

ROTHERWAS NEW STATION
HIGH LEVEL DEMAND AND BUSINESS
CASE STUDY

Technical Note

Rotherwas New Station Demand Forecast Model

Technical Note

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1 OVERVIEW

1.1 Introduction

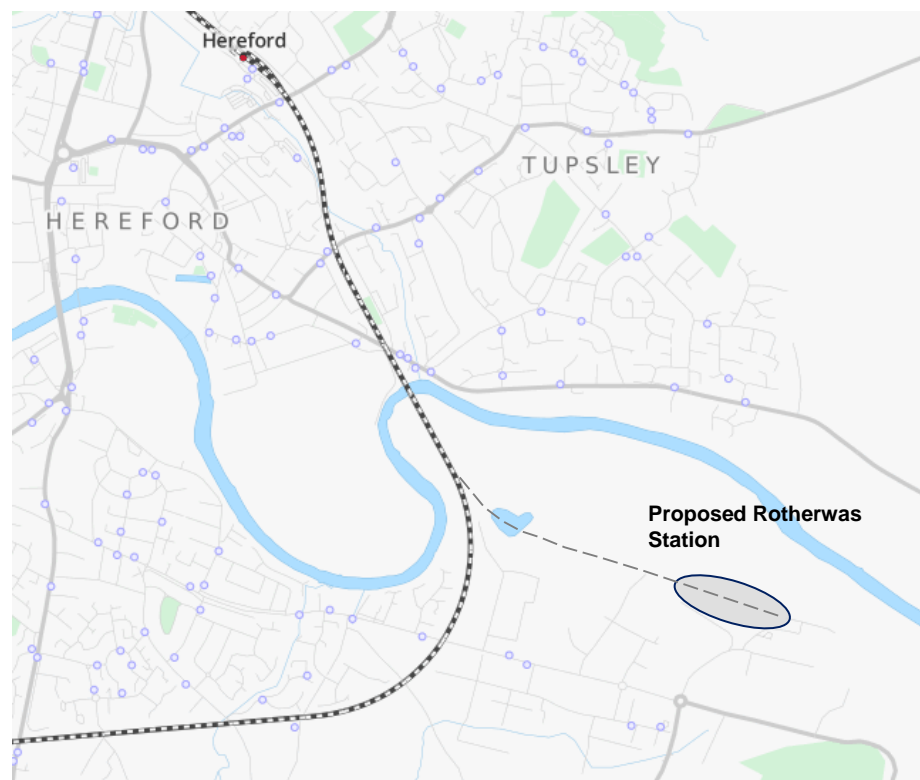
1.1.1 A new station is proposed at Skylon Park, the Hereford Enterprise Zone (HEZ) on Rotherwas. This would include an extension of infrastructure to connect Rotherwas to the rail network. The station would be served by the London Midland service currently operating between Hereford and Birmingham. The proposals would mean trains begin and end their journeys at Rotherwas instead of Hereford.

1.1.2 A study is required to assess the Value for Money Business Case of the new station. The impact of the new station in terms of social economic benefit or dis-benefit will be assessed against the costs.

1.1.3 As part of the study, a demand forecast model has been built to understand the potential impact in travel demand as a result of the new station.

