

# **Upgrading the West Coast Main Line**

## **A Better Alternative than the Golborne Link**

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# EXECUTIVE SUMMARY

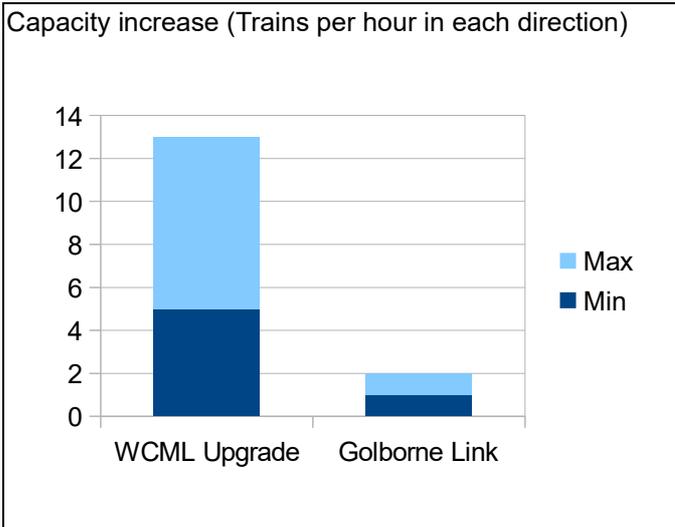
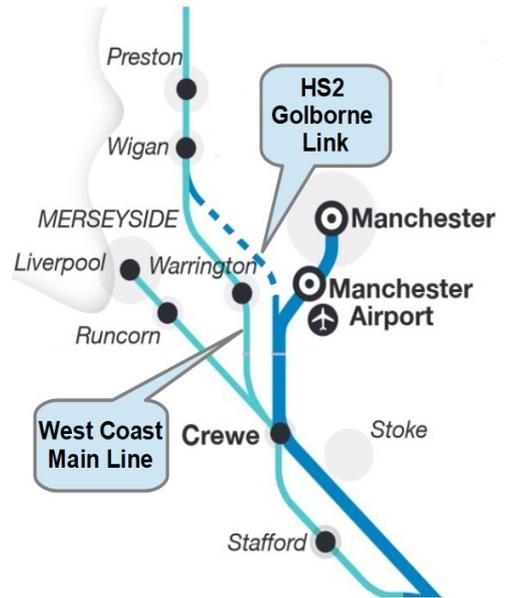
Upgrading the West Coast Main Line (WCML) between Crewe and Golborne from two tracks to four tracks is a better alternative than building the HS2 Golborne Link.

The WCML is a direct alternative to the Golborne Link.

The WCML Upgrade involves only 8 km of new railway construction and 16 km of re-instating track removed in the 1980's

Based on the report by Atkins "Strategic Alternatives to HS2 Phase 2b" for the Department for Transport, published by the Department for Transport in 2016:

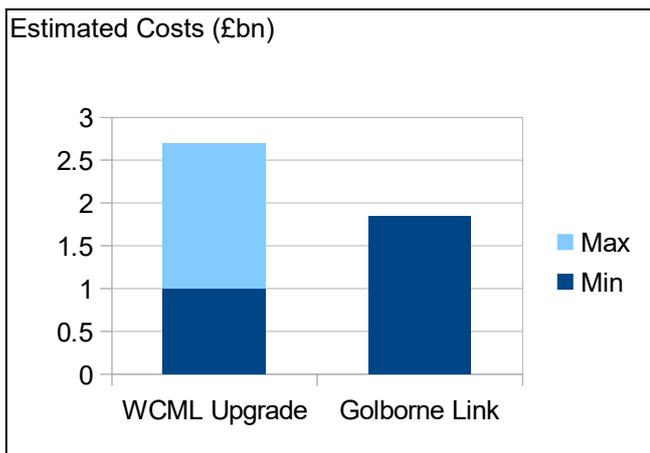
Upgrading the WCML will provide approximately five times the capacity increase that the Golborne Link will provide.



According to the Atkins report, the WCML upgrade will provide 5-13 additional trains per hour in each direction. These could be passenger or freight, and represent a major increase in capacity.

The Golborne Link will only provide 1-2 additional trains per hour in each direction.

The costs are of the same order although more work is needed to specify exactly what is actually necessary for the WCML upgrade.



The WCML upgrade costs are estimated at a maximum of £2.8 bn; Atkins say this may be over specified and more work is needed to identify what is actually necessary. It could be considerable less. The Golborne Link costs are estimated at £1.85 bn.

## **Contents**

	<b>Summary</b>	<b>4</b>
<b>1</b>	<b>Introduction</b>	<b>5</b>
<b>2</b>	<b>Objective of the Upgrade</b>	<b>6</b>
<b>3</b>	<b>The Upgrade - What Needs to be Done?</b>	<b>7</b>
<b>4</b>	<b>What Are The Benefits?</b>	<b>10</b>
<b>5</b>	<b>What Will It Cost?</b>	<b>13</b>
<b>6</b>	<b>Conclusions</b>	<b>16</b>
	<b>Appendix 1 – WCML Upgrade Mile By Mile</b>	<b>18</b>
	<b>References</b>	<b>20</b>

## Summary

This document looks at the option of upgrading the West Coast Main Line (WCML) between Crewe and Golborne to increase capacity by increasing the route from two to four tracks. It looks at costs and benefits of this as an alternative to constructing the Golborne Link proposed by HS2.

