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Project	Magor and Undy Walkway Station – GRIP3
Subject	Initial Demand Forecast & Economic Appraisal (v2)

1. Introduction

Mott MacDonald has been commissioned by Monmouthshire County Council (MCC) and MAGOR to progress the Magor & Undy Walkway station proposals towards GRIP3 (Option Selection). The decision to proceed to GRIP3 will be based partly on the ability to develop a favourable business case for the station. The stronger the business case, the more likely it is that the proposal can attract funding.

In order to develop a strong business case for Magor & Undy station, it must be possible to demonstrate the:

- **Strategic Case:** that there is a need for a new station in this location – i.e. that a problem exists (or will exist) and that a new station is the correct solution to deal with this problem.
- **Economic Case:** that the new station will offer value for money in the widest sense, bringing economic, social, and environmental benefits. It must be possible to demonstrate that the benefits will exceed the costs of delivering and maintaining the station.
- **Financial Case:** that required expenditure is realistic given available or potential future funding sources.
- **Commercial Case:** that the station can be procured and there is a realistic chance of rail services being scheduled to serve the new station.
- **Management Case:** that the station is deliverable in technical terms and that risks can be managed appropriately.

Previous work at GRIP2, and additional work undertaken by MCC and MAGOR, has shown that there is a realistic chance of being able to demonstrate strong Strategic, Financial, Commercial, and Management cases for Magor & Undy Station. However, until now, there has been limited work undertaken in respect of the Economic Case.

Given that a new station at Magor & Undy is anticipated to give rise to positive social impacts and is not anticipated to lead to adverse environmental impacts, it is the economic impacts that need further detailed investigation. Furthermore, funding decisions for new stations often hinge on the expected Benefit to Cost Ratio (BCR). This Technical Note therefore presents the outcomes of the initial demand forecasting and economic appraisal work undertaken by Mott MacDonald for Magor & Undy station and provides an indication of the BCR that could be achieved.

2. Methodology

Forecasting Method

Demand forecasts for Magor & Undy have been made using a 'gravity' model method. Gravity models use existing rail demand data, service quality (frequency, destination, fare) information, competing mode data (for car and bus), and population and socio-economic data for areas around stations to forecast flows. The UK rail industry's Passenger Demand Forecasting Handbook (PDFH) suggests a gravity model approach for assessing proposed new stations on existing rail lines, where a range of possible destinations are being served. Services from Magor & Undy would be expected to serve Cardiff Central, Newport, Bristol Temple Meads, Gloucester, and Cheltenham directly, which makes a gravity model approach appropriate.

The demand forecasts have been translated into forecast benefits (Present Value of Benefits – PVB) using assumptions based on changes in passengers' end to end journey times, changes in parking charges or fares paid by passengers and received by transport operators (including bus operators), and the net change in vehicle-kilometres on the highway network due to modal shift. Changes in vehicle-kilometres lead to external impacts on levels of congestion and knock-on environmental (noise, greenhouse gas) impacts, as well as changes in the number of road accidents taking place. A combination of local data obtained by MAGOR and standard Department for Transport parameters (from WebTAG) have been used in estimating the PVB.

Assumptions

In forecasting the demand and benefits, a series of assumptions have been made in relation to:

- Time savings and penalties for passengers (including existing through passengers);
- Rail service patterns;
- Parking provision at Magor & Undy and the next nearest station, Severn Tunnel Junction;
- Suppressed demand at Severn Tunnel Junction due to parking capacity constraints; and
- New housing developments in Magor and Undy.

A full list of assumptions is provided in the 'Economic Appraisal Assumptions' Memo, 14th February 2017. These assumptions were discussed and agreed with MCC and MAGOR in advance.

The forecasts contained in this Technical Note are based on two rail service scenarios, as detailed in the assumptions Memo. To allow for a fair appraisal of the proposed new station, the forecast benefits are derived from a direct comparison of each scenario both 'With' and 'Without' the proposed new station stop. In summary, the two scenarios are:

- **Scenario 1:** Magor & Undy is served by 2 trains per hour in each direction (the hourly Taunton-Bristol-Cardiff service and a future hourly Cheltenham-Cardiff/Maesteg service).
- **Scenario 2:** Magor & Undy is served by 2 trains per hour in each direction (a new hourly Bristol-Cardiff stopping service and a future hourly Cheltenham-Cardiff/Maesteg service). The Taunton-Bristol-Cardiff service continues to operate, calling at Severn Tunnel Junction but not Magor & Undy. Another new hourly Bristol-Cardiff service is also assumed to be in operation, calling at Severn Tunnel Junction but not Magor & Undy.

