidance on *The Proportionate Update Process*
[49] As defined in section 120 of the Planning Act 2008
[50] Where the words "planning obligations" are used in this NPS they refer to "development consent obligations" under section 106 of the Town & Country Planning Act 1990 as amended by section 174 of the Planning Act 2008. See paragraphs 203-206 of the Planning Act 2008.

A303 Stonehenge

Amesbury to Berwick Down

Valuing Heritage Impacts: Appendices

HE551506-AA-GEN-SWI-RP-JX-000026

P01, S2

06/02/2017

Q87 In the past, different scenarios have been put forward to change the layout of the existing A303 road. Work is currently underway to develop a range of scenarios and a public consultation is planned for early 2017. We will provide you with information about an alternative road scenario which would move the A303 road from its current position within the Stonehenge World Heritage Site. This is an indicative scenario which is presented here for the purposes of this hypothetical exercise only. We remind you that this survey is not a public consultation. It is a targeted survey for assessing the benefit of removing the A303 from the area surrounding Stonehenge. We would like you to imagine that two hypothetical scenarios exist for the A303 at Stonehenge. A. Current situation: Leave the A303 road as it is. B. A tunnel of approximately 2.9km (1.8 miles): Convert the A303 to a dual carriageway and construct a tunnel within the World Heritage Site through which the A303 road will pass, removing the A303 from its current surface route across part of the World Heritage Site. Construction of the tunnel would take around three years. Representation of an indicative alternative route for the A303 tunnel. Note that the tunnel portals are indicated as a range over a broad area within the World Heritage Site (hatched circles on the map). The route of the western approach road to the tunnel is also represented as a range (shaded area between dotted lines).

The pictures below show a view of the Stonehenge World Heritage Site if the A303 became a dual-carriageway with a tunnel of 2.9km (1.8 miles). The A303 within Stonehenge World Heritage Site would no longer be visible from Stonehenge. Reduced traffic noise whilst visiting the stones, which would make large areas of the World Heritage Site more tranquil. Removal of the A303 would reconnect the World Heritage Site to the north and south of the existing A303 allowing visitors to walk freely between Stonehenge and other archaeological sites in the World Heritage Site. Tunnel entrances would be constructed within the Stonehenge World Heritage site. These would not be visible from the stones but would be new visible features in the archaeological landscape, although the road would be carefully designed to reduce its impact as far as possible. Dual carriageway would lead up to the tunnel entrances, including the short sections inside the World Heritage site. Stonehenge would not be visible from the new A303 route. A route along the old A303 route would provide access for cyclists, horse riders and walkers.

Representation of the Stonehenge World Heritage Site with the A303 removed.

B3 Impacts associated with current A303 (do nothing) and the 2.9km tunnel option Current A303 (Status Quo) 2.9km Tunnel Alternative A303 runs 165 metres from stone circle A303 removed from current location and redirected through tunnel Single carriageway alongside Stonehenge monument, with some dual carriageway within the World Heritage Site Dual carriageways will lead up to the tunnel entrances, including sections inside the World Heritage Site. Traffic noise audible from stones Less traffic noise audible from stones and an increase in tranquillity Traffic visible from stones No traffic visible from stones No access to World Heritage Site to south of current A303 Reconnect the World Heritage Site to the north and south of the existing A303, allowing people to explore the whole landscape. Stonehenge visible from A303 Stonehenge not visible from the new A303 route. How easy or difficult did you find this information to understand? Please indicate on the scale below, where 1 is not at all easy to understand, and 5 is very easy to understand?

- ❍ Not at all easy to understand 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ Very easy to understand 5 (5)

B4 For the next set of questions, please imagine a situation where the tunnel scenario was selected and was paid for by an increase in national taxes, for three years. Please think for a moment about how much the proposed scenario to remove the A303 from the World Heritage Site would be worth to you and your household, if anything. Would you be prepared to pay something, even if only a very small amount, to support the construction of a tunnel route?

- ❍ Yes (1)
- ❍ Maybe (3)
- ❍ No (4)

If No Is Selected, Then Skip To You indicated that you would not be w...

B5 Looking at the list of amounts below, what is the maximum you would be willing to pay per year, to support a tunnel route? This would be via an increase in your annual taxes in each year of the three-year construction period. Studies have shown that many people answering surveys such as this one, say they are willing to pay more than they would actually be willing to pay in reality. Please think about this question as if it were a real decision and you were actually making a payment for real. Please do not agree to pay an amount if you think you cannot afford it; If you feel you have paid enough already; Or have other things to spend your money on. Also, this question is just about the proposed road scheme. Remember, we are not asking you about how much you value the Stonehenge World Heritage Site, we are asking you how much you would value taking the road out of part of the World Heritage Site.

- ❍ £0 (1)
- ❍ £0.05 (61)
- ❍ £0.20 (2)
- ❍ £0.50 (3)
- ❍ £1 (31)
- ❍ £1.50 (32)
- ❍ £2 (34)
- ❍ £2.50 (35)
- ❍ £3 (36)
- ❍ £4 (37)
- ❍ £5 (38)
- ❍ £6 (39)
- ❍ £7 (40)
- ❍ £8 (41)
- ❍ £9 (4)
- ❍ £10 (5)
- ❍ £10 (42)
- ❍ £11 (43)
- ❍ £12 (44)
- ❍ £15 (45)
- ❍ £18 (46)
- ❍ £20 (47)
- ❍ £22 (48)
- ❍ £25 (49)
- ❍ £27 (17)
- ❍ £30 (50)
- ❍ £35 (51)
- ❍ £40 (52)
- ❍ £50 (53)
- ❍ £75 (54)
- ❍ £100 (55)
- ❍ £125 (56)
- ❍ £150 (57)
- ❍ £175 (58)
- ❍ £200 (59)
- ❍ Other amount (60) _____

B6 How certain are you that you would really pay this amount per year, for 3 years, in additional annual taxes if asked?

- ❍ Not certain at all 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ Very certain 5 (5)
- ❍ Don't know (6)

Answer If Looking at the list of amounts below, what is the maximum you would be willing to pay per year, i... £0 Is Not Selected

B7 Below is a list of potential benefits of the proposed tunnel option for Stonehenge World Heritage Site. We would like to know which are the most important to you. Please rate the outcomes listed in terms of their importance to you.

	Not at all important (2)	Slightly important (3)	Important (4)	Fairly important (5)	Very important (6)
Reduction of traffic noise/ tranquility of Stonehenge and the World Heritage Site (4)	❍	❍	❍	❍	❍
No traffic visible from the stone circle at the Stonehenge World Heritage Site (5)	❍	❍	❍	❍	❍
The ability to explore the whole Stonehenge World Heritage site and explore all its archaeological monuments without the land being divided by the road (6)	❍	❍	❍	❍	❍
The removal of a modern road from a historic landscape (7)	❍	❍	❍	❍	❍

HM TREASURY

THE GREEN BOOK

Appraisal and Evaluation in Central Government

Note explaining changes made to the Green Book in July 2011:

This is the 2003 edition of the Green Book. However, pages 57-58, which deal with the valuation of non-market goods have been updated alongside the release of a Green Book discussion paper on this subject - Fujiwara and Campbell (2011), Valuation Techniques for Social Cost Benefit Analysis: Stated Preference Revealed Preference and Subjective Well-Being Approaches.

The changed text on pages 57-58 has been highlighted in red within this updated document. Because of the changes there is some duplication of paragraph numbers, and there is some change to the sequence of footnotes in this section

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Valuing Non-market Impacts

Annex 2

Value, Utility, Welfare and Well-Being

1 Social Cost Benefit Analysis seeks to assess the net value of a policy or project to society as a whole. The valuation of non-market impacts is a challenging but essential element of this, and should be attempted wherever feasible. The full value of goods such as health, educational success, family and community stability, and environmental assets cannot simply be inferred from market prices, but we should not neglect such important social impacts in policy making. This Annex outlines techniques for valuing non-market impacts, and some typical applications such as time-savings, health benefits, prevented fatality, design quality, and the environment. These approaches can be complex but are equally as important as market impacts.

2 Economists attempt to attach a monetary value to non-market goods by looking at the impact that these things have on utility. Utility, in the broadest sense, refers to the satisfaction that a person gets from consumption of a good, or to the change in their welfare or well-being. Because it is difficult to observe utility directly, it has traditionally been inferred by observing the choices that people make within related or hypothetical markets. More recently, economists have attempted to measure directly the impact of non-market goods on life satisfaction.

Market based approaches - Stated Preference and Revealed Preference

3 The preferred method of estimating this change in utility is to simulate the market in order to estimate people's 'willingness to pay' (WTP) or 'willingness to accept' (WTA) a project's outputs or outcomes. Willingness to pay is the maximum amount of money an individual is willing to give up in order to receive a good. WTA is the minimum amount of money they would need to be compensated to forego or give up a good. The amount consumers are willing to pay depends to a large extent on the levels of income available to them, so valuations are usually obtained by averaging across income groups.

4 The market based approaches consist of 'Revealed Preference' approaches and 'Stated Preference' approaches.[1]

5 Revealed preference techniques involve inferring the implicit price placed on a good by consumers by examining their behaviour in a similar or related market. Hedonic pricing is an example of this approach.For example, the relationship between house prices and levels of environmental amenity, such as peace and quiet, may be analysed in order to assign a monetary value to the environmental benefit. Another example is the travel cost method, which involves estimating the costs people incur in order to consume a non-market good such as a recreational site.

6 Stated preference techniques use specially constructed questionnaires which describe a hypothetical choice within a hypothetical market in order to elicit estimates of the willingness to pay (WTP) for, or willingness to accept (WTA), a particular outcome. When using stated preferences the main choice is between contingent valuation and choice modelling (CM). Contingent valuation studies elicit WTP or WTA via direct questions such as 'What is the maximum amount you would be prepared to pay every year to receive good x?' (the 'open-ended' format) or 'Which of the amounts listed below best describes your maximum willingness to pay every year to receive good x?' (the 'payment card' format). CM studies, on the other hand, elicit values by presenting respondents with a series of alternatives and then asking which is most preferred. They are often used in order to value specific attributes of a good, rather than the good as a whole.