The main reason for building HS2 is now to provide additional capacity on the network as a whole. Between Crewe and Golborne, the need is for increased intercity passenger and freight capacity, mainly freight, both to relieve the motorways and provide for planned developments in the region, particularly the planned increase in port capacity.

The Golborne Link cannot carry freight and will only provide additional capacity on the WCML by transferring a few fast passenger trains from the WCML to the Golborne Link. Upgrading the WCML can provide a much greater capacity increase for comparable costs.

This section of the WCML was mainly a four track route up to the 1980's, when reduced traffic allowed a reduction to two tracks for part of the route between Crewe and Golborne. The trackbed is still there to allow the four tracks to be re-instated fairly easily for two thirds of this (16km). Two river crossings will require additional bridges, and there are options for short diversions to avoid two complex junctions and more difficult terrain.

A study by Atkins published by the Department for Transport in November 2016 (Ref 1) states that this upgrading to four tracks will provide an additional 8-16 trains per hour in each direction. If HS2 require 3 of these to replace the Golborne Link, then an additional 5-13 paths per hour will be provided in addition for other passenger and freight trains.

In contrast, the Golborne Link, if built, can only provide extra capacity by transferring fast passenger trains from the WCML to the Golborne Link. There are relatively few of these which can be transferred. This will free up only 1-2 train paths per hour in each direction on the WCML for additional passenger and freight trains.

So the WCML upgrade provides approximately five times the capacity increase as the Golborne Link.

HS2 have stated that the cost of this upgrade to the WCML is £2.7bn, whereas the cost of the Golborne Link is £1.85bn. They have provided no details beyond these figures.

The Atkins report lists 5 major works for this section of the WCML, which they have independently costed at £2.838bn. It is not clear that all these items are necessary to provide the required capacity improvement; Atkins themselves say in their report that this list may be over specified for the required service pattern. If some are unnecessary, as Atkins suggest, the cost will be significantly less.

The best that can be said from the information available is that the WCML upgrade is a similar order of cost to the Golborne Link, whilst providing much greater benefits – it provides approximately five times the capacity increase.

Thus the currently available information does not support the decision to build the Golborne Link in preference to an upgrade of the WCML between Crewe and Golborne. In contrast, it indicates that the WCML upgrade will provide five times greater benefits for a cost of similar order.

## 1 Introduction

This note has been prepared to set out an option for upgrading the West Coast Main Line between Crewe and Golborne to allow HS2 through traffic to and from Scotland to use it.

There is much discussion of an upgrade of the West Coast Main Line (WCML) between Crewe and Golborne as an alternative to the Golborne Link as proposed by HS2 Ltd.

The current proposals by HS2 will involve the WCML north of Crewe being used for through traffic to and from Scotland when HS2 Phase 2a is completed but HS2 Phase 2b is still being constructed. So in principle this must be a viable option.

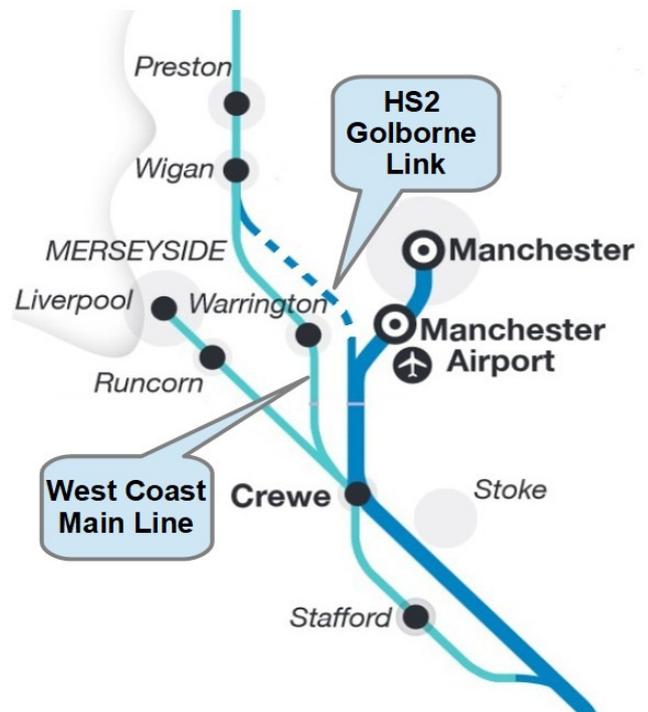
However, there is little public information as to what adopting this as a long term solution would entail. There are several possible interpretations of this idea, varying from making small improvements to the existing line operation, through signalling system upgrades, to rebuilding the line in a form suitable for full-gauge HS2 trains to travel along at full HS2 speed. The former would perhaps have little impact and the latter would be hugely expensive and disruptive.

