

COST BENEFIT ANALYSIS IN SUPPORT OF A TRACK ACCESS APPLICATION DECISION FOR THE WREXHAM - BIDSTON ROUTE



Final report

23 September 2022

SYSTRA



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1. INTRODUCTION

1.1 Background

SYSTRA was appointed to support the Office of Rail and Road (ORR) in its duty to grant or reject Track Access Rights applications to operate services on the Wrexham – Bidston route in North Wales.

ORR has received two applications:

- An application from Transport for Wales Rail Ltd (TfWRL) to increase the frequency of its Wrexham – Bidston services (Monday – Saturday) from hourly to 2 trains per hour.
- An application from GB Railfreight to operate around two services per week in each direction between Penyffordd and Avonmouth. This will involve allowing trains contained within the current timetable to operate under firm rights.

Network Rail has conducted a capacity assessment and concluded that there is insufficient space on the network to accommodate all of TfWRL's proposals, due to conflicts with freight paths, currently allocated to GB Railfreight. Specifically, there are conflicts between freight and additional passenger services in the pm peak (one train per day in each direction) and additional passenger services just after the am peak (one train per day in each direction). ORR has reviewed Network Rail's assessment and agrees with the conclusions drawn. In order to meet its Section 4 duties, ORR has several decisions available, however the key choice is as follows:

- Decline TfWRL's application. ORR could in principle approve an amended application with only the conflicting trains removed, however TfWRL has indicated that it would not wish to operate this service as it would be undermined by the resultant gaps in the half-hourly frequency, particularly in the pm peak. For the purposes of this assessment we have therefore assumed that the current quantum of passenger services and freight paths would remain; or
- Approve TfWRL's application, thereby resulting in a reduction in freight paths on the route.

Network Rail has conducted a Cost Benefit Analysis (CBA) of both scenarios. This work is intended to follow the guidance set out in the Department for Transport's TAG¹ publication. SYSTRA's role has been to review the work undertaken by Network Rail, discuss the applications and the Network Rail work with key stakeholders, and to amend Network Rail's assessment based on the best available evidence.

Our review is high-level in nature, in line with the study timescales and budget.

1.2 Files reviewed

Our review has considered the following files, supplied to us by ORR unless stated:

- Network Rail's economic appraisal model for the options in question, file name *220421 NR DCF Appraisal Model - Wrexham - Bidston 0.5.xlsm*, plus a suite of feeder spreadsheets and other supporting information.
- Network Rail's economic appraisal report entitled *Wrexham - Bidston Report v0.5 - Final.pdf*
- TfWRL response to Network Rail's representations of 16 May 2022

¹ [Transport analysis guidance - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

- GB Railfreight's Track Access Application Form F, *named 01 GBRf 17th Supplemental Form F (Submission to ORR).docx*
- Internal emails between Network Rail staff members describing and querying details of the freight option to inform Network Rail's CBA. This was supplied to us by Network Rail.
- An assessment of the Wrexham – Bidston passenger service conducted by consultants WSP. This work is dated May 2022 and was supplied to us by Network Rail.
- Business Case documents for the Wrexham – Bidston passenger service produced by consultants Arcadis. The work is dated July 2022 and was supplied to us by TfWRL.

1.3 Stakeholders consulted

We have discussed the competing freight and passenger applications with the key stakeholders. The email correspondence with TfWRL and GB Railfreight are embedded in Appendix A.

Stakeholders consulted were:

- **Chris Stennett, Economic Analysis Manager, Network Rail.** Chris is responsible for the CBA work undertaken by Network Rail. We held a Microsoft Teams (Teams) call with Chris to check our understanding of the options tested, confirm the assumptions made by Network Rail and check that we understood how to operate Network Rail's CBA model. We followed this call with some email clarifications.
- **Bruce Giles, Customer Manager, System Operator Freight & National Passenger Operators (FNPO), Network Rail.** Following our conversation with Chris, we were unclear on some of the detail on the freight option tested in the Network Rail CBA model. At Chris' suggestion we held a Teams call with Bruce to clarify some details.
- **Ben Sturgess, Advanced Timetable Manager (Wales & Western), System Operator Network Rail.** Ben is responsible for the Event Steering Group (timetable planning) process in the Wales & Western Region. At Bruce's suggestion we held a Teams call with Ben to discuss some of the freight option details that Bruce was unaware of. We also discussed specific details of an alternative freight routing proposed by Network Rail during the ESG process.
- **Chris Dellard, Head of Access Planning, TfWRL.** We held a Teams call with Chris to discuss a series of issues raised by TfWRL in its response to Network Rail's representations of 16 May 2022. We also discussed details of the proposed passenger service frequency increase.
- **Jason Bird, GB Railfreight.** GB Railfreight's key contact is Ian Kapur, however he has been on leave during much of our engagement. In Ian's absence we spoke by telephone with Jason Bird to clarify specific details of GB Railfreight's application.
- **Ian Kapur, Head of Strategic Access Planning, GB Railfreight.** We have engaged in email correspondence with Ian to discuss details of the application which Jason was unaware of. Specific dialogue has focussed on the cost and feasibility of a potential alternative freight routing, thereby enabling both the passenger and freight services to operate.

1.4 Outstanding information requests

At the time of writing three requested pieces of information were outstanding. We have listed them here for ORR to note and then commented on the significance in the relevant section below. The outstanding information is as follows:

- A breakdown of train operating costs from TfWRL for the proposed passenger service frequency increase.
- Confirmation from TfWRL of when, given an approval of Track Access Rights, services could commence operation.
- An estimate from GB Railfreight of the cost of pursuing an alternative routing for the services which are the subject of the Track Access Application.

2. REVIEW OF NETWORK RAIL'S WORK

2.1 Description of the options tested

Network Rail produced a CBA for three options. Network Rail has not described a Do-Minimum scenario against which these are compared but the implied Do-Minimum is that none of the services contained within the Track Access Application operate. Therefore, the freight is assumed to be transported by road and the passenger service remains at one train per hour as seen currently.

The three options Network Rail produced are defined below:

Option 1. This is services contained in GB Railfreight's application. These services operate currently and would continue to do so should ORR grant the application for firm rights. The option constructed by Network Rail consists of these services only.

Option 2. This comprises the services contained within TfWRL' application, namely the additional services which would operate once the frequency increased from hourly to half hourly. However, Network Rail has removed three trains per day from this option which conflict with the freight services in option one and therefore could not operate if the freight option was granted rights. Specifically, this is two services in the pm peak (one in each direction) and one service just after the morning peak period.

Option 3. This option comprises only the three passenger trains which have been removed from Option 2. We understand that this option is intended as an increment to Option 2.

To compare the CBA results for the two applications it is therefore necessary to compare Option 1 with Option 2 and Option 3 combined.

2.2 CBA Results

The table below summarises the CBA results from Network Rail's report.

The freight option (option 1) is shown to have total economic benefits (Present Value of Benefits, PVB) of £21.65m and a total cost saving (Present Value of Costs, PVC) of £2.06m. The Net Present Value (NPV) is therefore £23.71m. This results in a financially positive scheme, namely it generates economic benefit and saves cost versus the Do-Minimum situation..

Four scenarios were presented for the passenger option. Option 2a+3a is the central case, using Network Rail's core assumption on the recovery of the rail passenger market from the COVID-19 pandemic. Options 2b + 3b, 2c + 3c and 2d + 3d are sensitivity tests assuming reduced recovery rates².

Under the central case the passenger option is shown to have a PVB of £29.29m and a PVC of £31.39m. The NPV is therefore -£2.10m and the Benefit to Cost Ratio (BCR, i.e. PVB/PVC) is 0.93. This indicates that the proposed service enhancement is not worthwhile (in terms of standard economic appraisal) even if the paths were available.