7 The technique chosen will depend on the individual circumstances, and should be judged on a case-by-case basis. As a general rule, revealed preference methods are fairly reliable, and should be used where the relevant information can

[1] More detail on the practical application of both stated preference and revealed preferences approaches can be found in the Green Book discussion paper, Fujiwara and Campbell (2011), 'Valuation Techniques for Cost Benefit Analysis: Stated Preference, Revealed Preference and Subjective Well-Being Approaches', available on the HMT website: http://www.hm-treasury.gov.uk/d/green_book_valuationtechniques_250711.pdf. There is also more guidance on Stated Preference techniques specifically from the old DTLR, David Pearce and Ece Özdemiroglu et al. (2002), 'Economic Valuation with Stated Preference Techniques: Summary Guide', available on the DCLG website: http://www.communities.gov.uk/documents/corporate/pdf/146871.pdf

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Valuation Techniques for Social Cost-Benefit Analysis:

Stated Preference, Revealed Preference and Subjective Well-Being Approaches

A Discussion of the Current Issues

Daniel Fujiwara and Ross Campbell

July 2011

4 The Strengths and Weaknesses of the Three Methods

4.1 Introduction

In section 4.2 we address the main issues relevant to the strengths and weaknesses of all the methods (such as whether preferences or life satisfaction are the better measure of utility). Section 4.3 then tackles some additional issues which are *specific* to each of the methods (such as the potential for survey related biases when using stated preference). Section 4.4 presents some conclusions.

4.2 Issues relevant to all three methods

There are a number of issues relevant to the strength of all three methods. Below we deal with:

- whether preferences are a good measure of utility;
- whether stated life satisfaction is a good measure of utility;
- setting up the empirical study; and
- econometric methodology issues

4.2.1 Whether preferences are a good measure of utility

Broadly speaking there are three accounts of well-being or utility (Parfit, 1984):

1. Preference satisfaction
2. Mental states
3. Objective lists

The preference satisfaction approach is based on the premise that we can infer utility from people's choices because "*what is best for someone is what would best fulfil all of his desires*" (Parfit, 1984: 494). Traditional approaches to valuation (stated and revealed preference methods) focus on preference satisfaction accounts. These methods rest fundamentally on the assumption that people seek to maximise their expected utility subject to a budget constraint and that their preferences can be defined by the preference axioms in Chapter 2.

Mental state accounts refer to people's statements about their own utility, ie, measures of subjective well-being (SWB). Objective list accounts of well-being are based on assumptions about basic human needs and rights (Dolan et al., 2011a). The life satisfaction approach is based on the mental state account. In this paper we therefore focus on preference satisfaction and mental state (SWB) accounts.

Behavioural economics challenges the preference axioms by taking empirical findings from psychology. Here we cover the main findings relating to whether people behave in accordance with the standard economic model. For in-depth reviews the reader is directed to Hastie and Dawes (2010)[1] and Kahneman and Tversky (2000)[2]. It should also be noted that much of the

[1] Hastie and Dawes (2010) Rational Choice in an Uncertain World, 2nd edition. Sage: London

[2] Kahneman and Tversky (ed.s) (2000). Choice, Values and Frames.Cambridge University Press: Cambridge, UK.

discussion here is also relevant to the non-monetary valuation of health states using quality-adjusted life years (QALYS). The standard gamble (SG) and time trade-off (TTO) mechanisms of assigning utilities to different health states essentially ask people to state their subjective values and thus share many of the problems related to stated preference techniques discussed below. Our attention in this paper is on monetary valuation techniques and thus we do not cover issues related to QALYS in further detail. Interested readers are directed to Dolan and Kahneman (2008) for a full discussion.

Decision-making is a core element of preference-based methods; whether in a survey or real-world market setting economists observe people's decisions in order to infer values. Simon's (1955) theory of bounded rationality also sharply criticised the economist's view of individual decision-making by highlighting the role of perception, cognition and learning in the decision-making process. The resulting concept of preferences is that they are constructed at the time of elicitation and are context-dependent (Slovic, 2000). Ariely et al. (2006) even go as far as to say that people have no notion as to whether a good or product is even good or bad for them.

Work in the fields of cognitive psychology and decision science highlights the notion that in the decision-making process people use a number of cognitive shortcuts, especially when the issues with which they are faced are unfamiliar and complex[3]. These shortcuts or 'rules of thumb', which are used by individuals to simplify and speed up the decision making process, are called *heuristics*. Heuristics can lead to the generation of irrational preference relations and choices. This has obvious implications for both stated and revealed preference techniques.

Heuristics

Here we consider two categories of empirical finding that are thought to emerge from the use of heuristics:

i. 'utility misprediction'; and
ii. 'anchoring':

i) Utility mis-prediction

Preference-based valuation methods require people to be able to predict the future utility consequences of consuming or foregoing a good. Numerous experiments have shown that people are unable to do this with accuracy (Kahneman, 2000). Kahneman and Snell (1992), for example, report that people find it very hard to predict how much pleasure they will derive from consuming even everyday goods such as music, yogurt and ice cream. Participants were asked to consume these goods each day for a week. They rated their liking of the goods after each consumption and also predicted their liking and enjoyment of the goods for the following day. Correlations between predicted and actual enjoyment were negligible even in relatively large sample sizes. Nisbett and Kanouse (1969) and Read and van Leeuwen (1998) find evidence that shoppers who have recently eaten cannot forecast their future food consumption and appetites accurately. Gilbert (2007) and Kahneman and Snell (1992) attribute these findings to a **presentism** heuristic; people project current tastes and desires on to their predicted future preferences.

Other reasons for mis-predicting utility are **adaptation** and **focussing illusions**. Evidence from a number of different contexts suggests that individuals systematically fail to fully consider the extent to which they adapt to changes in circumstances. They therefore tend to over-estimate the utility gain that will result from events, circumstances or outcomes (Kahneman and Thaler, 2006; Loewenstein and Adler, 1995). Frey and Stutzer (2004), for example,argue that people underestimate how quickly they will adapt to extrinsic goods, such as money. They therefore end

[3] Dellavigna (2009) provides a comprehensive survey of the empirical evidence relating to deviations from the standard economic model, divided into three categories – i) non-standard preferences, ii) non-standard beliefs, and iii) non-standard decision making

up sacrificing too many intrinsic goods, such as time with family and friends, for time spent at work and commuting. Schkade and Kahneman (1998) present evidence that people are not able to predict the satisfaction they would derive from moving from the Midwest to California. Individuals tended to focus on one or two salient aspects associated with California, such as the weather (which in reality does not feature so saliently in people's actual day-to-day lives), when forecasting utility.

An issue related to focussing illusions is **proportion dominance**. People attach great weight to information formats that use proportions, percentages or probabilities, since these formats put the outcome dimension into perspective; these formats have upper and lower bounds which allow people to place where a given value falls (Slovic et al., 2002). This leads to some anomalous findings. For example, in a study on airport safety equipment, people in different groups were offered equipment that, in the event of a crash landing, would save 150 lives and equipment that would save 98% of 150 lives (Fetherstonhaugh et al., 1997). In general people stated that they valued the latter equipment higher although the outcome (in terms of lives saved) was not as good. In fact they found that saving 98%, 95%, 90% and 85% of 150 lives were all more valuable options than saving 150 lives.

ii) Anchoring

People's stated values can be influenced by irrelevant cues. Ariely et al. (2003) found, for example, that people's WTP for a range of everyday consumer goods and their WTA values for small annoyances, such as high pitched sounds, were heavily anchored around their social security (SS) numbers. People were asked to write down the last two digits of their SS number and were then asked whether they would be willing to pay or accept a value equal to that number. Values were increased or reduced from the initial SS number anchor until the respondents' maximum (minimum) WTP (WTA) values were derived. US SS numbers are randomly generated, which means that they could not provide any information on the quality of the good. In general, people with higher SS numbers were willing to pay significantly more for the goods. An interesting second finding was a marked stability of relative preference. For example, although people's absolute valuations of a superior and inferior wine were subject to normatively irrelevant number anchors, the vast majority of people valued the highly rated product more than the inferior product. Therefore, the evidence suggests that people did not know how much they were truly WTP for each of the wines, but they did know that they were WTP more for the superior wine. This, and other evidence, lead the authors to claim that people's preferences and valuations were coherently arbitrary; "consumers' absolute valuation of experience goods is surprisingly arbitrary, even under "full information" conditions. However, consumers' relative valuations of different amounts of the good appear orderly, as if supported by demand curves derived from fundamental preferences" (Ariely et al., 2003).

The neurological basis of anchoring is gaining understanding. Research suggests that the medial orbitofrontal cortex (mOFC) is a key area of the brain associated with experienced pleasantness (Plassmann et al., 2008; McCLure et al., 2004). In a wine tasting experiment Plassmann et al., (2008) gave the same wine to different groups, manipulating only the price across the groups. Using functional magnetic resonance imaging (fMRI), they found that reported experience/pleasantness *and* activity in the mOFC both increased with price (although the wine was identical). A follow-up experiment eight weeks later had the participants taste the wines again, but this time without a price anchor. There were no reported differences among the wines. Therefore, with anchoring it may be not just a case of people mis-reporting a value in contingent valuation (ie, feeling one thing but reporting another because of the influence of the anchor) but that people actually *subjectively experience* goods differently because of the anchor.

The role and implications of **neuroscience** for valuation techniques is discussed in more detail in Chapter 6.

Loomes (2006) reviews a number of contingent valuation studies (for goods relating to individuals' health and safety) that find excessive sensitivity to factors within an elicitation format that should, in conventional economic terms, be irrelevant. More specifically, he presents evidence showing that:

- estimates derived through the bidding game format have been found to be subject to **starting point effects**: The higher the opening offer is, the larger the valuation estimates are; and
- estimates found under the payment card elicitation format have been found to be sensitive to **range effects**: A presented range of £0-100, for example, attracting higher valuation estimates than a range of £0-50.

Dubourg, Jones-Lee, and Loomes (1997), for example, report results from a stated preference study for the UK Department of Transport that looked at the value people attach to reductions in the risk of road injuries. In an elicitation format similar to the bidding game, they found that a £75 starting point resulted in mean WTP estimates from 1.89 to 2.87 times as large as those elicited with a £25 starting point.[4] In a different round of piloting they utilised a payment card elicitation format. Using a range from £0 to £500 for one sample and from £0 to £1500 for another, they found that the latter generated higher WTP estimates in nine out of ten of their comparisons.