The option set out here in outline takes a middle course, proposing significant upgrades to the line capacity to allow for HS2 traffic, and more besides, without needing wholesale reconstruction of a new route.

This document sets this out, in broad terms, and suggests outline costs and benefits in relation to the HS2 proposals.

Since HS2 has declined to provide any detail on the basis for their proposals and recommendations, we have used what little information there is in the public domain to provide a commentary on the costs and benefits of these two options, viz upgrading the WCML versus the Golborne Link.

**This discussion is important since the primary reason for building HS2 is now the improvement it will make to the capacity of the national rail network.**



## **2 Objective of the Upgrade**

The option considered here is to upgrade the WCML to provide the capacity needed to allow the HS2 trains to and from the north of England and Scotland, currently proposed to travel via the Golborne Link, to use the WCML instead.

The HS2 services will in any event continue to Scotland on the WCML north of Golborne. They will therefore have to be “Compatible” trains ie those able to travel on lines of normal loading gauge. So the basic requirement focusses on the need to provide additional capacity between Crewe and Golborne.

It is not proposed under this option to upgrade the line speed of the WCML to HS2 standards, nor to open out the loading gauge to allow full height HS2 “Captive” trains to use it.

This is, we believe, the same objective as that adopted for the rest of the route north to Scotland.

As already noted, the current HS2 proposal when HS2 Phase 2a is complete is for Scotland to be served by such “Compatible” trains travelling on the WCML between Crewe and Golborne until the Golborne Link is completed as part of HS2 Phase 2b.

As we shall see, the option considered here will provide significantly more capacity than required for HS2 traffic, and so allow increases in freight and/or local and intercity traffic to be accommodated.

### 3 The Upgrade - What Needs to be Done?

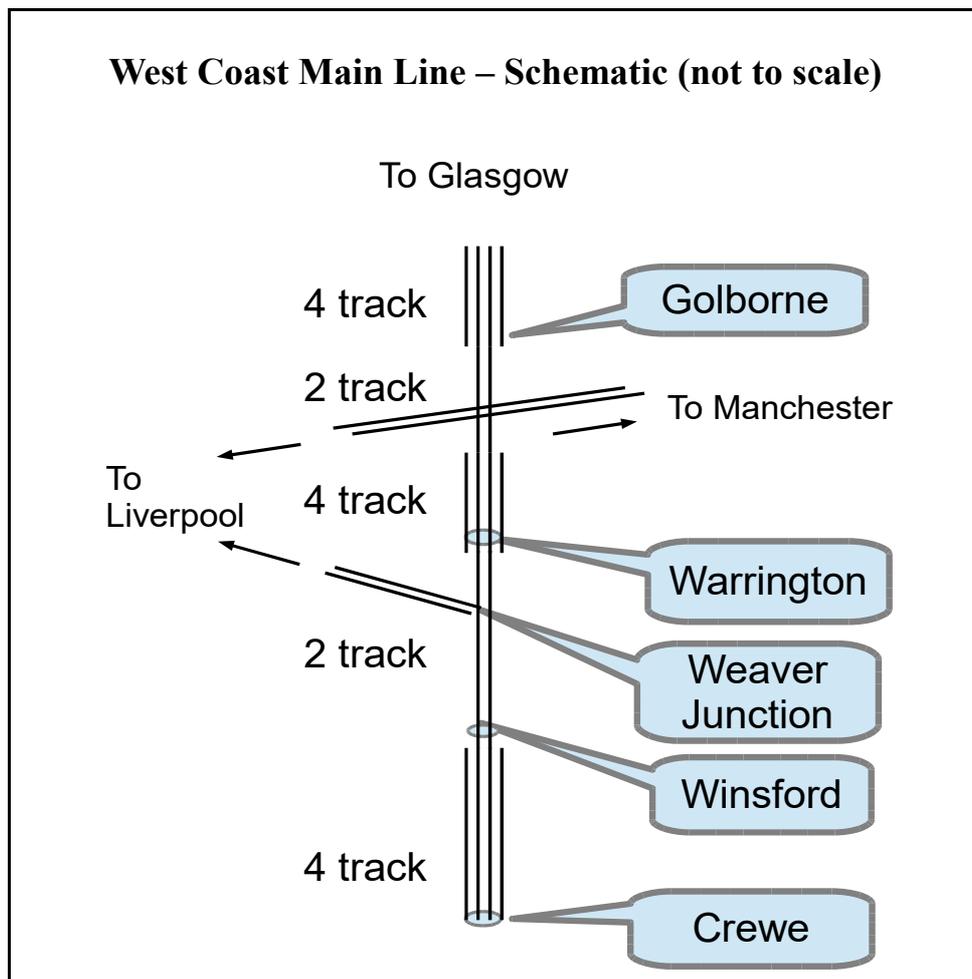
#### **Current Situation**

The WCML between Crewe and Golborne is an extremely heavily used section of route. As it currently exists, it is operating at its full capacity for much of the time, and can only accept more traffic if this capacity is increased. Even without HS2 traffic, there is already significant pressure for additional passenger and freight trains, which cannot be met as things are now.