1.1.4 Figure 1 below shows the location of the proposed Rotherwas Station.

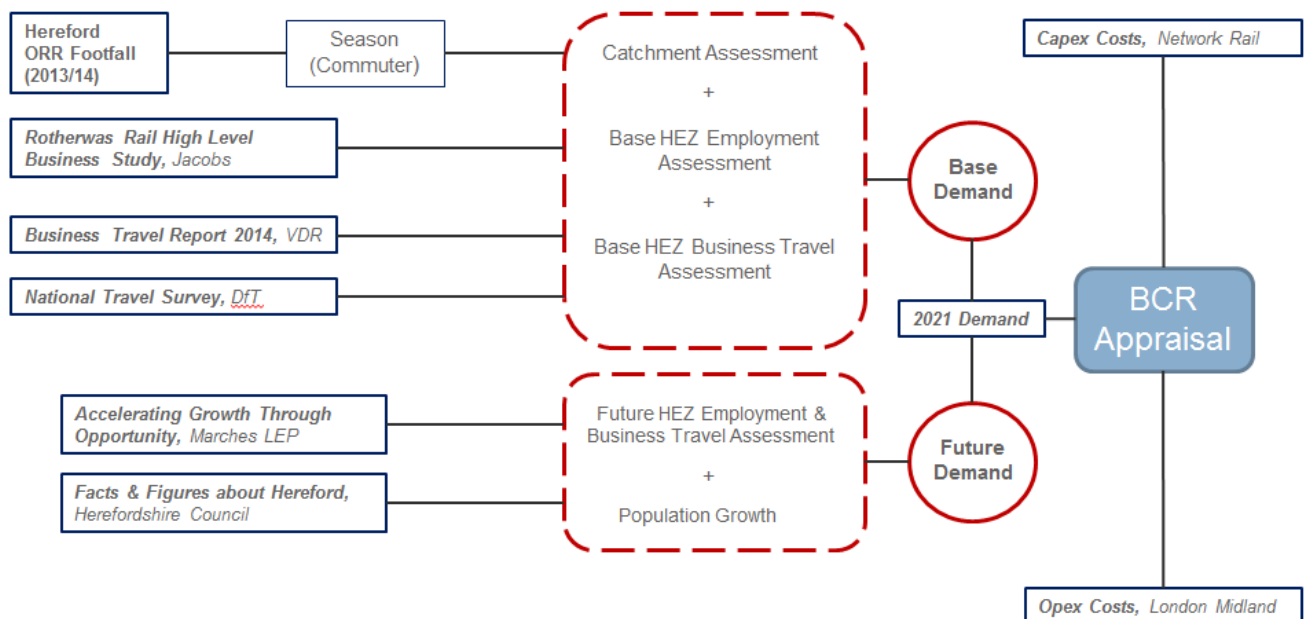
Figure 1: Location of Proposed Rotherwas Station



Source: Open Street Map

- 1.1.5 The demand forecast methodology considers the following aspects:
- Abstracted Commuter demand from Hereford Station;
 - Abstracted Commuter and Business demand from existing HEZ;
 - Generated Commuter and Business demand by future development of the HEZ; and
 - Herefordshire background population growth.
- 1.1.6 A business case appraisal has been developed to assess the case for the proposed station through comparing forecast demand against high level capital and operating costs.
- 1.1.7 The first full year of operation is assumed to be 2021.
- 1.1.8 Figure 1 shows a model map that identifies the process followed to generate the inputs for the Appraisal Model and determine a BCR.

Figure 2: Model Map



1.2 This Report

1.2.1 This technical note contains detailed modelling methodologies and assumptions. The purpose of the report is for internal project record and knowledge exchange.

1.2.2 This report is structured as follows:

- Section 2: Geographical Context
- Section 3: Base Demand for Rotherwas Station
- Section 4: Future Demand for Rotherwas Station
- Section 5: Business Case Appraisal
- Section 6: Operational Considerations
- Section 7: Summary and Recommendations

2 GEOGRAPHICAL CONTEXT

2.1.1 Hereford is a cathedral city located in Herefordshire England. It has a population of approximately 54,000 people.

2.1.2 The city is served by Hereford National Rail Station. The rail network provides connections to the major cities Manchester, Cardiff, Birmingham and London. The station had a total entry/exit of 1,104,000 passengers over 2013/14¹. The journey purpose was split by:

- Reduced (Leisure): 526,000 (48%)
- Season (Commute): 332,000 (30%)
- Full (Business): 246,000 (22%)

2.2 River Severance

2.2.1 The River Wye runs through Hereford, with only one major crossing connecting the town centre and Hereford Station in the north with the south.

2.2.2 This means that Hereford Station is more accessible to anyone located in north Hereford. It is proposed that anyone located in south Hereford, who currently has to travel over the bridge (A49) to access Hereford Station, could benefit from a Station in Rotherwas.