Loomes also discusses efforts by Guria et al (2003) and Chilton et al (2004) to eliminate such anomalous effects. The former presented respondents with a starting value in a bidding game format that was clearly a computerised random draw. The hope was that the randomness of the initial bid would cause respondents to attach less significance to it. Although the starting point effect became weaker in later questions, it still persisted. Chilton et al (2004) adopted a random card sorting procedure elicitation format in an attempt to counter the effects. This consisted of the interviewer visibly shuffling a small pack of cards; each one having a different sum of money printed on it. The respondent then turned over each card and declared whether they 'certainly would pay,' 'certainly would not pay,' or were 'unsure whether they would pay' the amount shown on the card. Having seen the pack being shuffled, the amount on the first card turned over should have had no effect. The results showed, however, that there was a significant positive linear correlation between the amount on the first card and respondents' stated WTP.

An important outcome of context-dependent preferences and heuristics is the phenomenon of **preference reversals.** There is a large body of evidence demonstrating that preferences can be reversed by changing from one mode of elicitation to another that is formally equivalent (Slovic, 2000). An early example of this is Slovic and Lichtenstein's (1971) study of gambling preferences. People were offered two different bets of the same expected value; a probability bet (high probability of winning a small amount – eg, an 80% chance of winning $5) and a dollar bet (low probability of winning a large payout - eg, a 10% chance of winning $40). In lab experiments as well as field experiments in casinos the overwhelming majority of people chose to play probability bets over dollar bets, but when both of the bets were given to them and they were asked to sell them back to the House, the majority assigned higher prices (higher WTA values) to the dollar bet. These preference reversals were explained as an anchoring effect. '*Respondents setting a price on an attractive gamble appeared to start with the amount they could win and adjust it downward to account for the probabilities of winning and losing as well as for the amount that could be lost. The adjustment process was relatively imprecise, with the price response greatly influenced by the starting point payoff. Rating and choices, on the other hand appeared to be governed by different rules, leading to greater emphasis on probabilities*' (Slovic, 2000).

[4] Respondents were allocated at random to either a £75 or £25 sample. They used an elicitation procedure to identify respondent's min, max, and best estimates. They also manipulated the levels of injury and the life of the safety feature (next 12 months or the rest of their life) across questionnaires. The comparative estimates reported here refer to the best estimates.

Preference reversals have also been found in risk-free experiments. Hsee (2000) finds that preferences can be reversed by changing from whether the good is evaluated on its own to whether it is evaluated jointly against another similar good. For example, Hsee's *Dictionary Study* asked students to state their WTP values for the following two music dictionaries:

	Dictionary A	**Dictionary B**
Year of publication:	1993	1993
Number of entries:	10,000	20,000
Any defects?	No, it's like new.	Yes, the cover is torn; otherwise, it's like new.

Respondents were assigned to three different groups: i) subjects who were shown both dictionary descriptions and asked to state their WTP for each (joint evaluation mode); ii) subjects who were shown dictionary A only and asked to state their WTP for that dictionary (separate evaluation mode); and iii) subjects who were shown dictionary B only and asked to state their WTP for that dictionary (separate evaluation mode).The mean WTP values for the two dictionaries are shown in the table below.

Preference reversals in joint and separate evaluations

Evaluation Mode	Dictionary A	Dictionary B
Joint	$19	$27
Separate	$24	$20

Source: Hsee (2000).

Under joint evaluation, people state a higher value for dictionary B. However, under separate valuation, dictionary A attracts the highest stated value. These joint evaluation– separate evaluation preference reversals can be explained by some simple heuristics. In separate evaluation people focus on the categorical attributes of the good, in this case '*whether the dictionary has any defects'.* In joint evaluation, attention is focused on the incremental aspects or differences in the goods, in this case '*the number of additional entries'.*

The study of preference reversals has not been limited to the field of psychology. For example, two economists, Grether and Plott (1979), criticised the previous work by psychologists and replicated the experiments introducing improved incentive compatibility, a wider and more varied range of participants and more information for participants. However, the preference reversal phenomenon did not disappear. Preference reversals have also been found in contingent valuation surveys for environmental goods and amenities (Brown, 1984; Gregory et al., 1993; Irwin et al., 1993).

The anchoring and preference reversal phenomena described above involve people stating or placing monetary valuations on goods. There is some evidence to suggest that part of the problem may be arising when people try to convert a feeling or concept of value into a monetary scale. In this interpretation people could have strong and well-defined preferences, beliefs and feelings for many of the things that are not sold through markets, but these beliefs are not represented monetarily (Gregory et al., 1993). Amir et al. (2008) find a disparity between people's WTP and their predicted experience or utility of goods like music concerts. Kahneman et al (1998) found that in a juror award experiment in which people studied a number of corporate malpractice cases and were asked to rate the defendant's (the corporation) actions on a scales of 'outrage' and 'degree of punishment justified.' There were strong correlations between the level of outrage and punishment across the different jurors, but the dollar awards had very little correlation. This is supported by a study by Malouff and Schutte (1989) who find that juror awards are highly susceptible to the anchoring effect of the plaintiff's initial level of compensatory demand.

The theory of constructed preferences suggests that the preference axioms do not hold. The evidence suggests that preferences and values are constructed on the spot, using a number of heuristics. This would imply that people's preferences are not *complete* and due to preference reversals are often *intransitive*. The above evidence suggests that preferences and valuations are highly dependent on the **framing** of the question, a phenomenon developed in Kahneman and Tversky's (1979) **Prospect Theory**[5]. These findings raise serious doubts about whether stated preference studies obtain meaningful WTP and accept estimates and whether prices at which goods are traded are accurate reflections of the value people place on goods and services. Little is known about the workings and properties of markets where economic agents have inconsistent preferences (Smith and Moore, 2010). In an experimental setting Smith and Moore (2010) find that non-rational agents can adversely impact on the earnings (the attainment of economic surplus) of the group of traders in general in market transactions.

A confounding problem is that people may lack good information about the good (Frey et al., 2004a; Frey and Stutzer, 2005); Robinson and Hammitt, 2011) and, specifically for stated preference, they may not fully understand the details of the payment system (Braga and Starmer, 2005) or could be susceptible to errors (Rashes, 2001). This would question whether, even with stable and well-defined preferences, people could state or reveal accurate values for non-market goods in stated preference and revealed preference contexts.

The theory of preference construction can also help to explain the odd findings that have emerged under the broad title of **embedding effects** in the stated preference literature. There are three types of **embedding effect**:

i) Insensitivity to scope

This refers to when the estimated WTP for a non-market good is insensitive to the size of that good[6]. For instance, Desvousges et al (1992) found no significant difference in the mean levels of WTP to save 2,000, 20,000 or 200,000 migrating birds from death. Scope insensitivity has been discovered in a number of other applications. Schulze et al (1993) discover little difference in the estimated WTP for a partial or complete clean-up of a contaminated area; McFadden and Leonard (1993) find that residents in four western states are willing to pay only 28% more to protect 57 wilderness areas in those states compared to the protection of a single area; Jones-Lee et al (1995) find that reducing the number of non-fatal road injuries by a factor of three only increases the stated WTP for a programme by 29%; and Chilton et al (2004) find insensitivity to WTP for increases in life expectancy in normal health for the respondent and all members of their immediate household. The mean WTP for an extra 6 months was just over 30% higher than an extra 1 month.

Ariely et al. (2003) claim that scope insensitivity is further evidence of coherent arbitrariness because insensitivity to scope is most dramatic in studies that use between-subject designs. Within-subject design studies produce valuations that are far more responsive to scale. Kahneman and Knetsch (1992) argue that insensitivity to scope is explained by respondents putting forward their WTP for the moral satisfaction of contributing to public goods, rather than their true valuation of the good. Another explanation (Kahneman et al., 1999) is that insensitivity to scope reflects respondents expressing an affective valuation of a prototypical exemplar. Here, affective valuation refers to assessments of preference on the basis of "the sign and intensity of the emotional response to objects" (Kahneman et al, 1999, p. 204). In the study by Desvousges et al (1992) discussed above, for example, under this psychological hypothesis respondents would have formed a, "mental representation of a prototypical incident, perhaps an image of an exhausted bird, its feathers soaked in black oil, unable to escape." (Kahneman et

[5] Prospect theory was developed as an alternative model to expected utility theory to describe decision-making under risk. Kahneman and Tversky (1979) show that decisions and valuations are highly dependent on the framing of the question in terms of gains or losses. Tversky and Simonson (2000) discuss further evidence of framing and context effects.

[6] See Kahneman et al (1999) and Loomes (2006) for a more substantial review of scope insensitivity findings in CV studies.

al, 1999, p.213). They would have then responded on the basis of their affective valuation of this image.

ii) Sub-additivity effects

These effects occur when the estimated WTP for one good plus the estimated WTP for another good is greater than the estimated willingness-to-pay when respondents are asked to value both goods together (Kahneman and Knetsch, 1992).

iii) Sequencing effects

These effects have been found when more than one good has been valued in a survey and the estimated value of a good differs according to when in the sequence it is presented to the respondent. The estimated WTP for a good has been found to fall the later in the sequence that it is presented (Tolley et al, 1983; Samples and Hollyer, 1990; Barber and ODwean 2008).

Attempts to explain and find solutions to the preference anomalies

It has been argued that insensitivity to scope findings are idiosyncratic and/or that the studies that have obtained such results are flawed in terms of survey design (Smith, 1992; Carson and Mitchell, 1993; Smith and Osborne, 1996; Carson, 2001). For example, the finding of insensitivity to scope should not be surprising if the description presented is not adequate to enable the respondent to distinguish between the smaller and larger good or if the survey emphasises they symbolic nature of providing the good. Another potential explanation is that individuals are running up against a budget constraint, so that they value the larger good more but they are unable to pay required multiple. However, Loomes (2006) notes that contingent valuation studies formed with WTA questions have also found insensitivity to scope.

Sequencing effects and sub-additivity effects have also been argued to be explainable with reference to income and substitution effects (Hoehn and Randall, 1989; Hanemann 1994; Carson, Flores, and Hanemann, 1998; Carson et al. 2001). Intuitively, each new good obtained reduces the income available for respondents to spend on other goods. Given this, the later in the overall package that a good is offered, the less desirable it will look. There may also be a similar effect if the goods are substitutes for each other.