² b = high, c = medium, d = low

Table 1. Option CBA results from Network Rail's Assessment across 60-year appraisal period. £m PV, 2010 Prices

	Option 1 – Freight Services	Option 2a + 3a Passenger Services (Central Scenario)	Option 2b-d + 3b-d Passenger Services (High-Low Covid sensitivities)
Net benefits to consumers and private sector (plus tax impacts)			
Rail user journey time benefits	0.00	29.15	27.90 to 18.50
Non user benefits - road decongestion	23.09	2.24	2.15 to 1.50
Non user benefits - noise, air quality, greenhouse gases & accident benefits	8.63	-1.54	-1.57 to -1.75
Rail user and non user disruption disbenefits during possessions	0.00	-0.06	-0.06 to -0.06
Benefits to society and the private sector	0.00	0.11	0.11 – 0.11
Indirect taxation impact on government	-10.07	-0.60	-0.57 to -0.31
sub-total (a) (Present Value of Benefits, PVB)	21.65	29.29	27.97 – 18.01
Costs to government (broad transport budget)			
Initial capital costs	0.00	0.48	0.48 – 0.48
Renewal costs	0.00	0.00	0.00 – 0.00
Non user benefits - road infrastructure cost changes	-2.06	-0.01	-0.01 to -0.01
Revenue transfer*	0.00	-6.17	-5.94 to -4.11
NR operating costs and TOC operating costs transfer**	0.00	37.10	37.10 – 37.10
sub-total (b) (Present Value of Costs, PVB)	-2.06	31.39	31.63 – 33.46
Net Present Value (NPV) (a-b)	23.71	-2.10	-3.66 – 15.45
Benefit Cost Ratio to Government (BCR) (a/b)	Financially Positive	0.93	0.88 – 0.54

Source: SYSTRA transportation of Network Rail's results

2.3 Review of the Key Assumptions

We have reviewed the assumptions made by Network Rail by examining the spreadsheets supplied and the Network Rail report, augmented by conversations with Network Rail. We believe the key assumptions are as follows:

1. **Freight market assumptions.** The number of freight trains per year and the assumed mileage per train, drive the bulk of the benefits in the CBA of the freight option. Network Rail's has assumed 108 trains per year in each direction between Penyffordd and

Avonmouth. This is consistent with both GB Railfreight's application and current usage levels. The paths in question are currently used for cement trains between the Hanson cement works at Penyffordd and the Hinckley Point C power station construction site, via Avonmouth. Our understanding is there will be a continued market for cement between Penyffordd and Avonmouth after the power station ceases to require cement delivery. The most recent information on the construction suggests that the power station will open in 2027, so after GB Railfreight's Track Access Rights would expire.

2. **Passenger market assumptions.** TfWRL's intention is for the passenger option to have a transformative effect on the Wrexham – Bidston (-Liverpool) corridor, with a doubling of the train service frequency from 1tph – 2tph, journey time improvements between specific locations, and newly refurbished Class 230 diesel-battery hybrid rolling stock.

Network Rail has used MOIRA2.2 to estimate the demand increase (and the value of time benefits). MOIRA2.2 is an elasticity-based model and by definition would not capture the impact of any release in suppressed demand from a transformative impact of the combined service improvements.

Guidance in the Passenger Demand Forecasting Handbook (PDFH6) suggests that elasticity-based models are generally appropriate for Generalised Journey Time (GJT) improvements of up to 30% (see PDFHv6 para B4.5.5). The GJT improvements under the passenger option are generally no higher than these values and we would therefore expect MOIRA2.2 to be appropriate. We also note that both WSP³ and Arcadis⁴ used elasticity-based models and we assume therefore that they drew similar conclusions.

Network Rail used MOIRA2.2 with the crowding functionality turned off. Any benefit from reduced overcrowding will therefore not be captured, however given the level of passenger demand on the line this is likely to be a marginal impact. As turning on the crowding functionality in MOIRA2.2 can significantly increase model run times, we view Network Rail's approach as a reasonable simplification.