¹ ORR Annual Station Count Data

3 BASE DEMAND FOR ROTHERWAS STATION

3.1 Leisure Journeys

3.1.1 It has been assumed that a station at Rotherwas would not abstract any quantifiable leisure (reduced) journeys from Hereford Station. This is due to its location, which has a very low immediate catchment. It is also considered that leisure travellers would not be influenced by the potential reductions in journey time identified in the same way as commuters might be.

3.2 Base Demand Sources

3.2.1 The Base Demand for Rotherwas Station is considered to be made up of the following demand sources:

- Abstracted commuter demand from Hereford Station;
- Demand from HEZ employees; and
- Demand from HEZ business (full) travel.

3.3 Commuter Journeys – Catchment

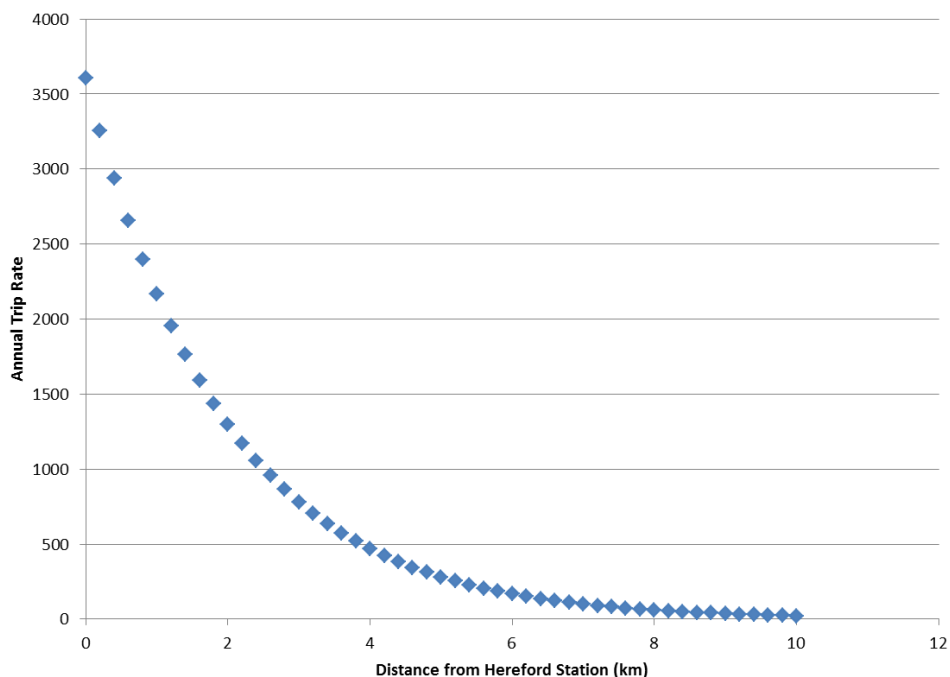
3.3.1 The methodology applied to derive a commuter catchment demand at Rotherwas Station is based on the following assumptions:

- The 332,000 Season trips to/from Hereford Station identified in Chapter 2 have been made by people located within a set catchment area that is identified in this analysis. The aim of the first stage of this assessment was to identify from the total Season demand those that could use Rotherwas Station as a start/end point for their rail journey in place of Hereford;
- Only those commuters able to travel directly to/from Rotherwas are considered in the final demand assessment. This second stage differentiates between commuters that could use Rotherwas Station and those that could actually benefit from travelling using Rotherwas Station.

3.3.2 A 20km diameter catchment was identified around Hereford Station using Office of National Statistics (ONS) Output Area (OA) data, which clusters households into groups of 125.

3.3.3 A decay function was used to determine the number of trips made to/from Hereford Station by population based on their distance from it. A decay factor of 0.4 was used which best represents Hereford's dense centre against its rural surroundings. The decay function curve is shown in Figure 2.

Figure 3: Decay Function Curve



3.3.4 The decay function was used to assign a total of 332,000 trips to all the OAs located within the catchment.

3.3.5 It was considered that anyone living north of the River Wye would not benefit from Rotherwas Station and so OAs located north of the river were removed from further analysis.

3.3.6 All OAs located south of the river were retained for further analysis to determine a base demand for the proposed Rotherwas Station. These OAs provided an annual trip catchment of 102,000, approximately 30% of the total commuter demand at Hereford Station.