Like many such route sections, the WCML was laid as four tracks, two Northbound and two Southbound, for most of its length. There were short two-track sections between Crewe and Golborne at river crossings where two-track viaducts were provided.

In the 1980's there was a reduction in rail traffic and as a result some of the four-track sections were converted to two-track sections to reduce maintenance costs. This of course resulted in a rough halving of the route capacity.

However, the basic four-track track-bed was retained, and so in almost all cases these two-track sections could be converted to four tracks by relaying the additional tracks.



Of course, it is more complicated than that, mainly because of junctions where one track crosses another. There are two main junctions on this section of track, Weaver Junction and the junction with the Liverpool/Manchester line north of Warrington. There are options for avoiding these with the additional track.

### ***What is Required?***

The DfT states (Ref 3) that the upgrade will require 24 km of two-track route to be increased to four tracks between Crewe and Warrington and a further 2 km north of Warrington, near Earlestown. This has been looked at, and the extent of the changes required has been summarised in Appendix 1.

Of the 24 km (15 miles) between Crewe and Warrington, approximately 16 km can be re-installed on the original trackbed.

In two places, new river crossings will be required as the existing crossings are only two tracks wide. This accounts for a further approximately three km of line.

Also, at the main junction for the Liverpool line at Weaver Junction, there is the option to divert the new line to the east of the junction, avoiding the junction itself and also the need to replicate the Preston Brook tunnel. This will account for approximately five km of line.

Overall, increasing the route between Crewe and Warrington to four tracks will require re-instatement of the original four-track route in approximately 16 km of route and new construction in approximately 8 km including two new river crossings.

For the route north of Warrington, there is a two km section of two tracks that will require upgrading to four tracks either by widening the existing route (which involves a cutting and a junction with the Liverpool-Manchester line) or bypassing the cutting and junction with a new tunnel under the Liverpool-Manchester line. A tunnel would be expensive, but so would the widening of the existing track because of the constrained nature of the existing route and the additional complication of the junction.

Overall, this would very approximately double the capacity of the line. In fact it would have a bigger effect than this potentially, as it would also allow the segregation of faster and slower trains - see box on the effect of different train types on line capacity).

#### **Effect of Different Train Types on Line Capacity**

Different train types – express passenger, local passenger, and freight – will have different speeds they can maintain.

On a two-track main line there is only one track in use in either direction, and all the trains going that way must use it. The faster trains will catch up with the slower ones but cannot usually pass them, so have to be allowed more “room” on the track if they are not to be delayed. This will waste some of the track capacity.

On a four-track main line there are two tracks in each direction. The faster trains can travel on one track and the slower ones on the other and they will not affect each other so much. So less of the capacity is wasted.

So a four-track main line has more than twice the capacity of a two-track main line.

### ***Is it All Necessary as Part of the Capacity Upgrade?***

How much of this is actually necessary?

The WCML north of Crewe is most heavily used between Crewe and Weaver Junction. At Weaver Junction the Liverpool traffic leaves the WCML and so there is less traffic on the WCML north of here. There is a further small reduction in traffic at Warrington. So there are three options to be considered:

- Upgrade the WCML from Crewe to Golborne
- Upgrade the WCML from Crewe to Warrington
- Upgrade the WCML from Crewe to Weaver Junction

The costs will be reduced as the length of route upgraded is reduced, but the benefits will also be reduced.

A detailed study is needed to decide which is the optimal solution at this point in time.

This point was recognised in the Atkins report Ref 1 which says in section 5.5.1: “There may be potential to rationalise the new infrastructure on this section as it may be over-specified for the required service pattern.”

## 4 What Are The Benefits?

The primary objective set out in Section 2 was to provide sufficient additional capacity to allow HS2 services to Scotland to use the WCML.

This is not a major increase, since the services to the North of England and Scotland represent only an additional three trains per hour in each direction, according to currently published assumptions. In fact, current proposals are for the existing WCML to be used for these services once Phase 2a is built until the Golborne link is completed under Phase 2b

This capacity requirement is easily met by the upgrade of the two track sections of the WCML to four tracks between Crewe and Golborne, which will roughly double the capacity of the route. There will be capacity to spare on the WCML which can be used for other additional services besides HS2.

### ***Benefits of upgrading the West Coast Main Line***

The Atkins study (ref 1) concludes that increasing the route to four tracks will increase total train capacity on the route by between 50% and 100%, providing an additional 8-16 trains per hour each way. If HS2 require 3 of these, then the WCML upgrade will deliver an additional 5-13 trains per hour in each direction for other services.

This is in contrast to the Golborne Link which will only divert three trains per hour each way off the WCML, some of which will have to be duplicated on the WCML to retain services to intermediate stations. The Golborne Link will only deliver an additional 1-2 trains per hour in each direction on the WCML by transferring trains to the HS2 line.

