

# A428 Black Cat to Caxton Gibbet improvements

TR010044

Volume 9

9.115 Economic Sensitivity Test (November 2021 TAG Update)

Planning Act 2008

Rule 8(1)(k)

Infrastructure Planning (Examination Procedure) Rules  
2010

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**The Infrastructure Planning (Examination Procedure)  
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**A428 Black Cat to Caxton Gibbet  
improvements  
Development Consent Order 202[ ]**

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**9.115 Economic Sensitivity Test (November 2021 TAG Update)**

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# 1 Introduction

- 1.1.1 Since the completion of the economic assessment of the A428 Black Cat to Caxton Gibbet improvements (the Scheme) which was reported in the Combined Modelling and Appraisal Report<sup>1</sup> [APP-250], there have been a number of updates to the economic forecast data that determine the Benefit to Cost Ratio (BCR) of the Scheme. Some significant changes were initially released in July 2020 when the Department for Transport (DfT) published 'A route map for updating Transport Analysis Guidance (TAG) during uncertain times' (referred to for simplicity as the DfT route map). This sets out how the appraisal framework should adapt and take account of future trends in relation to the evidence base or methods used within TAG.
- 1.1.2 The route map identified two changes introduced by the DfT in July 2020, these were:
- Interim carbon values advice provided by the Department for Business, Energy and Industrial Strategy (BEIS).
  - The latest Office for Budget Responsibility (OBR) long-term economic growth forecasts.
- 1.1.3 The forecasts and economic appraisal for the Scheme, reported in [APP-250], were completed in mid-2020 prior to publication of the DfT route map. These forecasts therefore pre-date the revised economic growth projections. However, a sensitivity test using the interim carbon values, as recommended in the DfT route map, was subsequently undertaken. This resulted in a reduction of the adjusted BCR from 1.9 to 1.8 and is reported in Table 5-21 of [APP-250].
- 1.1.4 An assessment of the Scheme based on the July 2020 Sensitivity Test TAG Data Book was undertaken in summer 2021 and detailed in Economic Sensitivity Test Technical Note - Rev 1 [REP1-027] submitted to the DCO at Deadline 1. However, since that submission there have been further updates to economic parameters (November 2021) and, of more significance, changes made to how future carbon emissions are calculated.

## Purpose of Document

- 1.1.5 The purpose of this document is to describe and present the results of a sensitivity test adopting the November 2021 Transport Analysis Guidance (TAG) Data Book (v1.17)<sup>2</sup> economic parameters that effectively supersedes the July 2020 values as reported in [REP1-027]. The process of calculating carbon emission costs has also been updated with the use of Emissions Factors Toolkit version 11 (EFT11) and the corresponding DMRB workbook. For calculating Wider Economic Impacts, the version of Wider Impacts in Transport Appraisal

<sup>1</sup> [https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000418-TR010044\\_A428\\_Black\\_Cat\\_to\\_Caxton\\_Gibbet\\_Improvements\\_7-10\\_Combined\\_Modelling\\_and\\_Appraisal\\_Report\\_Appendix\\_D.pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010044/TR010044-000418-TR010044_A428_Black_Cat_to_Caxton_Gibbet_Improvements_7-10_Combined_Modelling_and_Appraisal_Report_Appendix_D.pdf)

<sup>2</sup>

(WITA) software used was 2.0 as there was insufficient time to meet the Deadline 9 to update to version 2.2, which is consistent with the latest TAG guidance, although the economic growth parameters used were consistent with version 2.2 that ensures the assessment is in line with the latest TAG Data Book values.

- 1.1.6 The assessment has been undertaken using the A428 strategic traffic model, upon which the traffic forecasts and economic appraisal for the application for development consent was based. This traffic model was based upon the May 2019 version of the TAG Data Book, which was current at the time of the completion of the traffic forecasts in late 2019.
- 1.1.7 For the development consent application, the Scheme traffic forecasts were produced for a 2025 opening year, 2040 design year and 2051 horizon year. These three modelled years were used for the economic assessment that is detailed in the Economic Assessment Report (EAR), which forms Appendix D of the Combined Modelling and Appraisal Report [APP-254].
- 1.1.8 **Table 1-1** summarises the Scheme benefits as presented in Table ES-1 of the EAR Executive Summary. Over 90% of the Scheme benefits are attributable to just two elements: the transport economic efficiency (TEE) benefits that include time savings account for over 60% of total Scheme benefits and wider economic impacts which account for another 30% of overall benefits.

**Table 1-1 : Transport related benefits summary reported in EAR – May 2019 TAG Data Book**

Benefit Component	Amount £M*
TEE Benefits (including construction)	554
Indirect Tax Revenue	84
Accident Benefits	30
Carbon Benefits (Greenhouse Gas)	-127
Monetised Noise Benefits	2
Monetised Air Quality Benefits	-1
<b>Initial Present Value of Benefits (PVB)</b>	<b>541</b>
Wider Economic Impacts	259
Journey Time Reliability Benefits	83
<b>Adjusted PVB</b>	<b>883</b>
<b>Present Value of Costs (PVC)</b>	<b>463</b>
<b>Adjusted Benefit to Cost Ratio (BCR)</b>	<b>1.91</b>

\*2010 prices and values discounted to 2010, rounded to nearest million.

Figures in red indicate values that have been updated.