3.4 Commuter Journeys – London Midland Service Assessment

3.4.1 Between the peak hours of 07:00 – 10:00 and 16:00 – 19:00, 13 out of 34 existing services to Hereford are operated by London Midland between Birmingham and Hereford.

3.4.2 It is considered that only passengers on these services would benefit from a station at Rotherwas. Passengers on the remaining services operated by Arriva Train Wales would need to change at Hereford to continue on to Rotherwas, and need to be removed from the assessment as there is no realistic journey time benefit for them.

3.4.3 Despite a lower proportion of services running during the peak hours (40%), the London Midland rolling stock, Class 150 DMUs, have a higher capacity than the Arriva Train Wales Class 175 DMU rolling stock. Therefore, to ensure a robust assessment, a commuter demand of 60% of the total commuter demand has been assumed for the next stage of the demand assessment. This equates to 61,000 annual trips, approximately 20% of the total commuter demand at Hereford Station.

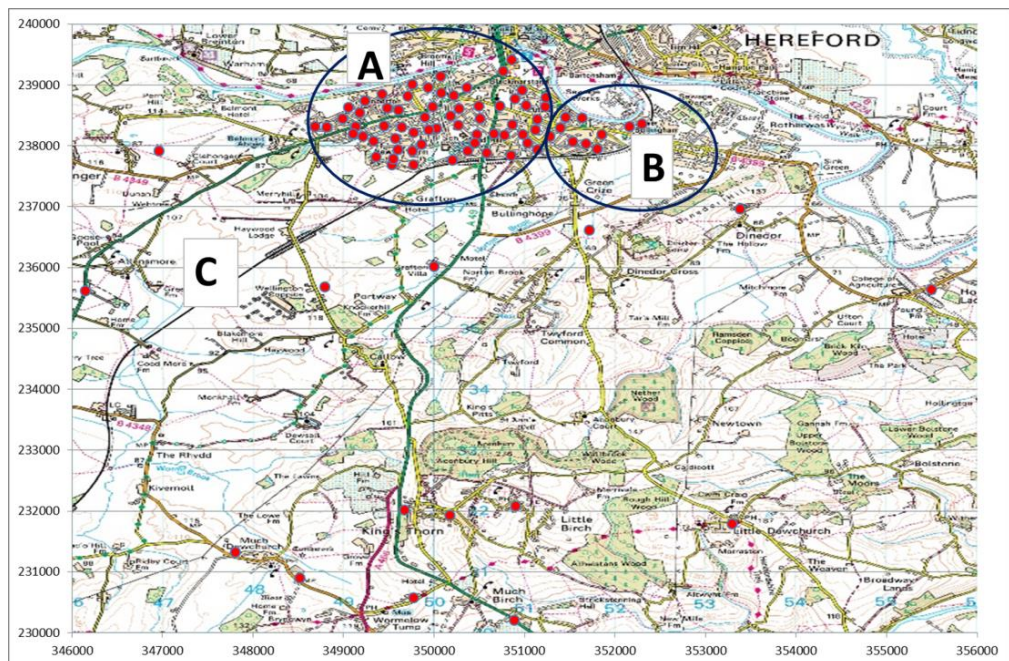
3.5 Commuter Journeys – Demand Assignment

3.5.1 Within the catchment area identified, the Generalised Journey Time (GJT) from each OA point was calculated for two possible route options. These routes were:

- Direct to Hereford Station; and
- Hereford Station via the proposed Rotherwas Station.

3.5.2 The southern catchment was divided into three zones to group together accessibility and travel characteristics. This is shown in Figure 3.

Figure 4: Demand Assignment Zoning



3.5.3 Zone A represents those with direct route availability and good public transport to central Hereford. It contains the largest catchment demand of the three zones.

3.5.4 Zone B represents those with direct route availability but limited public transport to central Hereford.

3.5.5 Zone C represents the remaining catchment whereby there are numerous route options but very limited public transport.

3.5.6 2011 census data for Herefordshire was used to inform the mode splits for each zone.