A number of studies have sought to derive solutions to these preference anomalies and informational problems for contingent valuation. Two editions of the journal 'Environmental and Resources Economics' (in 2005 and 2010) are dedicated to methods that have been developed to deal with preference anomalies in contingent valuation studies. One of the key mechanisms for anomaly reduction in these studies is through learning by repetition and experience. The work is based on Plott's (1996) Discovered Preference Hypothesis (DPH). DPH argues that stable and consistent preferences are the product of experience gained through repetition. There are a number of studies that report reductions in the effects of arbitrary anchors and in the number of preference reversals as people become familiar with the good and the institutional payment arrangements in a contingent valuation context (Bateman et al., 2006; Braga and Starmer, 2005)[7]. Bateman et al. (2006) propose a double-bound dichotomous choice payment format[8] for elciting values. This is contrary to the recommendations set out by the National Oceanic and Atmospheric Administration (NOAA) in 1993[9]. NOAA recommended a single-bound dichotomous choice format in order to mimic a market setting more closely. To allow for

[7] For a review of the literature see Bateman et al. (2006).

[8] See Annex A for details of payment formats in contingent valuation.

[9] In 1993 NOAA appointed a panel of economic experts to consider recommendations for the use of contingent valuation studies (Arrow et al., 1993).

learning and experience Bateman et al. (2006) instead recommend a double-bound format where participants have the opportunity to 'discover' their preferences in the survey.

However, the neurological evidence on the effects of anchoring (Plassman et al., 2008) would suggest that prices should *not* be mentioned in any format during a contingent valuation survey and therefore that the open-ended elicitation format would be most suitable. Under this format, participants are simply asked to state their maximum WTP or minimum WTA, with no mention of a starting price (which would create an anchor). At the same time, however, this format takes the respondents in contingent valuation further away from the type of market institutions with which they are familiar when deciding whether to buy a good.

In addition, it is not clear how applicable these results are for the stated and revealed preference methods because opportunities for learning are often minimal. It is hard to provide repetitive experience for many of the public goods assessed in stated preference (Braga and Starmer, 2005) and revealed preference often relies on markets where transactions are infrequent (eg, housing market) so that few chances for learning exist at the individual level (Genesove and Mayer (2001). To counteract this Bateman et al. (2009) have recently used virtual reality simulators to communicate environmental changes to survey respondents. Some contingent valuation surveys also now employ a workshop format whereby people discuss the valuation issues with others and they can seek further information from moderators and experts (Hanley and Shrogen, 2002).

Alternatively, Gregory et al. (1993), propose a deliberative CV mechanism (multi-attribute utility analysis) in which a group of stakeholders, that includes the affected citizenry and technical experts, assesses the merits of the good under consideration and determines which attributes have the greatest impact on utility and an agreed conversion scale to monetise the 'utils'[10]. They claim that

> "*designers of a CV study should function not as archaeologists, carefully uncovering what is there, but as architects, working to build a defensible expression of value*" Gregory et al. (1993).

There is some recent work on combining stated and revealed preference data. This allows stated preference data to be checked against actual behaviour whilst also extending the range of goods estimable for revealed preference methods. Stated preference data can also help in isolating causal effects in hedonic market approaches, especially in trip cost methods for recreational sites (see Accent, 2010 and Whitehead et al., 2008 for a full discussion).

4.2.2 Whether life satisfaction is a good measure of utility

The subjective well-being approach assesses the impact of non-market goods on people's life satisfaction as reported in surveys such as the ONS's Integrated Household Survey. The approach does not rely on the rationality axioms holding and therefore avoids many of the problems associated with the preference-based approaches that were outlined in section 4.2.1. The approach does, however, rely on stated life satisfaction being an accurate measure of welfare or utility. It is possible to challenge whether this is the case.

Life satisfaction can be seen as being made up of a balance of affect (positive and negative emotions and feelings) together with a cognitive assessment of how well one's life measures up to aspirations and goals (Diener, 1984; Kahneman and Krueger, 2006). A life satisfaction response will incorporate to some extent a retrospective judgement of one's life together with

[10] Multi-attribute utility analysis is a form of Multi-Criteria Analysis. For full details see Department for Communities and Local Government (2009) *Multi-criteria analysis: a manual.*

how one feels now (Kahneman and Krueger, 2006). This can create difficulties as people do not always correctly remember past experience and their present feelings can be influenced by contextual factors present at the time of the interview (Bertrand and Mullainathan, 2001; Kahneman and Krueger, 2006; Schwarz, 2010; Schwarz and Strack, 1999). Biases can also arise in the stage of verbally reporting life satisfaction scores (Schwarz and Strack, 1999).

Below we look at three specific difficulties that have been identified when people respond to life satisfaction surveys:

i. remembering past experiences;
ii. context effects; and
iii. reporting of life satisfaction.

Following this we discuss some of the ways in which psychologists have attempted to overcome these problems by using moment-to-moment measures of well-being and we review evidence that suggests that reported life satisfaction can be an accurate and valid measure of utility.

i) Remembering past experiences

'Remembered utility' refers to people's recollections of the pleasure or displeasure associated with previous experiences or consumption (Kahneman et al., 1997). Experiments have shown that people's remembered utility can be biased due to their tendency to adopt a peak-end rule; in retrospective evaluations people place greatest weight on the peak (more intense part) and the end of an experience. They attach less weight to the the duration of an experience. There is therefore often a mis-match between people's actual experiences at the time and their retrospective evaluations of these experiences (Kahneman et al., 1993; Schwarz, 2010). Wirtz et al. (2003), for example, compare remembered utility with experiences during the event and find that people cannot accurately remember the utility they actually derived from holiday trips.

ii) Context effects

When asked about their well-being individuals tend to base their judgement on information that is most accessible at the time. The accessibility of information depends on the recency and frequency of its use (Schwarz and Strack, 1999). An implication of this is that the research instrument can influence responses to life satisfaction questions. For example, information that was used to answer a preceding question is more likely to come to mind when a respondent comes to answer the life satisfaction question (Bertrand and Mullainathan, 2001). Empirical evidence supports this hypothesis. Strack et al. (1988) find that when a question relating to students' dating frequency came after a life satisfaction question, there was no notable relationship between the question responses. However, reversing the question order resulted in a correlation coefficient of .66. Schwarz et al. (1991) also find different correlation effects when a question relating to marital satisfaction is asked before (.67) or after (.32) a general life satisfaction question. Question order effects, however, may not effect all respondents (Schwarz and Strack, 1999). For example, respondents currently undergoing a divorce are unlikely to be affected by whether they are asked to consider their marriage before or after the general question because this information is frequently used by them (e.g. it relates to their current concerns).

A similar process can explain why reports of satisfaction with life have been found to be influenced by the weather, finding a dime on a copying machine, spending time in a pleasant (rather than unpleasant) room and watching a football team win (Schwarz and Strack, 1999). While such factors are likely to influence current mood, they should not have notable effects on true overall life satisfaction. However, current mood could impact on responses to life satisfaction questions in two ways. Thinking about one's life whilst in a good mood may lead to the selective retrieval of positive information relating to their life, leading to a more positive evaluation. People may also take their current mood as a good indicator of their well-being in

life in general (Schwarz and Strack, 1999). Some evidence suggests that the latter explanation may be more accurate and that people use a 'current-mood-heuristic' to judge overall life satisfaction (Ross et al., 1986; Schwarz and Clore, 1996).

iii) Reporting life satisfaction

Individuals may adjust their life satisfaction scores when reporting them in order to give more socially desirable responses. For example, reported well-being is higher in face-to-face surveys than in postal surveys (Smith, 1979). When interviewed by individuals with a disability, respondents have been found to subdue their life satisfaction responses. In contrast, when a disabled person was present in the same room as a respondent completing their own survey, their condition was used as standard of comparison with the result that life satisfaction scores were inflated (Strack et al. 1990). Indeed, more generally, life satisfaction ratings are likely to be determined to some extent by the comparisons people make with their own life at different times and with other people at one point in time (Diener and Suh, 1997; Dolan and White, 2006). The problem with these effects is that respondents may provide assessments of their well-being that do not reflect the true experiences of their lives (Dolan and Kahneman, 2008).

Experienced utility

Kahneman (for example see Dolan and Kahneman, 2008; Kahneman and Krueger, 2006; Kahneman and Sugden, 2005; Kahneman et al., 1997) has been a proponent of using 'experienced utility', defined as the quality and intensity of an hedonic experience[11] as the basis for policymaking. Experienced utility is a sum of the moment-to-moment 'utils' of an experience and can be measured using the Experience Sampling Method (ESM) (Csikszentmihalyi, 1990) or the Day Reconstruction Method (DRM) (Kahneman et al., 2004). The ESM collects information on people's reported feelings in real-time during selected moments of the day using a Personal Digital Assistant (PDA). Respondents report their activity at the time and their subjective experiences, such as anger, happiness and fatigue. This does not involve a cognitive assessment of well-being on behalf of the participant and is therefore a measure of peoples' positive and negative affect (Kahneman and Krueger, 2006).

One criticism of the ESM has been that it is intrusive and can interrupt the flow of people's experiences. As an alternative, the DRM was developed. This method asks people to fill out diaries of their day reporting what they were doing and how they felt during those episodes in terms of positive and negative affect. The DRM is less intrusive than ESM, but does rely, to some extent on remembering utility. As discussed above, recollections of the utility of past events have been shown in a number of contexts to be subject to systematic biases (Kahneman and Krueger, 2006).

Experienced utility methods reduce reliance on remembered utility and are less susceptible to irrelevant contextual factors. ESM is now taken to be the 'gold standard' in well-being evaluation and reporting (Kahneman and Krueger, 2006; Schwarz, 2010). An assessment of how life is going for someone can be gauged from the summation of ESM or DRM reports over a long period of time. However, due to the cost of ESM or DRM methods, the current most viable measure of *overall* well-being for use in non-market good valuation is therefore arguably the type of global life satisfaction question that is included in datasets like the IHS.

Evidence on the validity of life satisfaction responses

There is also a variety of evidence to suggest that overall life satisfaction is a good measure of well-being. Pavot and Diener (1993), Eid and Diener (2004), Fujita and Diener (2005) and Schimmack and Oishi (2005) find mood and contextual effects to be limited. Sandvik et al

[11] (Kahneman and Snell, 1992).