- 1.1.9 Another significant component that informs the economic benefit of the Scheme is carbon emissions. These are negative as the process used to calculate emissions forecast that the Scheme would result in additional carbon emissions over the 60 year appraisal period.
- 1.1.10 The results presented in Table 1 above were based upon forecasts of emissions that were calculated using version 9 of the Emissions Factor Toolkit (EFT). There were limitations in this version of the EFT as forecast changes in the vehicle fleet fuel use were only provided up to 2030. It therefore did not allow for the expected further electrification of the road vehicle fleet post 2030. The latest version 11 of the EFT released in November 2021 includes forecast changes to the vehicle fleet up to 2050 that assumed a higher take-up of electric vehicles, and this version 11 has been used in updating the operational carbon costs.
- 1.1.11 The TEE benefit total also accounts for £35M of dis-benefits incurred during construction of the Scheme due to extended journey times. As this forms a relatively small proportion of the TEE total, the construction delay dis-benefits have not been re-calculated using the November 2021 parameters. The impact of the November 2021 changes compared to the May 2019 Data Book would also be relatively limited as construction delays are based on the 2025 models and the changes in this year are relatively small with dis-benefits expected to reduce by less than 1%.
- 1.1.12 Therefore, this note reviews the impacts of the updated economic and carbon emissions forecasts on the operational TEE benefits, carbon costs and wider economic impacts.

### **Assumptions**

- 1.1.13 The Scheme costs reported in this technical note are the same as those presented in **[APP-250]** and **[APP-254]**.
- 1.1.14 It should also be noted that assumptions are consistent with what was prepared for the DCO and reported in **[APP-250]** including the 2018 uncertainty log and assumption on the opening year (2025).

## 2 DfT Route Map and Data Book Updates

- 2.1.1 In July 2020 the DfT released version 1.14 of the TAG Data Book, which was classified as a 'sensitivity testing' Data Book and was released to coincide with publication of the DfT route map. The 'sensitivity testing' Data Book was produced in response to a downgrade of the forecast long term growth of the UK economy, following projections released by the OBR in March 2020. This was followed in July 2020 by the release of the OBR Fiscal Sustainability Report, which was produced after the outbreak of COVID-19 and the subsequent impacts on expected growth. The result was that growth projections were further downgraded, and the overall changes were of a magnitude significantly greater than previous changes to economic forecasts.
- 2.1.2 In July 2021 the DfT released version 1.15 of the Data Book in which the July 2020 'sensitivity test' forecasts had become the standard forecasts albeit with changes to GDP growth in the short-term and post-2070 forecasts compared to those in July 2020. There was also a change to the way values of time were updated following the GDP per capita annual change to a fixed annual increase of 1.5% from the year of appraisal. This resulted in small increases in values of time compared to the July 2020 Data Book although the differences increased over the 60 year appraisal period.
- 2.1.3 The latest update to the Data Book occurred in November 2021 in which the major change was a significant uplift in the cost of carbon. This also coincided with a change to how carbon emissions were calculated with the release of EFT version 11 and the corresponding DMRB workbook to calculate carbon emissions based on speed banding.
- 2.1.4 Within **[REP1-027]** it was demonstrated that the impacts of re-running the variable demand model (VDM) with the July 2020 sensitivity test updated forecasts of values of time and vehicle operating costs had minimal impacts on traffic assignment and the TEE benefits. This showed an overall difference of just 0.3% compared to not re-running the VDM. Therefore, for the purposes of assessing the latest Data Book updates, an appraisal only assessment has been undertaken.
- 2.1.5 For the purposes of this assessment, only the core growth scenario of the traffic forecasts has been reviewed, as the impacts on the low and high growth scenarios would be expected to be proportionally similar, given only economic inputs are being changed.

### 3 TAG Data Book Comparisons

- 3.1.1 The differences between the May 2019 (adopted for the forecasts and economic appraisal described in the Combined Modelling and Appraisal Report (APP-250)) and November 2021 Data Books were significant. In terms of impacts on Scheme economics, the most significant was the reduction in forecast Gross Domestic Product (GDP) growth, and the subsequent change to real growth in traveller’s value of time (VoT). Another significant difference was the forecast changes in population and households, with the growth in these also expected to be significantly lower.
- 3.1.2 The lower population growth forecast in the November 2021 Data Book compared to the May 2019 Data Book is presented in **Table 3-1**. This demonstrates that population growth in the latter years of the assessment period is now forecast to be significantly lower than the May 2019 forecast. The change in population and household growth will be reflected in the next release of the National Trip End Model (NTEM), but as this is not yet available, the impacts of these changes in respect of the projections in forecast growth, cannot be assessed.

**Table 3-1 : Population Growth Comparison – May 2019 and November 2021 Data Books**

Year	May 2019 Data Book (2015 = 100)	Nov 2021 Data Book (2015 =100)
2025	105.8	104.6
2040	111.6	107.8
2051	115.0	109.2
2084	123.0	110.1

- 3.1.3 The change in GDP growth rates is quite significant, reducing from a long term annual growth rate of around 2% to around 1.5%. This reduction is also reflected in the VoT growth although this is now set at 1.5% for all forecast years. The difference in the VoT growth between the May 2019 and November 2021 forecasts is presented in **Table 3-2**, with the 2015 values equivalent to 100. This clearly demonstrates how the long-term reduction has a more significant impact in later years.



**Table 3-2 : Value of Time Growth Comparison – May 2019 and November 2021 Data Books**

Year	May 2019 Data Book (2015 = 100)	Nov 2021 Data Book (2015 =100)
2025	110.9	110.6
2040	146.2	138.2
2051	180.2	162.8
2084	353.6	266.1

- 3.1.4 Between the May 2019 and November 2021 Data Books there are also changes that have an impact on vehicle operating cost (VOC) outcomes. These are changes in respect of historic and forecast vehicle kilometre (vkm) splits, fleet fuel efficiency growth projections and base year electric vehicle consumption. These reflect recently implemented European Union (EU) legislation on tailpipe emissions, and updated input data on diesel sales, ultra-low emission vehicles (ULEV) take-up and new vehicle fuel efficiency. The latest forecast also included real fuel cost changes from 2031 to 2035. However, these VOC changes are much less significant in terms of economic benefits than the changes to the VoT.