3.5.7 Because this data represents all of Herefordshire, public transport and walking was assumed to be higher than average in Zone A and Zone B, with commuters in Zone C relying on car travel. Table 1 shows the following mode splits assumed for each zone.

Table 1: Mode Split Assumptions by Zone

Zone	Mode				
	Walk	Cycle	Bus	Car	Total
A	10%	5%	25%	60%	100%
B	7.5%	2.5%	10%	80%	100%
C	0%	0%	2.5%	97.5%	100%

3.5.8 Speed, fare and fuel cost assumptions were applied to derive a GJT for travel to both Hereford Station and the proposed Rotherwas Station. These are shown in Table 2 and Table 3.

Table 2: Speed Assumptions by Zone

Zone	Speed – km/h					
	Car		Bus		Cycle	Walk
	Hereford Centre	Hereford Approach	Hereford Centre	Hereford Approach	All	All
A	20	25	15	20	15	5
B	20	25	15	20	15	5
C	20	50	15	40	15	5

Table 3 Cost Assumptions (All Zones)

Mode	Costs			
	Av. Value of Time (£/min)	Fare Cost (£)	Fuel Cost (£)	Parking Cost (£)
Car	0.08	NA	0.075	5.00
Bus	0.08	3.00	NA	NA
Cycle	0.08	NA	NA	NA
Walk	0.08	NA	NA	NA

3.5.9 An additional 5 minutes GJT was applied to journeys made to Rotherwas Station to allow for travel from Rotherwas Station to Hereford Station.

- 3.5.10 No interchange penalty was assumed for walking between modes as this was assumed to be similar for each option.
- 3.5.11 A GJT was generated for each OA for travel to both Hereford Rail Station directly and to Hereford Station via Rotherwas Station. Any OA which was found to have a lower GJT to Hereford Station via Rotherwas Station than Hereford Station directly was retained for probability analysis.
- 3.5.12 Exponential probability analysis was carried out to determine a probable split of those passenger journeys that would use this new route option over the existing. The lower the estimated GJT for the new option than the existing option, the more probable it is that 100% of passenger journeys would use this route.
- 3.5.13 Using exponential probability analysis, a base demand of 5,800 passenger journeys per annum for the proposed Rotherwas Station was derived. This was out of a total of 10,600 passenger journeys identified as having a lower GJT through travelling to Rotherwas than continuing to travel direct to Hereford Station. This low factor, approximately 55%, suggests that in many cases the GJT benefit of the new option via Rotherwas Station over the existing direct option is small.

3.6 Hereford Enterprise Zone – Existing Employment

- 3.6.1 The Rotherwas Industrial Estate was awarded Enterprise Zone status in 2011 and is seen as an opportunity to meet the employment and economic aspirations identified in the *Herefordshire Local Plan Core Strategy 2011-2031*.
- 3.6.2 The methodology described above uses household densities to identify both population and employment areas. Because the HEZ is mostly employment land, this method has not abstracted the commuter demand travelling to the HEZ via Hereford Station that may benefit from Rotherwas Station.
- 3.6.3 A report produced in 2012 by Jacobs, *Rotherwas Rail High Level Business Study*, showed that results from a Travel Plan survey undertaken in 2008 showed that few existing HEZ employees commute using rail, but that around 2% of respondents could change their travel habits to use rail.
- 3.6.4 The Jacobs report was based on a direct rail service between Leominster and Rotherwas. In its assessment, it therefore identified a number of these employees as travelling to work via Leominster, which through this revised proposal are assumed to no longer benefit from a station at Rotherwas.
- 3.6.5 A 1% mode share has been assumed for existing employees with a station at Rotherwas. This reflects the fact that not all employees would change their travel habits and the level of uncertainty involved, most notably the potentially limited catchment of the station with respect to walking distance to any particular area of the HEZ.
- 3.6.6 Assuming 2,500 existing employees, a 1% mode share would generate up to 12,600 passenger journeys per annum.

3.7 Hereford Enterprise Zone – Existing Business Travel

3.7.1 A report by Verband Deutsches Reisemanagement has showed that on average, a business generates up to six business trips per employee per annum².