3. **Rail freight operating costs.** Network Rail has assumed that freight revenues and costs net-off to zero, and therefore are excluded from the appraisal. In our view this approach is consistent with TAG and proportionate.
4. **Passenger rail operating costs.** Network Rail's operating cost assessment is high-level in nature in the absence of more detailed information. There are several areas where more up to date information would be likely to improve the accuracy of the CBA:
 - a. **Train procurement costs.** Network Rail has assumed a capital lease cost for the trains required to operate the passenger service. TfWRL has indicated that the Class 230 fleet in question has already been purchased by Welsh Government and that given the specific operating characteristics of this fleet (principally a low top speed) they could not reasonably be used anywhere other than on the Wrexham – Bidston route. While this might be the case and the procurement cost of the fleet

³ BORDERLANDS LINE PHASE 2 STUDY WeITAG Stage Two | Impacts Assessment Report. March 2021. WSP
Borderlands Line Study. Updated WeITAG Stage Two | Outline Business Case. May 2022. WSP
Borderlands Line Study. Economic Appraisal. July 2022. WSP
Borderlands Line Impacts. Assessment Report. July 2022. WSP

⁴ WREXHAM TO BIDSTON FREQUENCY. INCREASE. Economic Appraisal Report. May 2022, Arcadis

could be viewed as a sunk cost and therefore set to zero in the CBA, it is likely that TfWRL could sell or lease the trains to another operator. It would therefore be appropriate to test the outcome of the CBA analysis to a sensitivity test on this point.

- b. **Train maintenance and operating costs.** Network Rail has assumed cost rates applicable to Diesel Multiple Unit (DMU) trains in the absence of better information. Class 230 diesel/battery hybrid trains may have different costs to DMUs, and the manufacturer has claimed that operating costs will be lower. We have asked TfWRL to provide us with detailed operating cost estimates, however this information has not yet been received.

We have checked publicly available Variable Track Usage costs⁵ for Class 230 trains and they appear to be broadly comparable to those used. Aside from this we have no specific information on Class 230 costs. We therefore believe that Network Rail's costs are appropriate.

- c. **Other operating costs.** Network Rail has calculated other operating costs, e.g. the number of additional train crew required, from first-principles based on the expected service level. Costs may differ in reality as the service increase would be integrated within TfWRL' wider operation.
 - d. **Optimism Bias.** Network Rail has assumed that costs are consistent with GRIP Stage 4 and has applied 21% Optimism Bias consistent with TAG. If more mature cost information was available, for example known costs supplied by TfWRL, then it may be possible to reduce the level of Optimism Bias applied. Removal of optimism bias entirely would not, on its own, change the conclusions of this paper but it is significant enough to merit a note here.
- 5. **Infrastructure/capital costs.** Network Rail has included the cost of some infrastructure work to enable the increase in passenger service frequency. We understand that significant proportion of this work has been undertaken since Network Rail produced the CBA in May, and given that the new infrastructure is to enable services to commence operation soon, we believe that it is reasonable to treat the capital expenditure as a sunk cost.
 - 6. **Opening year.** Network Rail has assumed that the passenger option could commence operation in 2023/24. We have asked TfWRL to confirm this as it requires both acceptance of a new fleet and an increase in traincrew. We are awaiting a response, and so in the absence of further information the approach taken is prudent and conservative.
 - 7. **Appraisal period.** The guidance set out in TAG is that it would be generally appropriate to use a 60-year appraisal period for a scheme that involves the procurement of new infrastructure, 30 years if the scheme has no new infrastructure but requires the procurement of rolling stock and 10 years if the scheme is a service change only.

Network Rail has used a 60-year appraisal period. We understand that this is because the passenger option requires additional infrastructure. However, as it is now reasonably likely that both the infrastructure and passenger rolling stock costs are sunk, the options in question more closely resemble service changes only. On this basis it is also appropriate to use a 10-year appraisal period.

⁵ Variable Track Usage (also known as variable Track Access) changes are intended to cover the cost of track wear and tear

We have not identified any further assumptions worth noting and in general the assumptions look to have followed TAG.

2.4 Review of the calculations made

Network Rail's CBA calculations use a standard spreadsheet template used regularly for scheme appraisal. We have not reviewed the calculations in detail as per our scope of work, however we have noted two specific issues worthy of commentary:

- **Split of services between options 2 and 3.** Network Rail has only excluded three of the four daily passenger services which could not operate under Option 2 and therefore only reported the benefit of these three trains in Option 3. The impact is likely to be very small, particularly as the relevant passenger option is both options 2 and 3 combined. In the interest of completeness we have asked Network Rail to correct the underlying MOIRA2.2 work, and we await the amended results.
- **Discrepancy between outputs and inputs.** We have noticed a small difference between one of the output sheets from MOIRA2.2 and the corresponding input sheet in the CBA model. We have asked Network Rail to explain this and await a response. The impact is likely to be minor and the updated MOIRA2.2 output to correct the allocation of services between options 2 and 3 will address the issue in any case.