## 4 TUBA Assessment

- 4.1.1 The TUBA assessment utilised the existing traffic forecasts (i.e. the forecasts adopted for the DCO assessment as reported in [APP-250]) within the November 2021 version of the transport users benefit appraisal (TUBA) software (version 1.9.17, that incorporates the latest Data Book parameters). A change that has been introduced in latest guidance is that VoT future growth is now set at a constant 1.5% per annum and not the increase in GDP per capita which, on average, is marginally lower.
- 4.1.2 **Table 4-1** compares the November 2021 based benefits with those using the May 2019 and July 2020 Sensitivity Test Data Books. These outputs are “masked” in the same way as detailed in section 2.5.6 of the Appendix D to the Combined Modelling and Appraisal Report; Economic Appraisal Report [APP-254]. The masking was carried out to exclude sector to sector benefits and dis-benefits that were considered unrepresentative of the Scheme’s impacts.
- 4.1.3 **Table 4-1** shows that total operational TEE benefits reduce by 15.1% from £589M to £500M between the May 2019 and November 2021 versions. The reduction in time benefits is the primary cause of this reduction, given that VOC dis-benefits reduce slightly. The reduction of 12.7% in time benefits over the 60 year assessment period is consistent with the VoT reductions presented in **Table 3-2**.
- 4.1.4 Also shown in **Table 4-1** is the change from the July 2020 Sensitivity Test (ST) outcomes to those based on the November 2021 Data Book. The latter TEE outcomes are around £23M (4.8%) higher mostly due to higher forecast VoT growth with the change to a fixed 1.5% per annum growth rate.

**Table 4-1 : Comparison of TEE outcomes (£000's)**

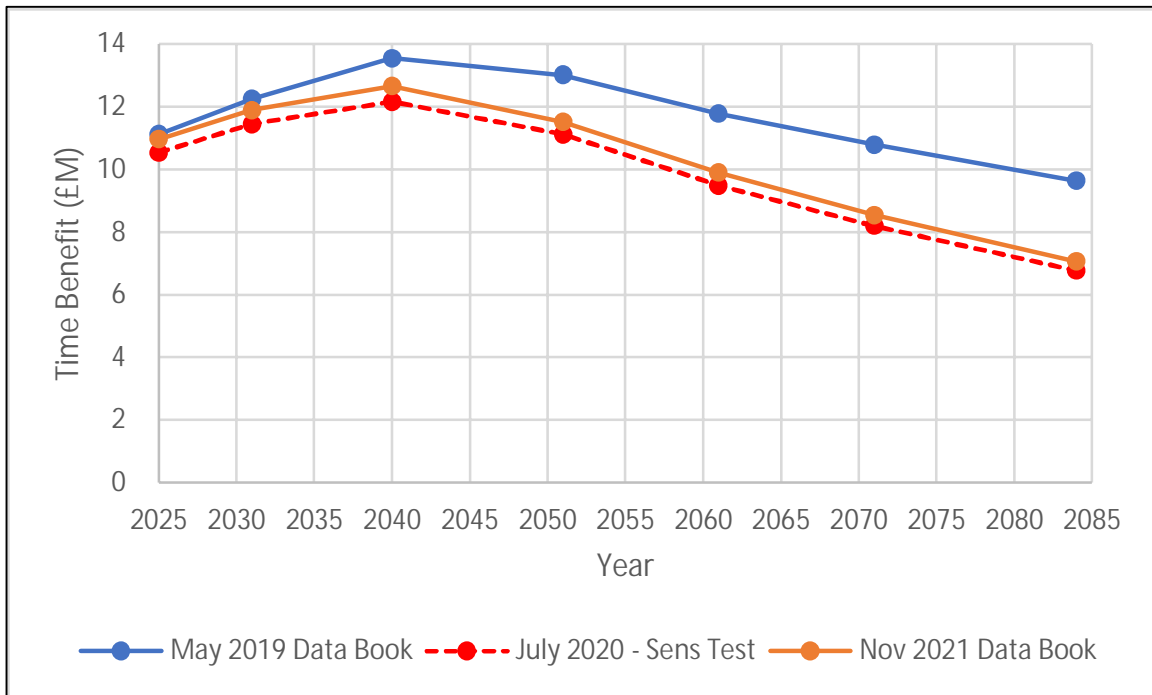
	Time Benefit	Fuel VOC Benefit	Non-fuel VOC Benefit	Total VOC	Total TEE
May 2019 Data Book	711,670	-7,308	-115,797	-123,105	588,566
July 2020 Sensitivity Test (ST) Data Book	599,356	-5,837	-116,881	-122,718	476,638
<b>Nov 2021 Data Book</b>	<b>621,245</b>	<b>-5,556</b>	<b>-116,173</b>	<b>-121,728</b>	<b>499,517</b>
Change from May 2019 to Nov 2021	<b>-90,425</b>	<b>1,752</b>	<b>-376</b>	<b>1,376</b>	<b>-89,049</b>
Proportional Change from May 2019	<b>-12.7%</b>	24.0%	-0.3%	1.1%	-15.1%
Change from July ST 2020 to Nov 2021	<b>21,889</b>	<b>281</b>	<b>708</b>	<b>990</b>	<b>22,879</b>
Proportional Change from July 2020 ST	<b>3.7%</b>	4.8%	0.6%	<b>0.8%</b>	<b>4.8%</b>

4.1.5 Given that the majority of the change in benefits is due to changes in the VoT, **Table 4-2** presents a comparison of time benefits for specific years, over the 60 year assessment period, at around 10 year intervals.

4.1.6 This clearly demonstrates that the reduction in time benefits increases over time in line with the reduction in VoT over this period. In 2025 the reduction is only 1.4%, by 2051 this increases to 11.6% and by 2084 the reduction is 26.7%. This is also demonstrated in **Figure 4-1** which compares the time benefits and shows the values diverging over time. It also includes the outcome of using the July 2020 Sensitivity Test Data Book reported in **[REP1-027]** which shows that the latest benefits have not reduced to the same degree, although they show a similar pattern post 2040.