3.7.2 The *National Travel Survey England* latest mode share for business trips gives a figure of 9% for rail travel. Under the same assumptions identified in *London Midlands Service Assessment* in Chapter 3, this figure has been reduced to 6% to reflect a more realistic catchment for Rotherwas. Using these assumptions, the proposed Rotherwas Station would generate up to 900 passenger journeys per annum through business travel.

3.8 Total Base Demand at Rotherwas Station

Following the methodology described above, a total base demand of 19,300 passenger journeys per annum would be expected for the proposed Rotherwas Station.

² VDR Business Travel Report 2014

4 FUTURE DEMAND FOR ROTHERWAS STATION

4.1.1 For the purpose of this assessment an opening date for Rotherwas Station has been assumed to be 2021.

4.1.2 Future demand for Rotherwas Station is considered to be made up of the following demand sources:

- Background commuter demand growth from population increase;
- Demand from increase in HEZ employees; and
- Demand from increase in HEZ business travel.

4.1.3 Lower Bullingham Development

4.1.4 An outline planning application is due for submission in Summer 2015 for a 1,000 unit development in Lower Bullingham. This development would be expected to directly benefit from Rotherwas Station.

4.1.5 A trip rate per OA was calculated for Zone B, the location of Lower Bullingham, to generate an annual trip catchment. This was calculated at 8,100 trips per annum for 10 OAs. This represents 810 trips per OA.

4.1.6 1,000 units represents 8 OAs of 125 households. This gives a total trip catchment of 6,500 trips per annum.

4.1.7 Under the probability analysis undertaken in the base commuter demand assessment, Zone B generated 4,400 annual trips. This is 55% of the total catchment.

4.1.8 Therefore, Lower Bullingham is estimated to generate (6,500 x 55%) 3,500 commuter trips per annum at Rotherwas Station.

4.2 Population & Housing Forecasts

4.2.1 The Facts & Figures about Herefordshire forecasts an additional 16,500 homes in Herefordshire between 2011 and 2031, with a 13% increase in population numbers within the same period.

4.2.2 This 13% has been converted into an annual growth of 0.7% up to 2031. The increase is assumed to only affect base commuter travel demand. This growth has been factored down to represent Lower Bullingham Development as part of the 16,500 proposed homes in Herefordshire.

4.2.3 This factored growth is estimated to generate an additional 500 passenger journeys per annum at Rotherwas Station.

4.3 Hereford Enterprise Zone – Future Employment

4.3.1 The Rotherwas Industrial Estate was awarded Enterprise Zone status in 2011 and is seen as an opportunity to meet the employment and economic aspirations identified in the Herefordshire Local Plan Core Strategy 2011-2031.

4.3.2 At least 4,500 jobs are expected to be created by the HEZ, which gives a figure of 2,000 additional jobs created by 2021.

4.3.3 Using the same assumptions identified in the base demand assessment, a 1% mode share would represent an additional 10,100 passenger journeys per annum using Rotherwas Station.

4.4 Hereford Enterprise Zone – Future Business Travel

4.4.1 Following the same assumptions applied to calculate Existing Business Travel journeys, an additional 2,000 jobs would generate an additional 700 passenger journeys per annum using Rotherwas Station.

4.5 Total Forecast Demand at Rotherwas Station

4.5.1 Table 4 shows the predicted future demand at Rotherwas Station based on the methodology described. This assumes that the HEZ is operating at full capacity by the time of opening.

Table 4: Total Demand at Rotherwas Station

Year	Forecast Annual Passenger Journey Demand				
	Hereford Station Catchment	Existing HEZ Demand (Commuter + Business)	Additional HEZ Demand (Commuter + Business)	Background Growth (Lower Bullingham + Population Growth)	Total Demand
2021	5,800	13,500	10,800	4,000	34,100

5 BUSINESS CASE APPRAISAL

- 5.1.1 A 60 year Value for Money Business Case has been produced to develop a Benefit Cost Ratio (BCR) for the proposed Rotherwas Station.
- 5.1.2 The appraisal adheres to relevant Web-based Transport Analysis Guidance (WebTAG) guidelines, and is based on the assumptions shown in Table 5. WebTAG is the Department for Transport's web based multi modal guidance on appraising transport projects and proposals.
- 5.1.3 The appraisal forecasts all monetised benefits and costs for 60 years, then converting them into 2010 prices. All forecasts follow the Passenger Demand Forecasting Handbook (PDFH) guidelines, an industry sponsored toolkit that advises on best practice approach when forecasting demand and revenue for transport projects and proposals.