(1993) and Shizgal (1999) demonstrate that there is a strong positive correlation between well-being ratings and emotions such as smiling and frowning. Research shows that Duchenne smiles (i.e. a type of smiling that involves a muscle near the eye called orbicularis oculi, pars laterali, which can distinguish between true and feigned enjoyment) are correlated with subjective well-being (Ekman et al., 1990). Urry et al. (2004) show that reports of life satisfaction are correlated with activity in the left pre-frontal cortex of the brain, which is the area associated with sensations of positive emotions and pleasure. Furthermore, well-being is a good predictor of health, such as heart disease (Sales and House, 1971) and strokes (Huppert, 2006). Cohen et al (2003) find that people who report higher life satisfaction were less likely to catch a cold and would recover quicker if they did. Kiecolt-Glaser et al. (2002) find that people with higher life satisfaction heal more quickly from wounds. Krueger and Schkade (2008) assess the test-retest reliability of life satisfaction responses. They question the same sample of women two weeks apart and find that correlation in life satisfaction responses was about $r = 0.59$, which relates closely to Kammann and Flett's (1983) results. Krueger and Schkade conclude that these levels of test-retest reliability '*are probably sufficiently high to yield informative estimates for……research*'. Finally, it should also be noted that a given person's tendency to over or understate their true well-being scores due to, for example, social desirability reasons could be seen as an underlying time-invariant personality trait. If this is the case, it would mean that using fixed effects estimators would control for this effect in life satisfaction regressions (Powdthavee, 2010; Tella and MacCulloch, 2006).

Interpersonal comparability is an important issue for analysts using cross-sectional or panel datasets on well-being. Sandvik et al (1993) have shown that individuals are able to recognise and predict the satisfaction of others, suggesting that SWB is observable and comparable between individuals. van Praag (1991) and Stutzer and Frey (2003) show that different individuals easily translate verbal labels, e.g. very good, into roughly the same numerical values. Furthermore, Kahneman (2000) suggests that there is considerable interpersonal convergence in the ranking of pleasure and pain.

4.2.3 Setting up the empirical study

All three valuation methods rely on collecting a sample of data from a chosen population in order to derive valuation estimates. Stated preference applications rely on the construction of original questionnaires which are then distributed to members of a target population. Revealed preference and life satisfaction applications typically use secondary data or a combination of both primary and secondary data.

Collecting primary data has the advantage of allowing value estimates to be based on specifically defined populations. For example, the direct users of a good (e.g. people with a licence to fish on a lake) or individuals within a specifically defined geographical area. It can also lead to bias reduction in certain areas. For example, as discussed in 4.2.2 above, Bertrand and Mullainathan (2001) argue that responses to subjective well-being questions are vulnerable to ordering effects. Dolan and Metcalf, (2008) note that this is a problem because many secondary surveys which ask life satisfaction questions, such as the British Household Panel Survey (BHPS), situate the (global) life satisfaction question in the middle of the survey.

However, original data collection is susceptible to problems that are potentially less prevalent in large national surveys, such as non-response bias, interviewer bias, and information bias. Non-response bias can occur when individuals who respond to a survey systematically differ from non-respondents (Champ, 2003). In contingent valuation surveys, for example, individuals with particularly strong feelings toward the good in question may be more willing to commit time to the questionnaire. Interviewer bias occurs when surveys are administered via telephone or face-to-face and the presence of the interviewer influences responses. This effect can be avoided with

well-trained interviewers (Carson, 2000). Information bias occurs if non-neutrality or inaccuracy in what is presented influences responses.

4.2.4 Econometric methodology

All three valuation methods rest on using a sample of data collected from a population in order to draw inferences about that population. However, a number of statistical or econometric issues are specific to the revealed preference and life satisfaction approach. We consider five of these issues below:

i. difficulties in causal analysis;
ii. functional form specification;
iii. the potential for measurement error,
iv. the fact that some values cannot be picked up; and
v. partial values:

i) Difficulties in causal analysis

The most basic econometric approach in revealed preference and life satisfaction applications is the specification of a linear regression model that is then estimated using Ordinary Least Squares. In this setting, valid causal interpretations cannot be attached to parameter estimates if the included covariates are correlated with the disturbance term of the model. This may limit our ability to identify, for example, the causal effect of the non-market good on house prices or wages in a revealed preference model, or the causal impact of income and the non-market good on well-being in a life satisfaction model.

With regard to the revealed preference method specifically, a large number of applications have indeed identified reasons to suggest that the non-market good of interest is correlated with the disturbance term. For example, in travel cost applications a number of cost components are chosen by the individual. Individuals who particularly enjoy the site under consideration are, for example, likely to base their choice of residence with this in mind thereby lowering their travel cost . If so, the partial relationship between individual trip frequency and trip cost will therefore (patially) reflect this unobserved determinant and will not give the true relationship between cost and trip frequency for a randomly selected member of the population (Randall 1994).

In studies valuing environmental amenities using housing markets, the large number of factors that influence the price of a house can lead to omitted variable bias. For example, individuals may accept a longer commute to work in order to live in an area with good air quality. Therefore if commuting time is not controlled for in the hedonic model then the least squares estimated value of the environmental amenity will not capture the true effect. Similarly, in an analysis of the effect of water quality on house prices, Leggett and Bockstael (2000) note that shore-side residential properties nearer to water of higher quality are also likely to be further away from the emitters of pollution. Therefore, if these emitters are undesirable neighbours for reasons distinct from their effect on water quality, then not controlling for a house's proximity to them will bias the estimated effect of water quality on house prices.

It has also been suggested that job risk variables are endogenous in labour market hedonic studies. The main explanation for this is that unobservable individual characteristics determine both specific job assignment and wages. Support for this hypothesis is presented by Black et al (2003). Using the National Longitudinal Survey of Youth they find that test scores from the Armed Forces Qualification Test and self-reported illegal drug use are correlated with their job-risk measures. This suggests that if such individual characteristics are not picked up by observable covariates, then least squares estimates of the implicit price for risk will be biased.

The most obvious solution to derive causal estimates for such non-market goods is the formation and identification of control variables that proxy for the omitted determinants. Other solutions include the use of instrumental variables (Chay and Greenstone, 2005) or using fixed effects models if a time-invariant assumption is reasonable for the unobservables. The *Magenta Book*[12] provides technical guidance on estimating causal impacts.

With regard to life satisfaction applications specifically, there is evidence to suggest that people with higher levels of well-being earn more income, are healthier and are more likely to get married (Diener and Biswas-Diener, 2002; Graham et al., 2004; Lyubomirsky et al., 2005; Stutzer and Frey, 2006). There is likely to be a problem of reverse causality here which will manifest itself by producing a correlation between the error term and such explanatory variables in the life satisfaction regression. To make causal inferences from the life satisfaction regression would require that the variables in which we are interested are determined exogenously. Ideally, to make causal inferences the explanatory variable should be determined through a randomised trial or it should be instrumented with a variable that is not correlated with the error term.

A small number of studies in the well-being literature have used instruments for some of the explanatory variables in the life satisfaction equation. Finding instruments for income is notoriously hard since it is difficult to identify variables that are correlated with income and not the determinants of life satisfaction that rest unobserved in the error term (for further discussion see Dolan and Metcalfe (2008) and Oswald and Powdthavee (2008)). Those studies that use instruments for income find that income has a positive effect on life satisfaction (eg, lottery wins (Gardner and Oswald, 2007; Lindahl, 2002); exogenous pay increases for East Germans after German re-unification (Frijters et al., 2004)). In actuality instrumenting for income generally *increases* the size of the income coefficient. Pischke (2010), Chevalier and Lydon (2002) and Luttmer (2005) use a range of instruments, including average industry wages and wages of the spouse, and find that Ordinary Least Squares estimates of the income coefficient are biased downwards. Instrumenting for income, therefore, should generally *increase* the size of the income coefficient, and therefore reduce the estimated income compensations required for the non-market goods.

Our meta-analysis of the life satisfaction approach literature suggests that very few studies have used exogenous changes in income and the explanatory variables of interest. Ferreira and Moro (2009) (air quality and climate), Luechinger (2009) (air quality), Dolan and Metcalfe (2008) (urban regeneration) and Oswald and Powdthavee (2008) (death of family members) use an instrument for income when deriving income compensations/valuations. As the above discussion would indicate, instrumenting for income reduces the income compensations associated with these non-market goods and 'bads' because the size of the income coefficient increases. Dolan and Metcalfe (2008) and Oswald and Powdthavee (2008) are the only studies in which the explanatory variable of key interest is likely to be exogenous. The urban regeneration project in Dolan and Metcalfe's study was essentially randomly allocated and it can be argued that in Oswald and Powdthavee's study the death of a family member is likely to be an exogenous event (Powdthavee, 2010).

ii) Functional form specification

Most applied hedonic and life satisfaction econometric applications impose an exact functional relationship between the dependent and explanatory variables and statistical inference focuses on the finite number of parameters included in the specified model. Using parametric models can lead to functional form misspecification if the specific functional relationship adopted is incorrect. In some cases, theoretical considerations can be used to develop specifications. For example, in the life satisfaction approach, income usually enters in logarithmic format to account for the diminishing marginal utility of income. However, in most cases theory does not

[12] http://www.hm-treasury.gov.uk/data_magentabook_index.htm

make definitive statements regarding the correct functional form. Taylor (2003) discusses this issue with regard to hedonic price functions.

Non-parametric and semi-parametric regression models offer an alternative regression approach (see Blundell and Duncan,1998; Yatchew, 1998). In this setting, the exact relationship between the dependent and explanatory variables can be left unspecified. These models have been used in both the hedonic and life satisfaction literature. For example, Layard et al. (2008) estimate the marginal utility of income non-parametrically using life satisfaction from a range of international surveys. Housing market revealed preference applications are also noted by Sheppard (1997).

iii) Measurement error

Measurement error in dependent variables typically results in larger error variances, but does not lead to inconsistent parameter estimates. Measurement errors in one or more of the explanatory variables (i.e., income and the non-market good of interest), on the other hand, is generally more serious as it potentially leads to biased and inconsistent parameter estimates for all the covariates.

In the life satisfaction approach, a natural concern is measurement error in (self-reported) income. Powdthavee (2009) estimates an life satisfaction regression using a sample for which accurate information on income was pertained by the interviewer through the presentation of actual payslips during the survey. This increased the size of the income coefficient. Hedonic price and wage studies have also identified sources of measurement error in non-market goods. Black et al (2003) in an analysis of the implicit price of risk, for example, note a number of likely reasons to suggest that their job-risk variables are mis-measured. Graves et al (1988) present tests of the effect of measurement error in non-market goods (air quality) as well as other covariates in the hedonic price function.