The upgrade will clearly provide considerably more capacity than is required for these HS2 services. This additional capacity could be used to provide additional passenger services to the conurbations of Warrington, Wigan, Lancaster and Preston, and to Runcorn and Liverpool, if there is the demand to justify these. It can also be used to provide through passenger services to Blackpool, which have been sought by the current WCML operator and denied because capacity is not available currently.

Additionally, and probably most significantly, it can be used to provide additional freight services. The demand for freight is increasing, and will increase further with the completion of current new port developments, particularly at Liverpool.

The upgrade of the two track sections to four tracks will also permit separation of slow and fast services, enabling higher average speeds and greater reliability of service times, particularly for the faster trains.

Upgrading the WCML will also bring benefits to local communities by retaining their main line through services to London and Scotland.

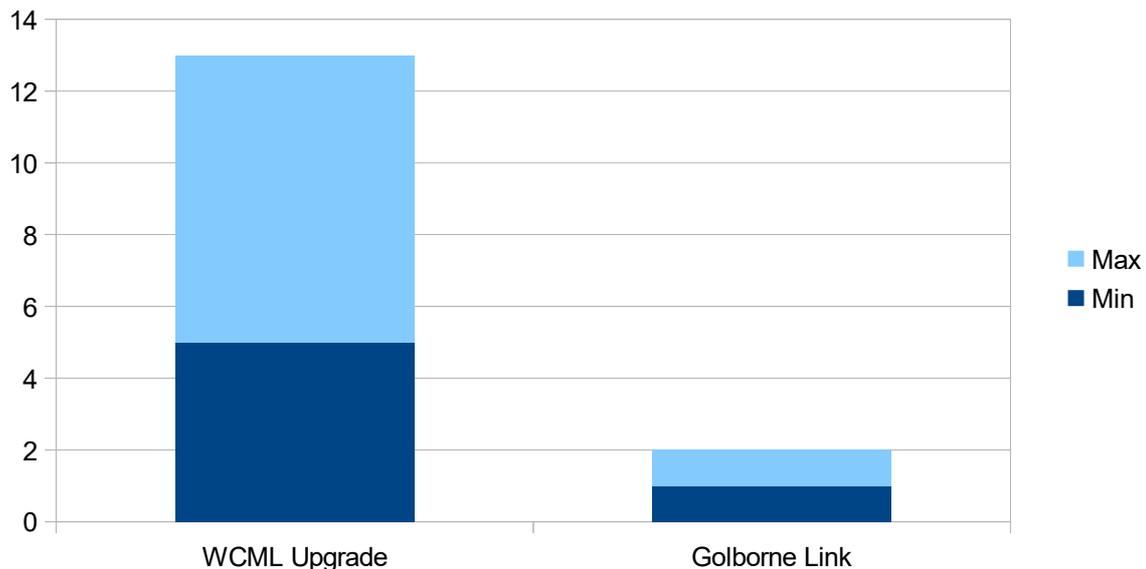
## **Benefits of the Golborne Link**

The HS2 Golborne Link itself will only carry passenger trains and so can only increase freight capacity by diverting a relatively few passenger trains off the WCML. The scope for this is very limited (possibly only one train per hour). As a result, the Golborne Link will only deliver an additional 1-2 trains per hour in each direction on the WCML by transferring trains to the HS2 line. This will only provide a marginal increase in capacity for freight or passengers.

### **Comparison of projected benefits from WCML Upgrade and Golborne Link in terms of trains per hour added to WCML**

**(In addition, both options provide for 3 HS2 trains per hour in each direction)**

The chart shows the range of benefits projected for the two options.



### **To Summarise the Benefits**

So, to summarise the benefits generated, upgrading the WCML to four tracks will provide the following benefits:

- Additional capacity for HS2 trains to and from the North of England and Scotland
- Additional capacity on the WCML of 5-13 trains per hour in each direction, which could be used for
  - Additional capacity for local and other inter-city services
  - Additional freight capacity
- Separation of slow and fast traffic offering potential for increased speeds and better reliability of services

- Benefits to local communities through retention of through services to London and Scotland

In contrast, the Golborne Link will only provide capacity benefits of:

- Capacity for three HS2 trains per hour in each direction on the Golborne Link itself
- Additional 1-2 additional trains per hour in each direction on the WCML

The WCML upgrade can potentially provide approximately five times the additional trains on the WCML as the Golborne Link (5-13 trains per hour cf 1-2 trains per hour).

## 5 What Will It Cost?

### 2013 Estimates

In 2013, in a response to a freedom of Information request by Alan Debenham (Ref 2, Appendix 1), HS2 gave estimates for the WCML upgrade costs as follows:

Cost of upgrades to WCML (including connection to HS2 line at Crewe)	£750m
Cost of building the Golborne Link	£800m

Since this estimate was given, the proposals for Crewe Hub station have been developed and now include the connection to the WCML mentioned above. This was said to be approximately half of the £750m estimated in 2013. As this will go ahead in any event, the cost of the WCML upgrade should be reduced by excluding this element of cost.