2.5 Options not considered by Network Rail

During the Event Steering Group (ESG) process to develop the future timetable, Network Rail identified an alternative freight routeing between Penyffordd and Avonmouth, which avoids the conflict with the proposed increase in passenger service frequency, thereby allowing both the freight and passenger options to operate.

GB Railfreight rejected this option and therefore Network Rail did not subject it to CBA. The objection looks largely be on financial grounds as it will require investment in driver route learning and potentially less efficient driver diagrams (resourcing of train services). We have asked GB Railfreight whether there are more fundamental obstructions to this potential compromise option and await a reply. If it were feasible and practicable then CBA would be required for a new option combining options 1, 2 and 3, including the additional cost to GB Railfreight.

Given the specific nature of the freight flow, it may well have a commercial opportunity for only a few years. Although we understand that the freight market between Penyffordd and Avonmouth is likely to continue once the power station at Hinckley Point no longer requires cement deliveries. Like any freight market projection there is some inherent uncertainty, and if the requirement for the freight services no longer existed there would be no conflict with the passenger option. There is some uncertainty about when the passenger option can commence operation due to the time taken to accept the new fleet, and potentially to recruit and train the necessary train crew. We have asked TfWRL for more information and await their response. In the interim we have assumed that Network Rail's assumed option is correct, namely that services commence operation in 2023/24.

2.6 CBA Documentation

During our dialogue, Network Rail requested that we flag any areas for potential improvement with their CBA process and model. Our suggestions mainly relate to documentation and we have included them here should ORR wish to request these items any further evidence relating to Track Access Rights applications. Suggestions are as follows:

- Our reviewers found it difficult to establish exactly what each option comprised, and the key supporting assumptions. A short Record of Assumptions, including a concise description of each option (and a do-minimum scenario) would be useful in this regard.
- Our reviewers needed some support from Network Rail to understand how to use the CBA model. A short operating manual would have helped to streamline the process.
- The Quality Assurance (QA) log in the front of the CBA model was not populated for the specific option. This implies, probably incorrectly, that QA may not have taken place.

3. AMENDED OPTIONS

3.1 Introduction

Informed by our review of Network Rail's CBA work and our dialogue with stakeholders, we have re-run the CBA for three amended options as follows:

1. The **passenger option** (option 2+3) was amended with the costs removed which we believe are likely to be sunk. From section 2, this is the infrastructure costs and the rolling stock capital lease. These amendments will improve the CBA results for the passenger option, enabling us to compare whether these changes bridge the gap to the freight option. One potential stakeholder challenge is that MOIRA2.2 has not captured the full transformational impact of the passenger service upgrade (frequency improvement, journey time improvement, rolling stock change), in spite of the guidance in PDFH. We have therefore conducted a sensitivity test to show the impact of a substantially higher passenger demand increase.
2. Sensitivity tests were conducted on the **freight option** to show the impact of reduced freight usage following the construction of Hinckley Point B power station.
3. The **passenger and freight options were combined**, assuming that the freight could operate by Network Rail's suggested alternative routeing. We have not received from GB Railfreight an estimate of the additional cost of this routeing and have therefore estimated the additional cost that this option could bear before it reached parity with the next best performing option in CBA terms.

The amended options have been assessed over both a 60 year and 10-year appraisal period, given the likelihood that both the infrastructure costs and rolling stock costs are now sunk.

For the passenger option we have used version 2a +3a as this is the central case. We have not repeated the analysis for the COVID-19 sensitivity tests (b-d).

3.2 Amended Passenger Option

All figures are presented in 2010 Present Values unless stated. This is in line with the output of Network Rail's CBA model, and is consistent with TAG.