Table 5: Assumptions for Business Case Appraisal

Parameter	Assumption	Source
Discount Rate	3.5% for 0-30 years 3.0% for 30-60 years	WebTag Unit A1.1
Appraisal Period	60 years (2021 – 2080)	Based on asset life
Price Base	2010	DfT Base Year
Start Year	2021	
Capital Cost Estimate	£11.5m	Network Rail Desktop Review
Operating Cost Estimate	£100,000 per annum	London Midland
Optimism bias	66% for capital cost 41% for operating cost	WebTAG for Project Level 1 (equivalent to Network Rail GRIP stage 1)
Demand base year	2014	
Journey purpose split	5% work (Business) 95% non-work (Commute)	Demand Calculations
Average yield per journey	£5.89	Fares Analysis at Hereford
Existing Passenger Journey Demand	-	
New User Passenger Journey Demand	34,100	
Rail User Demand Growth	2.2% per annum up to 2021 1% thereafter	West Midlands and Chilterns Route Utilisation Strategy (2011)

- 5.1.4 The capital costs supplied by Network Rail exclude any land acquisition and planning costs associated with the proposed station scheme.
- 5.1.5 Both the capital and operating costs are considered to be very high level and would require a more detailed assessment should the proposal be taken forward.
- 5.1.6 For the appraisal model, all demand generated by Rotherwas has been assumed to be new users.

5.2 60 Year Appraisal

- 5.2.1 Table 6 summarises the BCR outputs from the appraisal model.

Table 6: BCR Summary

Parameter	60 year Present Value (£m)
Present Value Benefits	
Non-user benefits – road decongestion	3.55
Non user benefits - noise, air quality, greenhouse gases, accident benefits and others	0.47
Indirect Taxation	-0.47
Total Benefits	3.55
Present Value Costs	
Revenue	-7.04
Capital Costs	14,96
Operating and Maintenance Costs	2.84
Total Costs	10.76
Net Present Value (Benefits – Costs)	-7.21
Benefit to Cost Ratio (Benefits / Costs)	0.33

- 5.2.2 The Present Value Benefits are seen to be the road decongestion from new users at Rotherwas Station who would have otherwise part driven for the same journey and the resulting reduced road emissions. A loss in tax revenue through vehicle fuel duty is included as a disbenefit.
- 5.2.3 The Present Value Costs are seen to be the Capital and Operating costs, offset by the Revenue that the station would be expected to generate.
- 5.2.4 The BCR for the 60 year appraisal was found to be 0.33 which is defined as representing poor value for money under DfT guidelines. This is largely because there is not enough forecast demand to offset the forecast capital and operating costs.

- 5.2.5 A BCR of above 2.0 is considered to represent high value for money under DfT guidelines, and is seen as a strong indicator that a project would generate a good financial return of investment.
- 5.2.6 Under the assumptions used for this appraisal, Rotherwas Station would need to generate a demand in the order of 70,000 passenger journeys per annum to achieve a BCR of 2.0.