**Table 4-2 : Comparison of Time Benefits by Year (£000's) – May 2019 and November 2021 Data Books**

	2025	2031	2040	2051	2061	2071	2084
May 2019 Data Book	11,121	12,242	13,544	13,014	11,777	10,789	9,631
Nov 2021 Data Book	10,965	11,883	12,650	11,510	9,892	8,542	7,059
Actual Difference from May 2019	<b>-157</b>	<b>-359</b>	<b>-894</b>	<b>-1,504</b>	<b>-1,885</b>	<b>-2,247</b>	<b>-2,572</b>
Proportional Difference	<b>-1.4%</b>	<b>-2.9%</b>	<b>-6.6%</b>	<b>-11.6%</b>	<b>-16.0%</b>	<b>-20.8%</b>	<b>-26.7%</b>

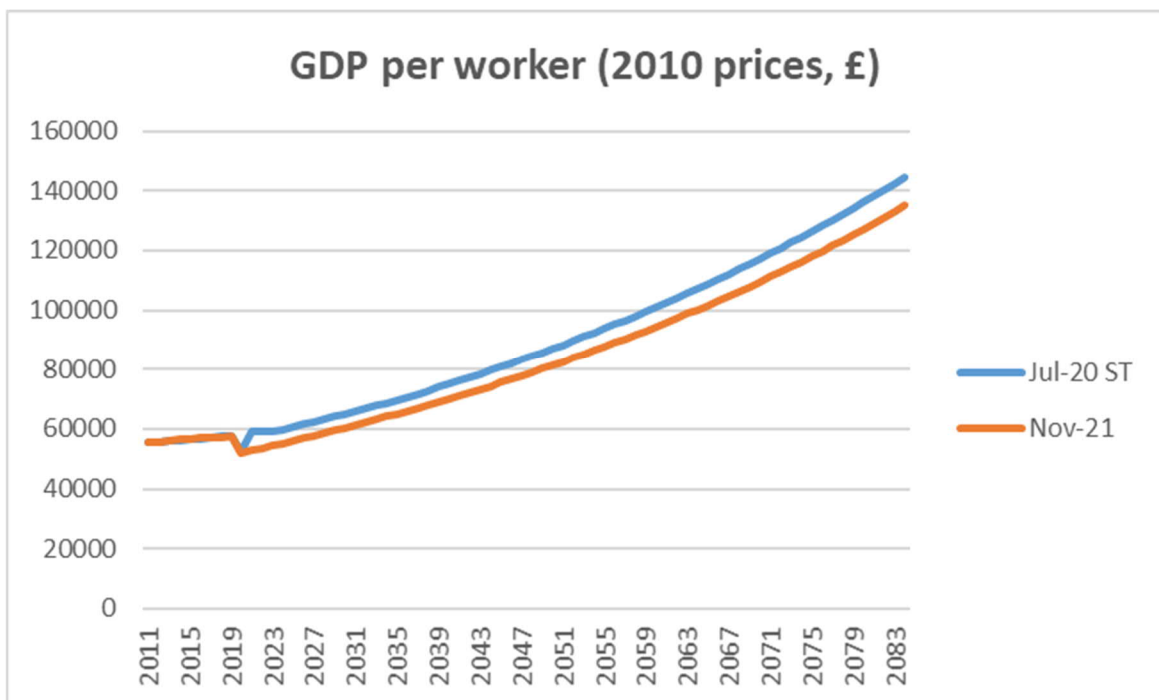


**Figure 4-1 : Comparison of TEE Time Benefits by Year**

## 5 Wider Economic Impacts

- 5.1.1 The other major component of Scheme benefits is wider economic impacts which based upon the results presented in **[APP-250]**, account for about 30% of overall benefits. These benefits are calculated using the WITA program.
- 5.1.2 **[REP1-027]** reported on the impacts of the July 2020 Sensitivity Test changes on WITA outcomes. For that test the following changes of significance applied to the WITA inputs compared to the May 2019 based assessment:
- Local GDP per Worker – By 2051 this was 14% less overall and by 2081 24% lower.
  - Total Employment/Employment by Sector – By 2051 there was no difference in the forecasts but by 2081 there was a 7% reduction.
  - National GDP per Worker – From 2030 onwards there were reductions in growth of between 0.4% and 0.6% per annum.
- 5.1.3 One notable point from the above changes, is that up to 2051, there is no change in forecast employment, even though population growth is lower.
- 5.1.4 Since July 2020 there have been further updates to WITA. The major update occurred in July/Aug 2021 with the release of WITA version 2.2. That incorporated reduced economic growth similar to the July 2020 Sensitivity Test but it also resulted in some changes to the methodology, these being:
- Significant update to the calculation of agglomeration benefits – these benefits are now calculated using the forecast growth in average GDP per worker for each Local Authority District and Industry Sector applied to the specified base year Local Authority District GDP per worker values by Industry Sector (rather than applying the national average growth in GDP per worker across all Local Authority Districts and Industry Sectors). The WITA v2.2 release notes state the following with respect to this update:  
*“It is expected that the switch to forecast LADs-based GDP per worker, rather than the forecast national averages previously used, may significantly change estimated wider impacts. The scale of change in wider impacts will be scheme specific.”*
  - Update to the specification of the total employment – previous releases permitted the total employment values to be omitted by the user from the Employment Data File. In these instances, the total employment (i.e. sector 0) was then assumed to be the sum of the values for each defined industry sector (i.e. sectors 1 to 4) but this will understate the total employment. The Wider Impacts (WI) datasets provide separate values for total employment and industry sector components, and both must now be provided. If the total employment values are omitted, the software will generate a fatal error. The WITA v2.2 release notes state the following with respect to this update:  
*“It is expected that if the user has not previously explicitly defined total employment values, there will be a change in the estimated wider impacts, with the scale of change being scheme specific.”*