### 2016 Estimates

However, cost estimates have now been increased significantly. On 15<sup>th</sup> December 2016, a representative of HS2 told a meeting with Warrington Borough Council and others that the comparison was now:

Cost of upgrading the WCML	£2.7bn
Cost of building the Golborne Link	£1.85bn

HS2 have refused to provide any more detailed costs supporting these figures.

CADRAG in 2013 estimated the cost of the Golborne Link at £1.855b without contingencies (Ref 2). This seems to support the HS2 figure quoted above, although we do not know on what basis the HS2 figures have been prepared.

As regards the WCML upgrade figure, we have only the published data in the Strategic Alternatives report (Ref 1) to work with.

The published report on Strategic Alternatives to HS2 Phase 2b, by Atkins, Ref 1, has a list of works required to upgrade the whole of the WCML which includes the following:

Crewe Curve	£491m
Sandbach – Hartford Junction	£559m
Winsford – Hartford – Weaver Junction	£541m
Weaver Junction – Acton Grange Junction -Warrington	£465m
Winwick Junction – Newton-le-Willows – Golborne Junction	£782m

The total of these is £2.838bn.

These estimates were produced by Atkins using Network rail methodologies, but are independent and will not necessarily be identical with those produced by or for HS2.

### ***Questions Regarding 2016 Estimates***

If this list of works is the basis for the cost quoted by HS2 for the WCML upgrade, there are a number of questions to ask, for example:

Is the Crewe Curve required specifically for the WCML upgrade or will it need to be in place for the Crewe Hub Station project? If so, it should not be taken into account here as well.

What is the purpose of the Sandbach – Hartford Junction work, which does not lie on the WCML? Is this essential, or merely “nice to have”?

Are the upgrades along the WCML from Crewe to Golborne all necessary to provide the capacity required for HS2? For example, the traffic is lower in the northern part of the route. Does the upgrade necessarily require the works north of Warrington (Winwick Junction – Newton-le-willows – Golborne Junction) to deliver the required capacity?

What alternatives have been considered for example for the major engineering required at Weaver Junction and north of Warrington?

### ***Uncertainty over Relevant Costs***

It is not obvious that all the costs listed above are necessary to deliver the upgrade required. Leaving some of the items out of the reckoning will have a major impact on the decision.

For example, if the Crewe Curve is not a necessary part of the WCML upgrade considered here, and neither is the Sandbach Hartford work, then the WCML upgrade cost falls to £1.788bn - very similar to the cost of constructing the Golborne Link quoted by HS2 whilst delivering much greater benefits.

If the works north of Warrington are not required then this will have a similar impact, reducing the costs to just over £2bn.

If none of these are required or relevant, then the WCML costs reduce to just over £1bn.

Each of these will deliver a different set of benefits as well of course.

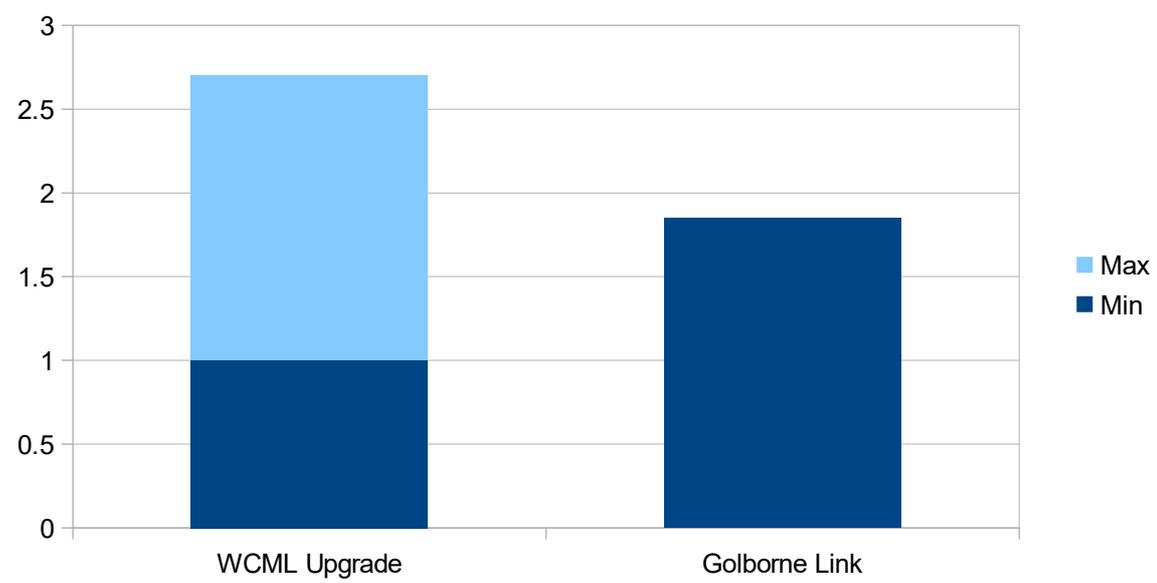
We believe that a detailed study of the requirements, of options to meet these, and of the benefits delivered, is required.

This point was recognised in the Atkins report Ref 1 which says in section 5.5.1: “There may be potential to rationalise the new infrastructure on this section as it may be over-specified for the required service pattern.”