In travel cost applications a primary concern relates to the measurement of an individual's trip cost (see Annex A). Firstly, the estimation of the cost of time foregone is difficult. Freeman (2003, p.285) notes the recreation applications typically use one-third to the full wage, but that neither bound is 'on firm footing'. Secondly, difficulties arise with multiple purpose trips. Methods to get round this problem include checking how results change with alternative travel costs estimates (Carr and Mendelsohn, 2003) or dropping multiple purpose trips from the analysis.

iv) Some values cannot be picked up

Revealed preference methods derive valuations based on observed actions by individuals. Since the non-use value any individual attaches to a non-market good is unrelated to such actions, the methods only measure use-value. For example, an individual who values a cultural monument for its mere existence would not pay a housing premium associated with proximity to its location. Similarly non-use values may not be picked up using the life satisfaction approach because there may be no variation in individual level data for goods and services that are not used.

In addition, because both methods rely on the econometric analysis of existing and available data, they are also unable to value impacts of non-market goods that arise in the future (that have not yet been experienced). For example, if all lakes in a region have contaminated fish then anglers will not have been able to choose an uncontaminated one. Hence, anglers will have not had a chance to reveal their preferences over such a change in water quality (Boyle, 2003) and levels of their well-being with the change will also be unknown. However, pooled stated preference and revealed preference approaches have been attempted in order to overcome this issue (Adamowicz, Louviere, and Williams, 1994)

Related to this, the reliance on market data typically narrows the range or specificity of non-market goods that can be valued. Mostly obviously, the travel cost method is usually only easily applicable to the valuation of recreational sites. The valuation of specific non-fatal risks to health, such as insecticide inhalation, is unlikely to be possible with hedonic regression methods (see Viscusi,1993, p.1939).

Finally, in certain cases more than one revealed preference method may have to be used to estimate the total value of a good. For example, to value the cost of a river becoming polluted the travel cost method may be used to value to loss to those who use the river for recreation and the hedonic pricing method may be used to value the loss to individuals that own houses along the river (Boyle, 2003).

In sum, it is clear that both the revealed preference (for hedonic market studies) and the life satisfaction approaches will work best for policies with significant impacts on market prices (eg, the housing market) or life satisfaction. When this is not the case, stated preference may be the only viable method for valuation of the policy impact.

v) Partial values

People may be compensated for a non-market 'bad' in a number of ways (Stutzer and Frey, 2004). For example, people may be compensated for living in a polluted area with both lower house prices as well as shorter commutes to work. Here, in a hedonic housing price model, the coefficient on the pollution variable would not fully reflect the value that people place on marginal changes in pollution if such marginal changes also, for example, increase the demand to live in their area and consequently their commuting times. Similarly, in the life satisfaction approach when looking at the impact of pollution on life satisfaction, it should be noted that pollution will have an indirect effect on well-being through house prices and time spent commuting.

In such a case in the life satisfaction approach, for example, it would be necessary to also control for house prices and commuting times in the life satisfaction regression. Doing so would allow us to estimate the full (rather than partial) cost of pollution using these approaches.

4.3 Issues specific to each valuation approach

In addition to the issues discussed in section 4.2, which are relevant to the strength of all three valuation methods, there are also some advantages and disadvantages specific to each of the methods. Below we discuss the following issues:

Stated Preference Methods

- Wide application and specific valuations
- Allows one to explore the reasons behind preferences
- Ex-ante application
- Widely used and researched
- Relatively easy to describe and explain
- Hypothetical bias
- Protest valuations
- WTP-WTA disparity
- Costly
- Survey-related biases

Revealed Preference Methods

- Estimates based on real economic choices
- Cost-effective

- Market imperfections
- Measuring WTP for non-marginal changes
- Marshallian versus Hicksian demand

Life Satisfaction Approach

- Cost-effective
- Reasonably wide application
- Fewer survey-related biases
- No market structure assumptions
- Difficulties in estimating the marginal utility of income
- Difficulties in estimating the marginal utility of the non-market good

4.3.1 Stated Preference Methods

Advantages

i) Wide application and specific valuations

Stated preference methods can, in principle, be used to value any specific non-market good. Choice modelling methods can also be used to estimate the value of the attributes of a non-market good. This can be useful if different policy options differ in the attribute levels that they provide (Mourato et al, 2005).

ii) Allows one to explore the reasons behind preferences

Stated preference questionnaires can include questions relating to:

- the respondent's characteristics or attitudes toward the non-market good; and
- the reasons behind the respondent's choices or answers to the WTP/WTA questions.

Exploring the variation in responses is useful for identifying the winners and losers of an intervention. This is useful for stakeholder analysis (Bateman, 2002). It is also helpful that, through the development of a primary questionnaire, groups can be defined by characteristics which are typically unobserved on the conventional datasets used in revealed preference or life satisfaction studies.

Uncovering the reasons behind respondents' answers can also be helpful. For example, in hedonic pricing studies, it is often identified that house prices increase with the air quality in their neighbourhood (Smith and Huang, 1995). The exact reason for this correlation is often not clear. For example, it could be due to lower cleaning bills, the neighbourhood being more aesthetically pleasing, or due to the health damages associated with polluted air (Portney, 1981).

iii) Ex-ante application

The value of any specific policy or intervention can be estimated before it is actually implemented. Therefore stated preference methods can aid decision-making at an early stage of the policy cycle. Other valuation methods can be used ex-ante however they rely on an implicit assumption that the preferences revealed in the past do not change in the future.

iv) Widely used and researched

There have been a large number of applied contingent valuation studies. Carson et al (1995) present a bibliography of over 2000 studies from more than 40 countries and Carson (2004) presents a bibliography that exceeds 5000. In addition to application, the reliability and

credibility of the methods have been widely debated and tested (Arrow et al, 1993; Diamond and Hausman, 1994; Hanemann, 1994; Portney, 1994; Carson, 2001). Best-practice guidance manuals for conducting stated preference studies have also been produced (Carson and Mitchell, 1989; Bateman et al, 2002).[13]

The application of choice modelling methods is, however, relatively newer and a number of challenges have been identified (Hanley et al, 2001).

v) Relatively easy to describe and explain

The general methodological approach of contingent valuation and choice modelling studies is relatively easy to describe to policy-makers. It is arguably more difficult to explain how valuation estimates are derived through revealed preference and life satisfaction approaches.

Disadvantages

Even in cases where people may have stable, well-defined preferences there are some biases that may emerge in a stated preference survey.

i) Hypothetical bias

The hypothetical nature of the good in question and the payment mechanism can lead to inflated values in surveys. It is widely believed that individuals overstate their valuation of a good by a factor of two to three when comparing hypothetical versus actual payments for goods (Murphy et al., 2005). The reasons for hypothetical bias are not fully determined. One reason is attributed to **non-commitment bias;** respondents may overstate their true WTP because they do not face a budget constraint and do not consider substitute goods within the world of the hypothetical scenario. Including simple reminders of substitutes and real world constraints or the adoption of more formal techniques have been suggested as solutions (Kemp and Maxwell, 1993).

Another reason could be due to **strategic bias**: respondents in stated preference surveys may have an incentive to deliberately misrepresent their true preferences in order to achieve a more desirable outcome for themselves. An individual's incentive to behave strategically will be conditional on their beliefs of how their response will affect the price they pay and the provision of the good. For example, individuals may overstate their valuations of the good if they believe their responses influence its provision and are un-related to the price they will be charged for it. Individuals may understate if they believe that their response will not influence their desired outcome but will influence the price they are charged for it (Carson et al., 2001). Mitchell and Carson (1989) argue that true economic preferences are revealed when respondents believe that the non-market goods provision is contingent on their stated values and when they believe that they will have to pay the amount they state.

There is some evidence that the magnitude of hypothetical bias is greater for public goods than for private goods (Murphy et al., 2005). One increasingly popular method of dealing with hypothetical bias is to use a '*cheap talk*' script in which respondents are told about the bias and are essetinally asked to refrain from it (Hanley and Shrogen, 2002). Cheap talk can reduce WTP in hypothetical markets to levels similar to actual payments (Accent, 2010; Murphy et al., 2005).

[13] The National Oceanic and Atmospheric Administration (NOAA) appointed a panel of economic experts to consider the use of contingent valuation studies of non-use value in damage suits (Arrow et al., 1993). The panel's report discusses criticisms of contingent valuation and also presents a set of guidelines for how contingent valuation surveys should be applied (Arrow et al, 1993). These recommendations are summarised by Portney (1994). The panel concluded that contingent valuation studies can produce estimates reliable enough to be the starting point for a judicial or administrative determination of natural resource damages including lost non-use value.

See Blumenschein et al. (2008) for a review of the methods developed to tackle hypothetical bias in contingent valuation.

ii) Protest valuations

Respondents with a positive true WTP may put forward a zero stated valuation due to, for example, ethical objections to the idea of paying for the good under consideration. If such respondents are not identified through follow up questions, and their responses consequently excluded from the statistical analysis, then biased estimates of the value of the good will result.

Hanley and Shrogen (2005) suggest that protest values can be reduced by making WTA scenarios more acceptable by specifiying community-level compensation rather than individual compensation "if individuals are adverse to the idea of benefiting personally in money terms" (p.16).

iii) WTP-WTA disparity

All stated preference survey choices and questions can be presented in terms of WTP (to receive a good or prevent a loss) or in terms of WTA (to lose a good or incur a loss). In theory, WTA for most goods evaluated under Stated Preferences should exceed WTP by a few percentage points due to the fact that WTP is constrained by an individual's income (Sugden, 2005). Numerous papers have found, however, that stated WTP is often far below stated WTA for the same good (Shogren et al, 1994; Horowitz and McConnell, 2002). Sugden (2005) argues that the most credible explanations for this relate to the psychological arguments concerning loss aversion and its derivative; the endowment effect (Kahneman and Tversky, 1979; Loewenstein and Adler, 1995; Ariely, 2009).

Some authors argue that the appropriate formation depends on property rights (Carson et al, 2001). That is, if the respondent does not currently have the good and does not have a legal entitlement to it, the WTP formation should be used. On the other hand, if the consumer is being asked to give up a legal entitlement, the WTA formation is appropriate (Carson, 2000). Following this approach means therefore that legal property rights can have a substantial influence on the estimated welfare effects of interventions.