- 5.1.5 Another change of significance is that version 2.2 uses a different GIS dataset for Local Authority Districts (LAD), changing from a 2011 dataset to the ONS 2017 'InFuse' Local Authorities dataset.
- 5.1.6 As the change to LAD boundaries would require the WITA input data to be modified which would require additional time, for the purposes of this update WITA version 2.0 has been used although with updated economic inputs in line with the November 2021 TAG Data Book.
- 5.1.7 As WITA version 2.0 does not recognise the use of two sets of GDP growth rates that are now used in TUBA, it was necessary to modify the respective economics input file to combine the 'historic' and 'future' annual growth rates and change the 'current year' from 2019 to 2022.
- 5.1.8 WITA also requires a 'Global Data' file that contains economic data regarding GDP per worker (GDPw). This has also been updated as part of the WITA version 2.2 release, including a change to historic data back to 2010.
- 5.1.9 However, the main change is in terms of GDPw growth from 2021 onwards. This is now set at 1.5% per annum whereas in the July 2020 Sensitivity Test version, the forecast growth for 2021 was significantly higher (13%). **Figure 5-1** shows that both forecasts have a large reduction in growth (of around 9%) in 2020 reflecting the reduction due to COVID-19. It is noted that the latest forecast does not include a rebound in 2021.



**Figure 5-1 : Comparison of Forecast Growth of GDP per Worker**

- 5.1.10 As TUBA allows for the impacts of COVID it seems counter intuitive that the WITA GDPw does not follow a similar pattern. This issue has been queried with the WITA team at Atkins, who maintain the WITA software on behalf of the DfT to which a response is currently awaited.

## WITA Results reported in the EAR

- 5.1.11 The WITA outputs reported in sections 4.8.3 to 4.8.8 of Appendix D to the Combined Modelling and Appraisal Report (Economic Appraisal Report [APP-254]) are based on version 2.0 of the WITA program and a summary of the outputs are presented in **Table 5-1**. These are the benefits attributable to the six local authority areas local to the Scheme, these being:
- a. Huntingdonshire.
  - b. South Cambridgeshire.
  - c. Bedford.
  - d. Cambridge.
  - e. Central Bedfordshire.
  - f. Milton Keynes.

**Table 5-1 : WITA Results reported in the DCO EAR – based on May 2019 Data Book**

Category	2010 Prices discounted to 2010 (£000s)
Agglomeration - Manufacturing	8,592
Agglomeration – Construction	11,269
Agglomeration - Consumer Services	47,622
Agglomeration - Producer Services	162,973
<b>Agglomeration – Total</b>	<b>230,456</b>
Increased output in imperfectly competitive markets	26,257
Labour supply impact	1,960
<b>Total</b>	<b>258,673</b>

- 5.1.12 The majority of the wider economic benefits were due to agglomeration which accounts for 89% of the total, with most of the remainder accounted for by the benefits in increased output, which is based on 10% of the TUBA TEE business benefits.
- 5.1.13 Of the agglomeration benefits, around 70% were attributable to producer services and 20% attributable to consumer services, with manufacturing and construction attributable for the remaining 10%.

5.1.14 The breakdown of agglomeration benefits by the six local authorities is shown in **Table 5-2**. South Cambridgeshire and Huntingdonshire accounted for the two highest proportions at just under 30% each. Bedford and Cambridge accounted for a third of benefits between them, whilst Central Bedfordshire and Milton Keynes combined accounted for 10%. These proportions are considered credible when taking into account the location of the Scheme and forecast changes in journey times and relative population, workers and employment within these areas.

**Table 5-2 : WITA Agglomeration by Local Authority – based on May 2019 Wider Impacts Dataset**

District	Benefits over 60-year appraisal period (£000's, 2010 prices discounted to 2010)	
	Stage 3 Core	Proportion of Total
South Cambridgeshire	66,695	29%
Huntingdonshire	62,060	27%
Bedford	39,034	17%
Cambridge	37,668	16%
Central Bedfordshire	14,783	6%
Milton Keynes	10,216	4%
<b>Total*</b>	<b>230,456</b>	<b>100%</b>

\*Totals may differ due to rounding

### Updated WITA Results

- 5.1.15 **Table 5-3** presents the results of WITA using the November 2021 Data Book using the updated WITA economics and data input files. It also provides a comparison with the results reported in the EAR **[APP-254]** using the 2019 Data Book and results using the July 2020 Sensitivity Test Data Book as reported in **[REP1-027]**.
- 5.1.16 **Table 5-3** shows that the agglomeration benefits reduce by 21.7% compared to the results reported in **[APP-254]**. There is also a reduction of £3M in 'increased output' benefits, which are based on changes to business purpose benefits in TUBA, with a proportional change of 11.4%. There is a small decrease in labour supply impacts of £0.2M. There is an overall reduction of £53.3M (20.6%) in overall wider economic impacts compared to the original forecasts.
- 5.1.17 Compared to the July 2020 Sensitivity Test based results the November 2021 results are lower overall by 4.6%. As noted in paragraph 5.1.10 above, since the November 2021 VoT growth is higher than forecast in the July 2020 Sensitivity Test it might be expected that the WITA benefits would also be higher, given the input traffic data and process are unchanged.