6 OPERATIONAL CONSIDERATIONS

- 6.1.1 The operational considerations described in this section have not been included in the 60 year Business Case Appraisal. It is considered at this stage that the operational impacts of including Rotherwas in London Midland services between Birmingham and Hereford are not quantifiable without more information and detailed modelling. However, the following text provides a commentary on the likely impact of the current proposals.
- 6.1.2 Information as to the operational feasibility of including Rotherwas in the London Midland Service has been provided by London Midland.
- 6.1.3 Under the current timetable, 22 out of the 30 Monday-Saturday train services operating between Hereford and Birmingham New Street could be altered to begin and terminate at Rotherwas Station. Eight services would be able to run on a Sunday.
- 6.1.4 Trains operating between Birmingham and Hereford have a shorter turnaround time at Hereford than they do at Birmingham. The current Public Performance Measure (PPM) for London Midland services between Hereford and Birmingham is approximately 85%. This means that 15% of services are over 5 minutes late to their terminating station and classed as 'Late'.
- 6.1.5 London Midland have indicated that because of the even shorter turnaround times arising from service extensions to Rotherwas, any train that is 'Late' would be at serious risk of having to terminate at Hereford instead of Rotherwas. This would have the knock on effect of the next service beginning at Hereford instead of Rotherwas, effectively removing two services at Rotherwas from the timetable on each occasion.
- 6.1.6 London Midland are currently operating to an annual average PPM of 88%³. Therefore, under the current timetable, an extension of the Birmingham to Hereford service to Rotherwas would be expected to negatively impact this.
- 6.1.7 In 2014 Network Rail were fined £1.5m for every 0.1 percentage point Long Distance services were 'Late' over Control Period 4 by the ORR. Whilst it is not possible at this stage to quantify any operational impacts of Rotherwas being included in London Midland's service, it is expected that under the current timetable, financial penalties to London Midland and Network Rail could be incurred should a service include Rotherwas.
- 6.1.8 Any impacted demand as a result of the operational constraints identified would be expected to impact passengers travelling to/from Rotherwas only, and not impact any journeys by passengers using the rest of the network.
- 6.1.9 It is considered that a revised timetable would have to be introduced to effectively include Rotherwas in the service between the existing Birmingham and Hereford service. If not, the service would be so unreliable that the forecasted rail demand to Rotherwas would be significantly impacted upon.
- 6.1.10 It is unclear as to what extent a revised timetable would impact on existing passenger journeys the service between Hereford and Birmingham and connecting services.

³ London Midland – About Us <http://www.londonmidland.com/about-us/company/performance/>

7 SUMMARY AND RECOMMENDATIONS

- 7.1.1 A new station is proposed within the Rotherwas Industrial Site, Hereford. This would include an extension of infrastructure to connect Rotherwas to the rail network.
- 7.1.2 This technical note has assessed the potential demand that would be generated by the proposed Rotherwas Station.
- 7.1.3 Following the methodology described, a base demand of 19,300 journeys per annum is forecast.
- 7.1.4 Allowing for population growth and future employment within the Hereford Enterprise Zone, the total forecast demand would be expected to be around 34,100 passenger journeys per annum by the assumed first year of operation, 2021.
- 7.1.5 A 60 year Value for Money Business Case showed that the current proposals offer a BCR of 0.33 which is defined as representing a poor value for money under DfT guidelines. Under the assumptions used for this appraisal, Rotherwas Station would need to generate a demand in the order of 70,000 passenger journeys per annum to be considered as good value for money.
- 7.1.6 Because of the low BCR, it is not considered that such a service could be delivered commercially and would therefore require a subsidy. The current shortfall of demand to generate a BCR of 2.0 is approximately 36,000 passenger journeys per annum, which using the average yield of £5.89 identified in Table 5 translates to a revenue shortfall of approximately £118,000 per annum. At a very high level, a subsidy in the order of £100,000 per annum could therefore be required.
- 7.1.7 It is considered that a revised timetable would have to be introduced to effectively include Rotherwas in the service between the existing Birmingham and Hereford service. If not, the service would be so unreliable that rail demand to Rotherwas would be significantly impacted upon. It is unclear as to what extent a revised timetable would impact on existing passenger journeys the service between Hereford and Birmingham and connecting services.
- 7.1.8 Any further information that becomes available in relation to a proposed station in Rotherwas could be used to update a more accurate demand forecast and BCR.
- 7.1.9 Further analysis could be undertaken to further investigate the potential demand from the HEZ employees as this is a key supplier of demand to the station. Finally, alternative options could be assessed to integrate Rotherwas and the HEZ into the public transport system and wider rail network. This could be via a Shuttle Bus operation between Hereford Station and the Enterprise Zone or general improvements to local bus services between central Hereford and the HEZ.