Other authors have argued that the WTP formulation should always be used (Arrow et al., 1993). One reason for this is that CV studies adopting a WTA formulation have often been unsuccessful due to an inability to convince respondents that they have the right to sell a non-market good (Mitchell and Carson, 1989). The WTP-WTA disparity may also be, to some extent, a product of informational constraints and inexperience. Bateman et al.'s (2009) virtual reality survey tool described above reduced the difference between WTP and WTA for environmental goods. List (2003) finds that experienced traders (in a number of different real markets) do not exhibit the endowment effect. The WTP-WTA disparity may be reduced by re-calibrating WTP values into WTA amounts (List and Shrogen, 2002).

iv) Costly

Stated preference studies can be both financially costly and time-consuming. They require focus group and interviews to determine respondents' understanding, and pre-tests (Carson 2000; Mitchell and Carson, 1989; Bateman et al, 2002). DTLR (2002), although noting that it is difficult to generalise, state that, "*it is unlikely that reliable research for a single sample study can be carried out for less than £25-£30,000 (excluding the field survey costs)*".

v) Survey-related biases

All stated preference methods rely on surveys in order to elicit valuations. As such, responses to valuation questions are likely to be influenced by what information is presented (Bergstrom et al, 1990; Whitehead and Bloomquist, 1990). The bias generated by non-neutrality in presentation is termed as **information bias**.

Face-to-face or telephone surveys also create the potential for **interviewer bias** if respondents deviate from their true preferences under influence exerted by the interviewer. Of course, this effect should be avoided with well trained interviewers (Carson, 2000).

Non-response bias occurs if individuals who feel strongly for or strongly against a good or issue are more likely to respond, which can lead to either an upward or downward bias.

There is also the potential for **fatigue** and **frustration** to set in, especially in iterative bidding formats. In this situation respondents make end up making little effort to provide accurate replies (Accent, 2010).

In general, findings from lab settings (stated preference surveys are essentially lab experiments) may not reflect behaviour and preferences in the real world (Levitt and List, 2007). Presence of an interviewer and choice-set restriction in the survey setting are likely to be important factors (Carlsson, 2010). In studies by Cook et al. (2007) and Whittington et al.(1992) respondents were given time to think as interviewers left surveys with respondents for one day before collecting responses. During the decision making process interviewers were therefore not present and respondents has time to think about their choice sets more largely and to discuss with friends and family which may replicate more closely actual decision making behaviour. In both studies (for environmental goods) they found that giving people longer time to think reduces people's WTP amounts.

4.3.2 Revealed Preference Methods

Advantages

i) Estimates based on real economic choices

The most notable advantage of the revealed preference approach is that valuation estimates are derived from real economic choices made by individuals in real markets. Revealed preference results are not based on verbal responses in hypothetical markets and are not derived with the use of self-reported life satisfaction variables. Crucially, however, the approach remains based on the fundamental assumption of individual rationality (Viscusi, 1993). As discussed above, this is problematic if people do not in fact have well-defined preferences over goods and cannot forecast changes in their utility due to the consumption of these goods.

ii) Cost-effective

Original surveys are not always used in hedonic pricing studies as suitable secondary data is often available. However, this is not always the case and some hedonic studies and all travel cost applications require some original data to be collected. This cost may be lower, however, than the cost of running stated preference surveys for there is less need to engage in such extensive pre-testing of the survey instrument.

Disadvantages

i) Market imperfections

The hedonic approach rests on the assumption that equilibrium exists in the perfectly competitive market through which valuations are revealed (Freeman, 2003). In housing market applications, this implies a number of criteria. Households must have full information on all house prices and house attributes; there must be zero transaction and moving costs; and market prices must instantly adjust to a new equilibrium after supply and demand change. There are analogous criteria for labour market hedonic wage studies.

However, imperfect information seems likely in a number of cases, including assessments of the probability of risks of injury or death in a job (Viscusi, 1993) and the environmental conditions in housing neighbourhoods (Poor et al, 2001). In addition, Greenwood et al. (1991) and Glaeser et al. (2005) argue that markets may be in disequilibria for some time.

ii) Measuring WTP for non-marginal changes

In the hedonic framework there are challenges associated with estimating the welfare effects of non-marginal changes in the level of a non-market good (Freeman, 2003; Viscusi, 1993; Taylor, 2003). Roughly speaking, a marginal change refers to a slight increase or decrease in a good from the status quo level. Therefore, the introduction of a new park or a policy that leads to signification improvement in air quality would represent non-marginal changes.

Second-stage analyses in the hedonic approach use the estimated implicit prices recovered in the first stage to estimate the entire demand (or marginal WTP) function for the non-market good. The estimated implicit prices represent the dependent variable and are regressed against the observed quantities of the non-market good and other exogenous demand shifters. The econometric challenges and data needs associated with this practice is outlined by Freeman (2003). Due to these complications, most applications stop after estimation of the hedonic wage or price function and assess the value of marginal changes in the nonmarket good or make strong assumptions regarding the form of the marginal WTP function in order to indicatively assess the welfare effects of non-marginal changes (Chay and Greenstone, 2005).

iii) Marshallian versus Hicksian demand

EV and CV are estimates of Hicksian surplus. Hicksian surplus is essentially derived from the substitution effect of a change in prices and is the theoretically appropriate measure for it captures the monetary compensation required to hold each individuals' utility constant. While some applications have made attempts to recover compensated measures, travel cost and hedonic methods typically estimate and report changes in Marshallian surplus. Marshallian surplus differs from Hicksian surplus in that it picks up the income effect as well. For this reason Marshallian surplus is usually smaller than Hicksian surplus (Freeman, 2003; Willig, 1979). However, in practice, income effects are likely to be small in non-market valuation settings.

4.3.3 The Life Satisfaction Approach

Advantages

i) Cost-effective

The life satisfaction approach is highly cost and time-effective.. Most panel datasets which include life satisfaction questions, such as the British Household Panel Survey (Understanding Society), are freely available online. The cost-effective argument would of course not hold if primary survey data collection is required.

ii) Reasonably wide application

There is a rich variety of variables concerning people's lives that national datasets contain. The large number of variables also means that there is scope for analysis of the main drivers behind the valuation results – demographic and geographic factors, for instance.

Given that the life satisfaction approach usually exploits large national datasets, sample sizes tend to be larger than those used in Revealed Preference studies and vastly greater than the sample sizes that are typical of Stated Preference studies. This allows the analyst to derive results for samples that are much more representative of the population in general.

iii) Fewer biases

As discussed above, in the life satisfaction approach well-being data are matched with objective measures of the determinants of well-being and for this reason it is near impossible for respondents to use strategic behaviour to influence analysis results. In addition, the possibility of non-commitment bias and of eliciting protest values is eradicated (Frey et al., 2004a).

iv) No market structure assumptions

A significant advantage over revealed preference approaches is that the life satisfaction approach does not need to make assumptions concerning equilibria in proxy markets. As noted above, however, any potential compensating mechanisms in markets (such as the housing market) must be held constant in the LS model in order to provide full, rather than partial, values of the non-market good. In addition, the approach avoids asymmetric information problems. For example, if there are adverse health affects associated with living in particular areas but people are unaware of the causal link, then their WTP for these effects will not be reflected in house price differentials (Freeman, 2003)

Disadvantages

The life satisfaction approach is relatively new. The number of applications is relatively small and research into understanding and refining the method is still ongoing. A number of studies have generated implausible valuations. For example, the Culture and Sport Evidence Programme (CASE) Technical Report on the value of engagement in culture and sport (2010) reported a life satisfaction valuation estimate for *going to the cinema once a week* of about £85 per visit[14]. While the likely reasons for this high estimate and solutions to correct for the sources of bias are discussed below, caution still must be exercised over the results generated by life satisfaction studies if they have not addressed the concerns discussed in this paper.

i) Difficulties in estimating the marginal utility of income

There are long-standing issues with the estimation of the marginal utility of income in the LS regression. A consistent finding is that the coefficient on income tends to be statistically significant but small, often resulting in implausibly high value estimates for non-market goods (Dolan et al., 2011b). For example, Clark and Oswald (2002) estimate the income compensation required for someone to move from employment to unemployment (i.e. the value of work) to be approximately £23,000 per month in addition to the loss of the wage income from work. Powdthavee (2008) derives large values for social involvement; he finds that life satisfaction is associated with greater frequency of interaction with friends, relatives, and neighbours, and derives a value of £85,000 per year for moving from 'seeing friends or relatives less than once a month' to 'seeing friends or relatives on most days'. Levinson (2009) and Luechinger (2009) both find that values from well-being are orders of magnitude greater than revealed and stated preference values for environmental goods.

[14] Assuming that people who report 'going to the cinema at least once a week' go to the cinema twice a week on average.

As already discussed in section 4.2.4 part of the reason for the high valuations is likely to be that income is often not instrumented. Using an instrumental variable for income tends to increase the income coefficient, thus reducing the income compensation values.

Relative income

There is a theoretical justification for the inclusion of relative income in the utility function to account for reference group effects (Duesenberry, 1949; Frank, 1997). There is empirical evidence that relativities in income matter to well-being (Blanchflower and Oswald, 2004; Easterlin, 1974; Easterlin, 1995, 2001a; Ferrer-i-Carbonell, 2005; Graham and Felton, 2006; Luttmer, 2005; McBride, 2001). Relative income effects can be controlled for by including a measure of the average income for the reference group as an additional explanatory variable. Controlling for relative income in the LS function tends to have the effect of *increasing* the impact (ie, coefficient) of income on LS (eg, Alpizar et al., 2005; Clark et al., 2008; Easterlin, 1995; Frank, 2005). This is because in essence the 'price' of status is held constant as other people's incomes do not change.

There is no consensus on whether relative income should be included when estimating income compensations. In theory Stated Preference techniques implicitly hold others' income constant as people are asked to think about their own finances only. This could be seen as an argument for including relative income in the LS function and this is likely to reduce the levels of income compensation required for non-market goods. However, including relative income in the LS function is not an easy task as assumptions need to be made in the empirical analysis as to what group is used as the reference group (Pischke, 2010). For example is the appropriate reference the incomes of work colleagues, wage levels in the region or GDP per capita? The effect on the income coefficient will vary depending on the reference group used (Dolan and Peasgood, 2006).