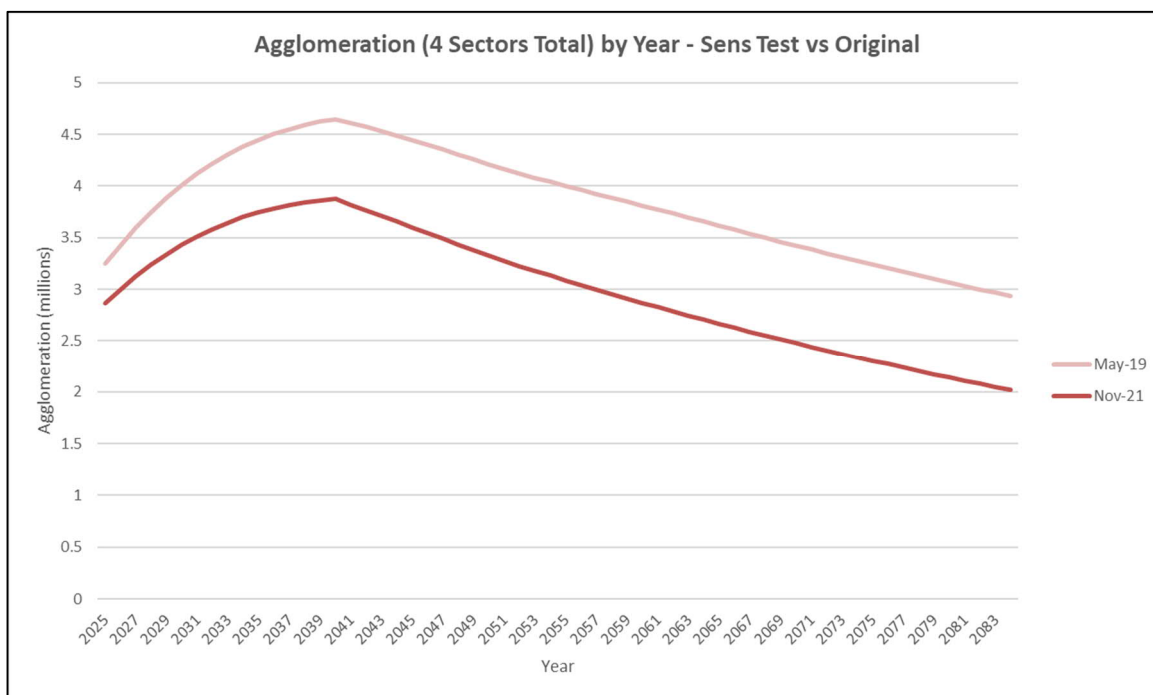


**Table 5-3 : WITA Results Comparison – May 2019 and November 2021 Data Books**

Category	May 2019 Data Book	July 2020 ST Data Book	Nov 2021 Data Book	Change From May 2019 to Nov 2021	% Change From May 2019	% Change From July 2020 ST
Manufacturing	8,592	7,143	6,708	-1,884	-21.9%	-6.1%
Construction	11,269	9,354	8,790	-2,479	-22.0%	-6.0%
Consumer Services	47,622	39,656	37,314	-10,308	-21.6%	-5.9%
Producer Services	162,973	135,622	127,577	-35,397	-21.7%	-5.9%
<b>Agglomeration Total</b>	<b>230,456</b>	<b>191,774</b>	<b>180,389</b>	<b>-50,068</b>	<b>-21.7%</b>	<b>-5.9%</b>
Increased output in imperfectly competitive markets	26,257	21,926	23,252	-3,005	-11.4%	6.0%
Labour supply impact	1,960	1,676	1,735	-224	-11.4%	3.5%
<b>Total</b>	<b>258,673</b>	<b>215,377</b>	<b>205,376</b>	<b>-53,297</b>	<b>-20.6%</b>	<b>-4.6%</b>

\* 2010 Prices discounted to 2010 (£000s)

5.1.18 **Figure 5-2** compares the agglomeration benefits, reported in the EAR, with those based on the November 2021 Data Book for the six local authority areas. The difference in profiles is similar to that presented in Figure 4-1 for the TEE time benefits, with reductions being greater in later forecast years. In 2025 the difference is around 12% increasing to 21% in 2051 and 31% in 2084.



**Figure 5-2 : WITA Agglomeration Benefits – May 2019 and November 2021 Data Books**

5.1.19 **Table 5-4** presents the agglomeration benefits by local authority. This shows that South Cambridgeshire and Huntingdonshire contribute the two highest proportions of agglomeration benefits, at 29% and 27% respectively which is consistent with the results of the original assessment presented in **Table 5-2**.

**Table 5-4 : WITA Agglomeration by Local Authority – based on November 2021 Data Book**

District	Benefits over 60-year appraisal period (£000's, 2010 prices discounted to 2010)	
	Sensitivity Test	Proportion of Total
South Cambridgeshire	52,209	29%
Huntingdonshire	48,328	27%
Bedford	30,482	17%
Cambridge	29,454	16%
Central Bedfordshire	11,217	6%
Milton Keynes	8,699	5%
<b>Total*</b>	<b>180,389</b>	<b>100%</b>

\*Totals may differ due to rounding

## 6 Carbon Emissions and Costs

- 6.1.1 The third major component of Scheme benefits/disbenefits is carbon emissions which for the Scheme, due to forecast additional vehicle distance travelled, result in a significant disbenefit which, as reported for the original assessment in [APP-250] and [APP-254] totalled £127 million.
- 6.1.2 The carbon emissions and costs were calculated using the Emissions Factors Toolkit (EFT) version 9. There have been two significant updates to the EFT and relevant inputs since that time, affecting the carbon costs and annual carbon emissions.
- 6.1.3 The first change of significance is the cost of carbon emissions. These are sourced from the Department for Business, Energy and Industrial Strategy (BEIS) but those forecasts are only to 2050. The latest BEIS advice (September 2021) is that to obtain values post-2050, a real annual growth rate of 1.5% starting at the most recently published value for 2050, should be applied.
- 6.1.4 For carbon emission purposes, three sets of carbon values are provided, one each for Low, Central and High cost scenarios. In the May 2019 Data Book, the costs per tonne of carbon in 2010 prices for the three cost scenarios were as follows:
- |         |   |        |
|---------|---|--------|
| Low     | = | £26.20 |
| Central | = | £52.41 |
| High    | = | £78.61 |
- 6.1.5 The release of the November 2021 Data Book resulted in a significant increase in carbon costs with the costs in 2010 being over three times the previous values.
- |         |   |  |
|---------|---|--|
| Low     | = | £82.97 per tonne (2010 value in 2010 prices) |
| Central | = | £165.94                                      |
| High    | = | £248.92                                      |
- 6.1.6 Another significant change to carbon costs between the May 2019 and November 2021 values is how they change over time as displayed on **Figure 6-1**. This compares the May 2019 Central and High costs against the November 2021 Central cost values. It can be seen that the latter values are significantly greater than the previous Central costs throughout the 60 year appraisal period from 2025. Compared to the previous High costs, the latest Central costs are higher until 2050 after which they are lower until 2084 when they are about the same value. This indicates that the previous sensitivity test making use of the High carbon cost, as reported in [APP-250] and [APP-254] was a reasonable approximation of the updated Central carbon cost.