What we can say is that, on the basis of the very limited information available, the costs of upgrading the WCML may be less than, similar to, or more than the cost of the Golborne Link, but the benefits of the WCML upgrade are clearly much greater than the Golborne Link.

### Cost Estimates for WCML Upgrade and Golborne Link

Costs in £bn for the WCML Upgrade and the Golborne Link.



The uncertainty in the WCML Upgrade costs are due to uncertainty as to what is actually required to meet the capacity increase needed, and what costs are already covered by the Crewe Hub.

## 6 Conclusions

We can draw a number of conclusions from the above:

1 The currently available information does not support a decision to go ahead with the Golborne Link in preference to a WCML upgrade between Crewe and Golborne.

2 The WCML upgrade will deliver significantly greater benefits than the Golborne Link:

Upgrading the two track sections of the WCML to four tracks will provide the following benefits:

- Additional capacity for HS2 trains to and from the North of England and Scotland
- Additional capacity on the WCML of 5-13 trains per hour in each direction, which could be used for
  - Additional capacity for local and other inter-city services
  - Additional freight capacity
- Separation of slow and fast traffic offering potential for increased speeds and better reliability of services
- Benefits to local communities through retention of through services to London and Scotland

In contrast, the Golborne Link will only provide capacity benefits of:

- Capacity for three HS2 trains per hour in each direction on the Golborne Link itself
- Additional 1-2 additional trains per hour in each direction on the WCML

3 The costs of the WCML upgrade depend dramatically on the correct identification of the work packages necessary to deliver the required capacity improvement. The Atkins report for DfT (Ref 1) states that more work is required to identify what is really necessary:

“There may be potential to rationalise the new infrastructure on this section as it may be over-specified for the required service pattern.” (Ref 1 Section 5.5.1)

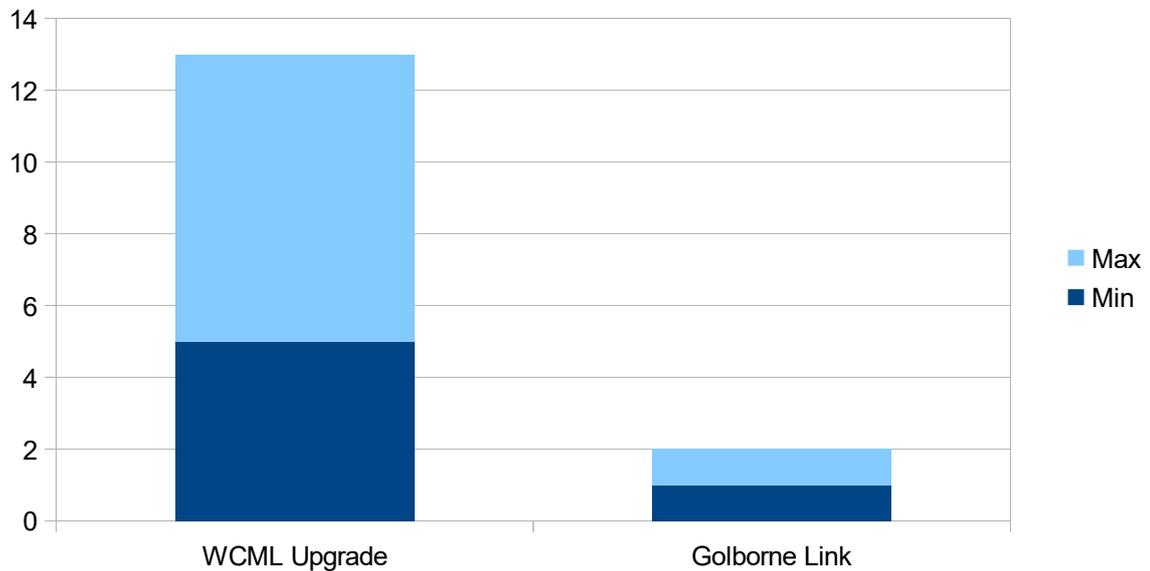
4 The estimated costs of the WCML upgrade could lie between £1bn and £2.8bn, depending on what work is actually necessary; the estimated cost of the Golborne Link is given by HS2 as £1.85bn.

5 The best that can be said based on available information is that the WCML upgrade will have costs of a comparable order with the Golborne link but with much greater benefits, as shown on the next page.