The figure below sets out the amended passenger option with the sunk costs removed, and compares this with the freight option. We have compared NPVs rather than BCRs as the freight option has no cost to Government and is therefore financially positive with no BCR.

As can be seen, the NPV of the passenger option improves significantly from -£2.10m to £9.18m over a 60-year appraisal period and -£2.96m to £0.85m over a 10-year period. This is still some way short of the freight option (NPV of £23.71m over 60 years and £2.65m over 10 years).

We have estimated the change in forecast demand required to increase the NPV of the amended passenger option to the freight option. Over a 60-year appraisal period an increase of almost 240% is required and over a 10-year period a circa 250% increase is required. This is clearly a significant margin of error.

Figure 1. Amended Passenger Option versus the Freight Option. £m 2010 Present Values

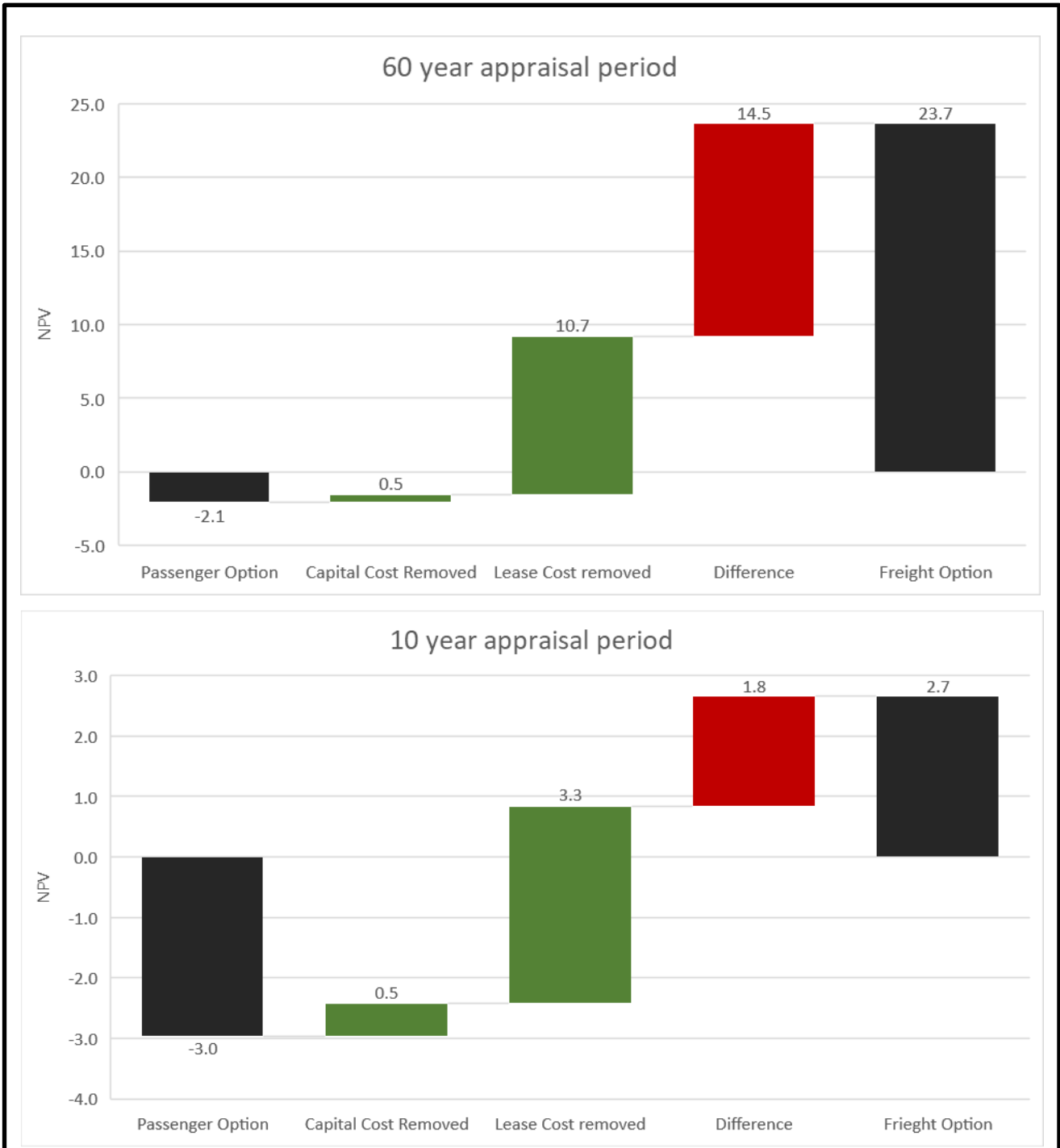
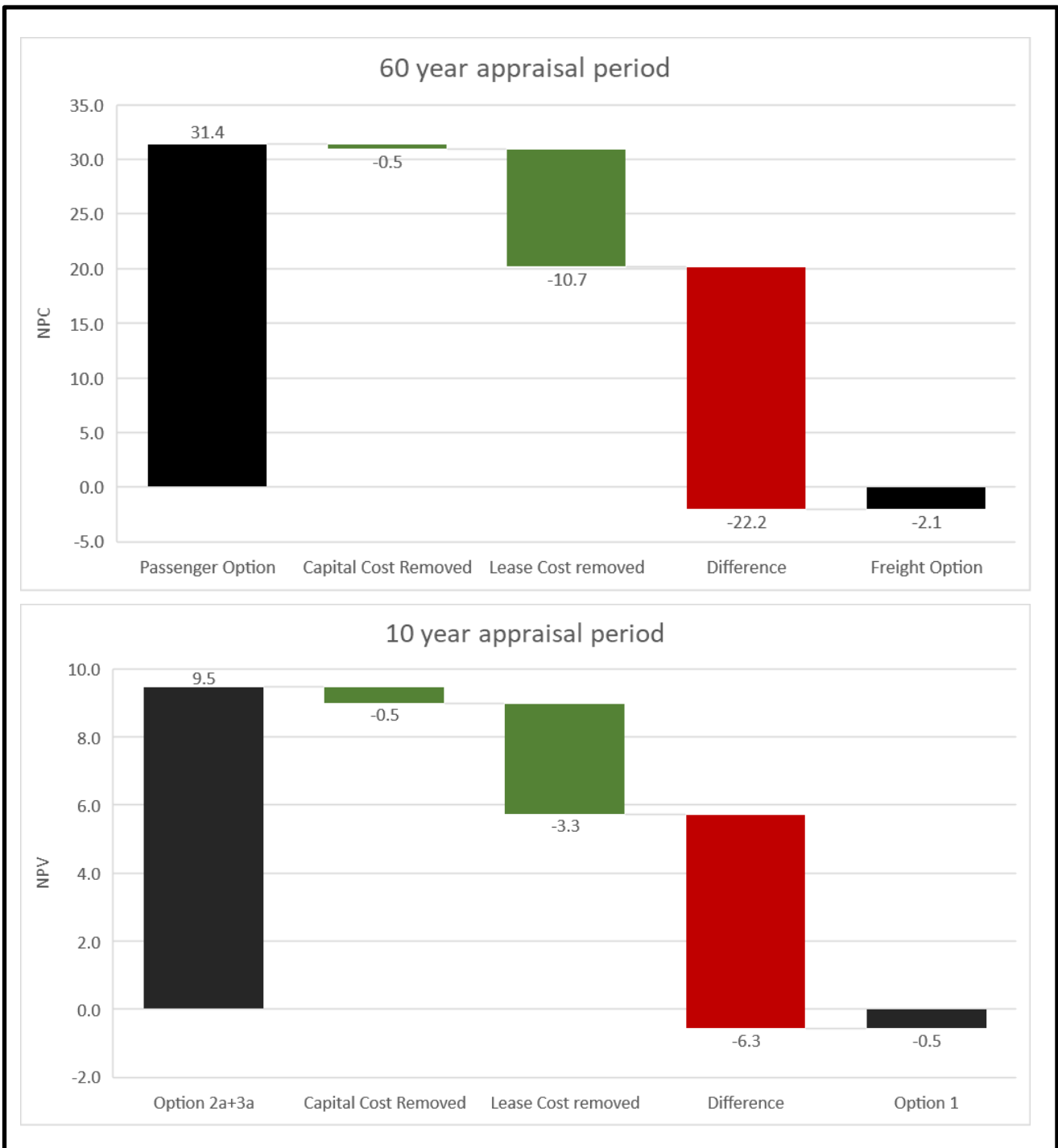