- 6.1.7 As well as there being a significant change to the price of carbon emissions, the other major update has been how emissions are calculated. In EFT9, the vehicle fleet was assumed to remain unchanged from 2030, with the proportion of electric vehicles remaining fixed from 2030. Given the current intention that the sale of new petrol and diesel cars and vans are to be banned in the UK from 2030 and hybrid vehicles from 2035, the post-2030 fixed fleet assumptions would lead to an overestimation of vehicle carbon emissions.
- 6.1.8 EFT11 was released from the Department for Environment, Food and Rural Affairs (DEFRA) in November 2021. This included changes to the vehicle fleet after 2030 and until 2050. This resulted in the calculation of lower carbon emissions compared to EFT9 based on the same traffic model outputs in terms of AADT and traffic speeds on links.
- 6.1.9 A comparison of the additional annual carbon emissions due to the Scheme, is presented in **Figure 6-2**. EFT9 calculated emissions are not only higher until 2030 but continue to increase until 2040 where they remain at that level for the remaining 44 years of the assessment period to 2084. Using EFT11, emissions are lower in the 2025-40 period and continue to remain lower for the remainder of the appraisal period. Although the overall fleet emissions continue to reduce from 2040 to 2050, this impact is not present in these EFT11 outputs as the traffic data from the 2051 horizon year have not been incorporated in the assessment. It should be noted that the 2051 traffic forecasts have not been utilised in this assessment in order to be consistent with the previous assessments.
- 6.1.10 Over the 60 year assessment period, EFT11 results in a total of 2.00 million tonnes in additional carbon emissions due to the Scheme which is 32% lower than the 2.90 million tonnes calculated using EFT9. The EFT11 outputs also include the 'Traded' element as these now form a much higher proportion of emissions although they only form a small proportion, <2%, of total additional emissions resulting from the Scheme. It should also be noted that the additional emissions due to the Scheme account for under 0.05% of total carbon emissions calculated by the EFT.
- 6.1.11 However, as the costs of carbon emissions are significantly greater in EFT11 than those in EFT9, the overall discounted Central cost is £151.4 million in 2010 prices. This is £24.4 million greater than the Central cost presented in **[APP-250]** and **[APP-254]** but £45 million lower than the £196.4 million High carbon cost value.