### Comparison of projected benefits from WCML Upgrade and Golborne Link in terms of trains per hour added to WCML

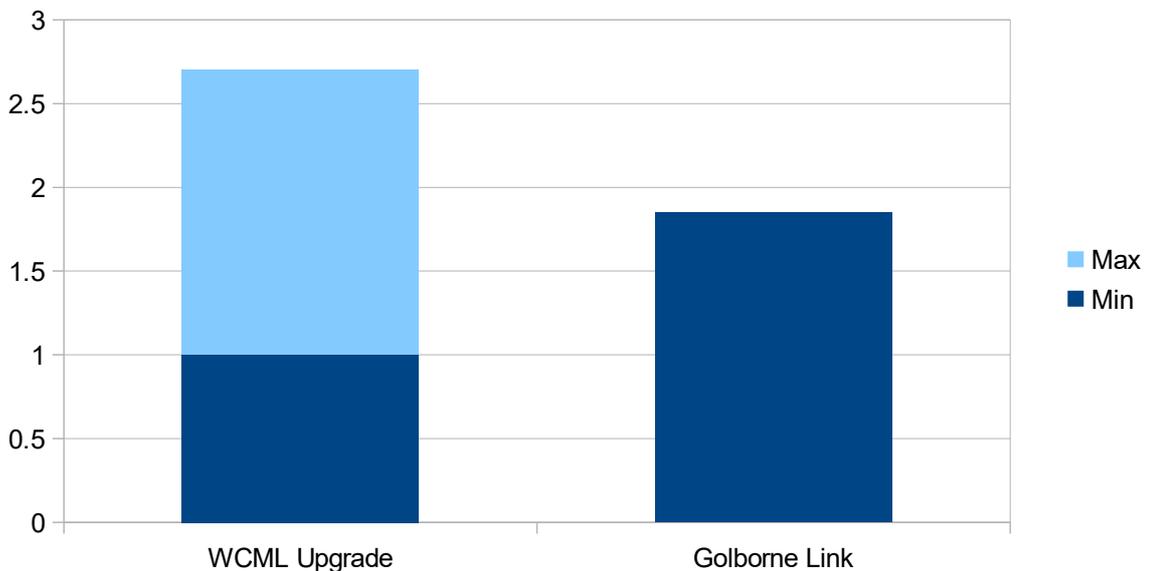
(In addition, both options provide for 3 HS2 trains per hour in each direction)

The chart shows the range of benefits projected for the two options.



### Cost Estimates for WCML Upgrade and Golborne Link

Costs in £bn for the WCML Upgrade and the Golborne Link.



The uncertainty in the WCML Upgrade costs are due to uncertainty as to what is actually required to meet the capacity increase needed, and what costs are already covered by the Crewe Hub.

## Appendix 1 – WCML Upgrade Mile By Mile

The DfT have stated (Ref 3) that 24 km of track between Crewe and Warrington require upgrading from two tracks to four tracks. We have looked at what might be required to achieve this, based on work done in 2013 for the LENDF response to the Route Consultation. The chart below indicates, for each mile of track, what is needed and what options there might be.

(This is done by mile as opposed to by km to allow the WCML mileposts to be used as references for the work.)

Mile (from start)	Current Status	Comments
1	Original 4 track track-bed extant	Modification required to Winsford Station (modern building of light construction) * Some track-bed used as car park, may require cut-and-cover to restore parking facility.
2	Original track-bed extant wider than 4 track	Redundant sidings available for use.
3	Original 4 track track-bed extant	
4	2-track river crossing	First Crossing over River Weaver. Will require additional viaduct.
5	Original 4 track track-bed extant	Modification required to Hartford Station (modern building of light construction) *
6	Original 4 track track-bed extant	
7	Original 4 track track-bed extant	
8	Original 4 track track-bed extant	
9	2-track river crossing (Dutton Viaduct)	Second crossing over River Weaver. Will require additional viaduct.
10	Weaver Junction and approaches; Preston Brook tunnel	Possible diversion to the East of the current line to avoid Weaver Junction and tunnel.
11		
12		
13	Original 4 track track-bed extant	
14	Original 4 track track-bed extant	Option to use extant viaduct over Ship Canal and re-instate Helsby Up and Down Slow lines, or provide new viaduct.
15	Original 4 track track-bed extant	

This indicates that there are approximately 10 miles (16 km) of route where the existing track-bed can be used, and approximately 5 miles (8 km) where new construction is required.

\* Both Hartford and Winsford stations are of light construction; re-location to more favourable positions and modernisation would be straightforward and benefit the travelling public.

There may be concern over possible disruption to the normal WCML traffic during upgrades. The following suggestion was made by Peter Fillery in his response to the 2013 Route Consultation:

“It has been said that it would cause delays and disruption along the existing line for several years while the new line was being built. This is not the case if the construction was handled correctly. While each section of the new line is being built a safety barrier and fence could be constructed in between the West Coast Main Line and the HS2 line to give protection to the construction workers. This barrier could then be in position to protect workers while regular maintenance work was being done. Doing this would mean that trains could use the existing line at all times while the new track was being built and also while doing regular maintenance work, even if the trains had to slow down while going past the construction or maintenance site this would not cause a great deal of delay.”

## References

- Ref 1            Strategic Alternatives to HS2 Phase 2b  
Prepared by Atkins
- Published by Department for Transport, November 2016
- Ref 2            Analysis of the Proposed HS2 Route from London to Glasgow and  
Edinburgh, Western Leg, Golborne Connection, near Culcheth
- CADRAG R1, 19<sup>th</sup> November 2013
- Ref 3            Letter Robert Goodwill MP – Councillor Sean Anstee, 22 Dec 2015