Figure 2. Amended Passenger Option versus the Freight Option. £m 2010 Present Value of Costs



3.3 **Freight Option Sensitivity Tests**

We understand that the freight paths will be required to connect the cement works at Penyffordd with other customers after the power station at Hinckley Point has been built. Our central assumption is that the Penyffordd – Avonmouth freight flow continues, however we have conducted two sensitivity tests:

- After the first five years of the appraisal, the number of freight paths required remains the same, however the number of rail freight miles reduces by 50%.
- There are no freight services after the first five years of the appraisal period, and the relevant train paths remain unused.

The first test results in an NPV of £12.3m . This is still higher than for the passenger option.

The second test results in a NPV of £2.0m. This is inferior to the amended passenger option, and whilst it is an unlikely scenario, we advise that ORR considers whether and how to mitigate against this situation occurring.

3.4 **Amended Combined Passenger and Freight Option**

The combined passenger and freight option has a NPV equivalent to the sum of the NPV for the individual options. We have added operating costs to the combined NPV as an allowance for additional freight driver training associated with the alternative routing. This cost would need to reach approximately £13.2m for the 60-year appraisal period and around £1.2m for the 10-year appraisal period (in 2022 prices) to give equivalent option NPVs. To put this into context we believe that the annual employer's cost on an additional train driver is in the region of £100k per year.

We have not included or subtracted any costs for differences in route lengths or freight transit time, pending further information from GB Railfreight.

4. CONCLUSIONS

4.1 Conclusions

We have conducted a high-level assessment of CBA work produced by Network Rail for competing passenger and freight services on the Wrexham-Bidston route. We have reviewed files supplied by ORR and other stakeholders and have engaged in dialogue with Network Rail, TfWRL and GB Railfreight.

Some of the information we have requested from stakeholders is outstanding. This information would potentially help ORR in its decision and would improve the accuracy of our work, however it is unlikely to undermine the validity of our conclusions.

The work produced by Network Rail is generally consistent with TAG and we have not identified any errors in the analysis which are material to the CBA results.

Network Rail may potentially have not considered in the CBA a realistic option to combine the passenger and freight options, with the passenger option operating via an alternative route. We are waiting for further details from GB Railfreight on the validity of this option.

If a new option is not possible then CBA results are clearly stronger for the freight option. This is despite removing significant costs from the passenger option which are likely to be sunk costs.

The level of passenger demand uplift required to achieve parity, in NPV terms, between the passenger and freight options is very high and unlikely to be supported by the available evidence (e.g. PDFH).

If the combined passenger and freight option is feasible then there is some headroom to cover additional freight operating costs, providing that a funding source can be found. This would need to be investigated in further detail.

Finally, we understand that both the freight and passenger options will commence as assumed in Network Rail's analysis and continue to the end of the appraisal period. There is, however:

- Some potential uncertainty as to the extent that the freight paths will be required beyond the end of the period that the construction of Hinkley Point C power station requires major cement deliveries. If 50% of the modelled freight miles occur after this point then the freight option would retain a higher NPV than the passenger option. If freight mileage dropped to zero but the freight paths were retained, then the NPV of the passenger option would be higher. We recommended that ORR considers this in its decision-making process.
- A potential need for some more clarity on when the passenger option could commence operation. This may have a small impact on the CBA results, and a larger implication for the period of time when the two options conflict with each other.

Appendix A. Notes of stakeholder consultation

This appendix contains embedded Microsoft outlook files of relevant email correspondence with TfWRL and with GB Railfreight

Corre  dence with Chris Dellard of TfWRL

RE_Wrexham -
Bidston data informat

Correspondence with Ian Kapoor of GB Railfreight


RE_
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