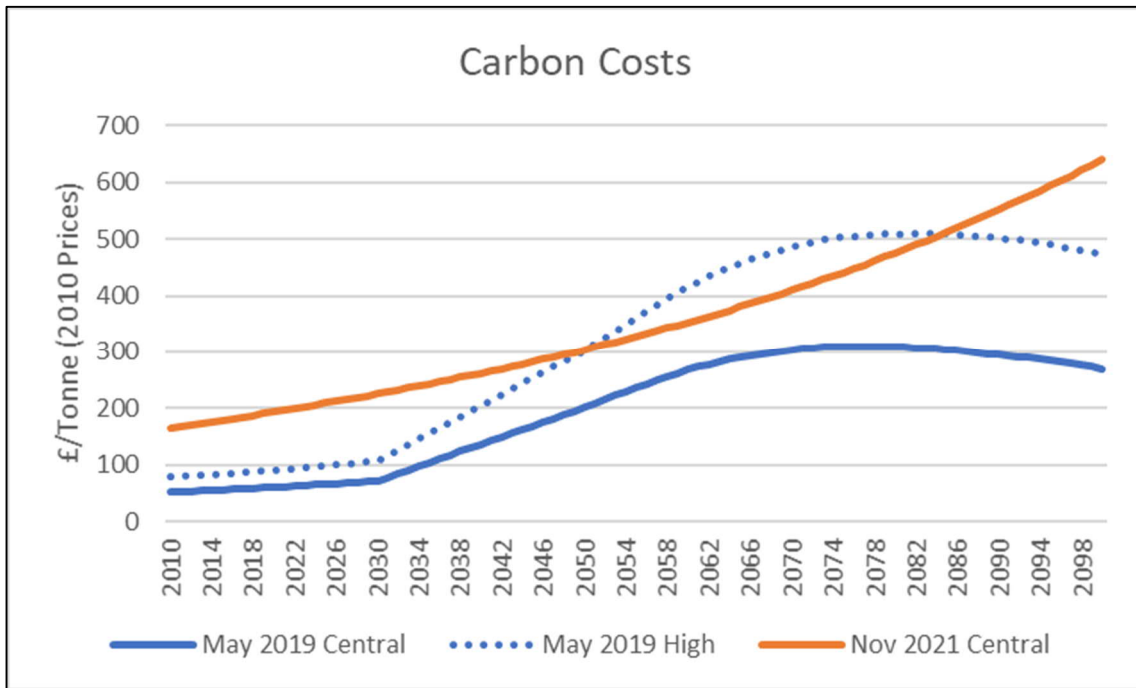


Figure 6-1 : Comparison of May 2019 and November 2021 Carbon Costs

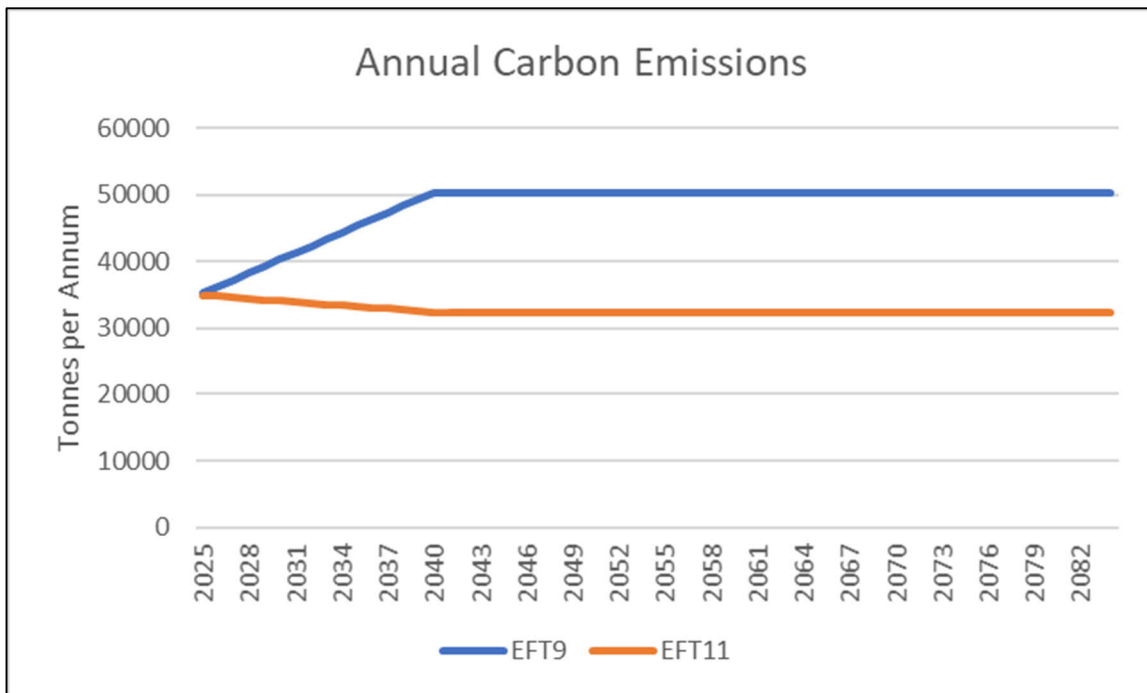


Figure 6-2 : Comparison of EFT9 and EFT11 Additional Carbon Emissions

## 7 Summary and Conclusions

- 7.1.1 As part of the strategy addressing the uncertainty arising from the COVID-19 pandemic, sensitivity tests were carried out to analyse the impact of the revised forecasts of economic growth on the economic benefits of the Scheme.
- 7.1.2 This note has presented the TUBA, WITA and Carbon emission results based on the most recent updates to the TAG Data Book and Emissions Factor Toolkit that were issued in November 2021. This follows on from the Sensitivity Test economic data released in July 2020 reported in [REP1-027]. Updates have only been undertaken to re-calculate the operational TEE benefits, WITA benefits and carbon dis-benefits since these account for the majority of Scheme benefits or disbenefits.
- 7.1.3 **Table 7-1** presents a summary of the transport related benefits and compares the outcome of the original results presented in the Combined Modelling and Appraisal Report [APP-250]. TEE benefits reduce by 16% compared to those reported at submission of the application, and wider economic impacts reduce by 21%, whilst carbon costs (dis-benefits) have increased by 19%. It also shows that the latest TAG parameters result in the adjusted BCR reducing by 0.39 from 1.91 to 1.52 but is similar to the 1.55 BCR outcome using the July 2020 Sensitivity Test parameters.
- 7.1.4 It is noted that the benefits from the latest assessment as presented in are likely to be conservative for two reasons. Firstly, the wider economic impacts are likely considered to be an underestimate due to the issue raised in paragraph 5.1.10. Secondly, as noted in paragraph 6.1.9, the 2051 traffic model forecasts were not used in the preparation of emissions forecasts in EFT11. If 2051 traffic forecasts had been utilised, it is likely they would result in lower carbon costs over the 60 year appraisal period, given the updated assessment does not recognise the increased proportion of zero-emission vehicles post 2041.

**Table 7-1 : Transport related benefits summary**

<b>Benefit Component</b>	<b>May 2019 Data Book EFT9 (£M)*</b>	<b>July 2020 ST Data Book (£M)*</b>	<b>Nov 2021 Data Book EFT11 (£M)*</b>	<b>% change Nov 2021 from May 2019</b>
TEE Benefits (including construction)	554	441	465	-16%
Indirect Tax Revenue	84	75	72	-14%
Accident Benefits	30	30	30	-
Carbon Benefits (Greenhouse Gas)	-127	-127	-151	-19%
Monetised Noise Benefits	2	2	2	-
Monetised Air Quality Benefits	-1	-1	-1	-
<b>Initial Present Value of Benefits (PVB)</b>	<b>541</b>	<b>420</b>	<b>417</b>	<b>-23%</b>
<b>Present Value of Costs (PVC)</b>	<b>463</b>	<b>463</b>	<b>463</b>	<b>-</b>
<b>Initial Benefit to Cost Ratio (BCR)</b>	<b>1.17</b>	<b>0.91</b>	<b>0.91</b>	<b>-23%</b>
Wider Economic Impacts	259	215	205	-21%
Journey Time Reliability Benefits	83	83	83	-
<b>Adjusted PVB</b>	<b>883</b>	<b>718</b>	<b>705</b>	<b>-20%</b>
<b>Adjusted Benefit to Cost Ratio (BCR)</b>	<b>1.91</b>	<b>1.55</b>	<b>1.52</b>	<b>-20%</b>

\*2010 prices and values discounted to 2010, rounded to nearest million.