Indirect effects of income

As well as affecting our utility directly (for example, the pleasure of having more money in the bank), income affects utility indirectly through the goods and services it allows individuals to purchase (Dolan et al., 2011b; Dolan and Peasgood, 2006). Income may have a positive effect on a number of variables that are held constant in the life satisfaction regression, such as health, social relationships, marital status and place of residence. Controlling for these effects therefore subdues the impact of income on well-being and inflates the monetary values derived (Dolan et al., 2011b). In Stated Preference surveys people are often urged to think about the value of money when stating a WTP figure. In other words, they should consider the opportunity costs or everything else they could do with the money, and so in line with the above argument, in theory, people are asked to think about how income impacts on their health, relationships and place of residence.

The indirect effects of income have generally been ignored by the LS approach literature. One exception is Ferrer-i-Carbonell and van Praag (2002), who model the impacts of income on life satisfaction through its effects on a set of domain satisfactions, including leisure, housing and job satisfaction. A problem with this approach is that the final LS function does not include controls for many of the explanatory variables that have been shown to impact on SWB, such as age and marital status, thus biasing the model. We discuss some solutions to this problem below.

Counter-effects of income

When calculating EV or CV we essentially consider exogenous changes in income required to hold utility constant. For example, if we are interested in estimating the level of compensation that would be required to return people to their original levels of utility after the loss of a good or service (ie, the compensating variation) this compensation is essentially an exogenous increase in income for those affected. However, the income variable used in the life satisfaction function is usually a measure of household income, which is in large part derived from labour income.

Earned labour income incurs costs to the individual, such as loss of leisure time, and thus does not have the required exogenous interpretation.

In the life satisfaction approach it is important to hold constant the determinants of income (Frey and Stutzer, 2004). This would include, for example, time spent commuting and hours at work (in order to earn income people must forego valuable leisure time commuting and at work). If these factors are not held constant the income coefficient will be understated for the purposes of estimating monetary values. Holding constant commuting time and hours at work, should increase the income coefficient and result in a reduction in the values attributed to non-market goods.

ii) Difficulties in estimating the marginal utility of the non-market good

Indirect effects

Welsch (2007, 2008a, 2008b) and Welsch and Kuhling (2009) recognise that the good being valued may also have indirect effects on well-being through some of the other control variables. For example, being employed could impact positively on well-being indirectly through improved health and so if health status is included in the life satisfaction model (as it should be) the impact of employment on well-being is understated.

The issue of indirect effects shares close empirical similarity with the issue of partial values discussed in section 4.2.4. We distinguish between the two issues. The partial values issue refers to changes in realisations on other variables in the life satisfaction regression that emerge because of changes that take place in the economy in response to changes in a non-market good.

Multiple values

On some occasions the value estimate for the good may pick up other unrelated values if in the act of consuming the good, the individual consumes other complementary goods. The valuation estimate for a trip to the cinema reported above (£85) for example, may be picking up additional irrelevant values such as the utility derived from the consumption of popcorn and drinks and from any travel to and from the cinema. Other issues with this study include income not being instrumented and the indirect and counter effects of income not being properly acknowledged. Correcting for all of these factors would considerably reduce the estimated cinema trip value.

Ideally consumption of such complementary goods should be controlled for in the life satisfaction regression, but the data usually do not contain enough detail. As a second best option the price of goods consumed in complement with the good being valued can be subtracted from the overall value estimate. Therefore in the current example a better estimate of the value of a cinema visit can be obtained by subtracting the average expenditure on popcorn and drinks per cinema visit (eg, £4) and the average travel cost to and from cinemas (eg, £3). The problem with this approach is that economic theory suggests that this price will be an underestimate of the utility derived from consumption of these complements.

4.4 Conclusions

This chapter has discussed the strengths and weaknesses, both principled and pragmatic, of the stated and revealed preference and life satisfaction valuation approaches. Arguably the main appeal of the life satisfaction method relates to the fact that it does not rely on people having well-defined pre-existing rational preferences. We presented empirical findings from a number of experimental and contingent valuation studies in different settings that raise doubts as to whether preference-based approaches are measuring the theoretical constructs that they intend to measure. The life satisfaction approach does not require individuals to predict their future utility and values of goods will not be anchored by irrelevant cues or affected by a focusing

illusion. Instead, respondents are simply asked to provide a subjective assessment of their overall well-being which is then matched with objective measures of the determinants of well-being and their exposure to the non-market good. Using panel data we can track the effects of a non-market good over time and therefore fully estimate the degree of adaptation. Furthermore, people are not required to have perfect information about the good being valued and there is no (hypothetical) payment involved and so this solves for the problems related to the payment vehicle in stated preference techniques.

If variables are measured accurately, increased consumption of a non-market good or service should show up in changes in well-being and thus values, therefore reducing the risk of insensitivity to scope. Although it has not been tested empirically, sub-additivity and sequencing effects should also logically disappear. The resulting value estimate will be calculated on the basis of how people are actually affected by the good over time.

Finally, since the analyst in effect calculates the marginal rates of substitution between income and the non-market good there is no potential for errors to occur due to people's inability to convert subjective feelings and beliefs into a monetary scale.

On the other hand, we have highlighted that contextual factors can have large effects on people's reported well-being and there may be biases inherent to the way that people report their well-being to the surveyor. This means that reported measures of well-being may be pick up highly irrelevant factors which would bias any estimated statistical relationship between life satisfaction and the variable of interest, say income or employment.

The life satisfaction approach typically involves conducting econometric analysis in order to estimate the true causal effect of both income and the non-market good of interest on reported life satisfaction. For a number of reasons outlined above this is extremely challenging and often requires rich data sets and careful econometric analysis. Many of the valuations which have been generated so far are implausibly high. Most of the reasons for this are likely to have been addressed in this chapter. The approach is still very much in development in the academic literature.

The robustness of a valuation generated by a given study using any of the three valuation methods, and therefore the appropriateness of including it in Social Cost-Benefit Analysis, should always be assessed on a case-by-case basis. However, given the relative infancy of approaches that utilise reports of life satisfaction to derive valuations, we suggest relatively more caution be exercised regarding this method. Instead, we recommend that the life satisfaction approach to valuation be currently regarded as a *complement* to the more standard preference-based approaches, especially where good data on life satisfaction are available.

Nevertheless, even when the valuations derived from a specific life satisfaction study cannot be considered robust enough for Social Cost-Benefit Analysis due to the reasons outlined here, the valuations and their description can still be of value. It is likely that the study may still be able to indicate the approximate magnitude of an impact thereby allowing decision makers to refine the values that they may otherwise place implicitly on these impacts.

National Audit Office

Report
by the Comptroller
and Auditor General

Department for Transport and Highways England

Improving the A303 between Amesbury and Berwick Down

HC 2104 SESSION 2017–2019 20 MAY 2019

Scope of the report

6 This report follows on from our 2017 report, *Progress with the Road Investment Strategy*. It makes early observations on the progress and risks of constructing a tunnel through the World Heritage Site at Stonehenge, including:

- the background to the Amesbury to Berwick Down project (Part One);
- the case for the project (Part Two);
- progress on the project (Part Three).

The report does not look at other routes in the South West. Given the project is at an early stage, we do not seek to conclude on value for money. Instead, we highlight factors that will be relevant in the future to the overall value for money of the tunnel at Stonehenge and wider investment along the road corridor.

Key findings

7 **There is a good strategic reason for the Amesbury to Berwick Down project.** It aims to improve the speed and reliability of journey times on the section of road between Amesbury and Berwick Down, which suffers from high levels of seasonal congestion. It also aims to protect and improve the World Heritage Site by removing most of the road from the site. By upgrading this section of the A303, the Department and Highways England intend to remove a key constraint that has prevented them upgrading the A303/A358 corridor and unlocking growth in the South West (paragraphs 1.4 to 1.6, 1.8 to 1.10).

8 **Previous attempts to construct a tunnel at Stonehenge have been cancelled due to escalating costs and disagreements between stakeholders.** Disagreements included the length of tunnel and the design of the project. For the current project, Highways England and the Department have gained agreement from the National Trust, English Heritage, Wiltshire Council and Historic England on a solution. Together they have agreed a minimum acceptable tunnel length that ensures an appropriate position for the tunnel entrances and road layout in order to protect the Outstanding Universal Value of the World Heritage Site. Highways England and the Department rejected longer and more expensive options as unaffordable. However, other bodies, including the UNESCO World Heritage Committee, have voiced concerns about the current proposed project (paragraphs 1.11, 1.12, 1.17 and 3.12 to 3.14).

9 **The economic case relies on heritage benefits that are uncertain.** The high cost of building a tunnel, compared with widening or moving the road, means that under the standard method for appraising transport projects, the project would only deliver 31p of benefit for every £1 spent. Highways England therefore expanded its appraisal to include a monetary value for cultural heritage, to reflect the project's wider objectives. At £955 million (2010 prices and discounted) these make up 73% of total monetised benefits. With these included, Highways England expects the project to deliver £1.15 of benefit for every £1 spent, which the Department considers low value for money. While Highways England used approved methodologies to do this, calculating benefits in this way is inherently uncertain and the Department advises decision-makers to treat them cautiously (paragraphs 2.5 to 2.7).

80034-R0013-01: Modified extract from Defra website indicating monuments, boundaries and access South of A303.

Additional information related to Representation 20020712

Showing paths through private land, the open access "Stonehenge Landscape" (small triangle of land south of Stonehenge), NT ownership and the "World Heritage Site".

Approx extent of World Heritage site south of A303

Approx extent of National Trust land south of A303

ACCESS LAND (England and Wales)

Access information point

Access land

Access land in wooded area

within sand

Coastal margin

Access land portrayed on this map is intended as a guide to land normally available for access on foot, for example access land created under the Countryside and Rights of Way Act 2000, and land managed by National Trust, Forestry Commission, Woodland Trust and Natural Resources Wales. Some restrictions will apply; some land shown as access land may not have open access rights; always refer to local signage.

The depiction of rights of access does not imply or express any warranty as to its accuracy or completeness. Observe local signs and follow the Countryside Code. Visit: **gov.uk/government/publications/the-countryside-code**

All land within the 'coastal margin' (where it already exists) is associated with the England Coast Path (**nationaltrail.co.uk/england-coast-path**) and is by default access land, but in some areas it contains land not subject to access rights – for example cropped land, buildings and their curtilage, gardens and land subject to local restrictions including many areas of saltmarsh and flat that are not suitable for public access. The coastal margin is often steep, unstable and not readily accessible. Please take careful note of conditions and local signage on the ground.

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