In both Scenario 1 and Scenario 2, Severn Tunnel Junction is assumed to have a superior level of service than Magor & Undy.

3. Demand Forecasts

Table 1 presents demand forecasts for Magor & Undy station, and identifies the percentage of this demand that is assumed to have transferred from Severn Tunnel Junction (STJ). Opening year (2021) demand is assumed to be 70% of full annual demand, to reflect the ‘ramping up’ effect as people’s travel habits begin to change.

Table 1: Magor & Undy demand forecasts

Year	Passengers (annual) – total station entries and exits	Approx. % of new Magor passengers transferred from STJ
Scenario 1		
2021	125,572	10%
2026	203,399	10%
2036	222,814	10%
Scenario 2		
2021	132,353	10%
2026	214,168	10%
2036	234,309	11%

The 5% difference in forecast demand at Magor & Undy between Scenario 1 and Scenario 2 should not be seen as significant. The forecasts in Table 1 indicate that the increased relative attractiveness of Severn Tunnel Junction in Scenario 2 (in terms of rail service frequencies) does not appear to affect passenger numbers at Magor & Undy.

Table 2 provides a forecast of passenger destinations, based on the outputs of the gravity model. New demand for rail services at Magor & Undy is expected to be influenced particularly by people travelling to Newport and Cardiff, amounting to almost 60% of passenger throughput. Passenger numbers to Bristol are expected to be constrained because only one train per hour is assumed to be provided, compared to a minimum of two trains per hour from Severn Tunnel Junction. Higher levels of service to Bristol from Magor & Undy would lead to increased passenger numbers.

Table 2: Magor & Undy approximate passenger split by destination (Scenario 1 and 2)

Destination - Westbound	% split	Destination - Eastbound	% split
Newport	20%	Chepstow / Lydney / Gloucester / Cheltenham	24%
Cardiff & Vale of Glamorgan	39%	Bristol and Bath area	6%
S Wales valleys	1%	Other - England	3%
Marches line & N Wales	2%		
Other - West	5%	<i>Total (whole table)</i>	100%

To put the passenger number forecasts into perspective, **Table 3** sets out 2015/16 passenger numbers and service levels at comparable stations in South Wales and in the nearby Forest of Dean District of Gloucestershire. The comparable stations have similar population and location characteristics, serving stand-alone settlements that are within 10 miles of another station that has higher service levels.

Table 3: Comparable stations actual passenger numbers

Station	Passengers (2015/16) – total entries / exits	Rail service level (tph = trains per hour)
Caldicot	96,856	West: Up to 1tph to Newport/Cardiff, East: Up to 1tph to Gloucester/Cheltenham
Rhosee CIA	140,000 (excludes airport trips)	East: 1tph to Cardiff and the Valleys West: 1tph to Bridgend
Llanharan	169,428	East: Approx. 1tph to Cardiff/Newport West: Approx. 1tph to Bridgend
Lydney	185,232	West: Approx. 1tph to Newport/Cardiff East: Approx. 1tph to Gloucester/Cheltenham (6 per day continue to Birmingham)
Eastbrook / Dinas Powys combined	279,612	East: 4tph to Cardiff and the Valleys, West: 3tph to Barry Island / 1tph to Bridgend

Table 3 demonstrates the plausibility of the Magor & Undy forecasts (approximately 125,000 to 130,000 in 2021), given that it would be served by two trains per hour in each direction, including a direct service to Bristol. Other stations with lower service levels (such as Llanharan) manage to reach similar passenger numbers.

4. Monetised Benefits Assessment

Table 4 provides the estimated Present Value of Benefits (PVB) of Magor & Undy station for the two rail service scenarios. The PVB is a standard indicator used in economic appraisal to represent the expected current value of a future stream of benefits arising from a scheme, reported in a specified price base and with discounting in line with HM Treasury guidance. The higher the PVB, the more beneficial the scheme is expected to be.

Table 4: Estimated Present Value of Benefits (PVB) for Magor & Undy, full appraisal period

Scenario	PVB (2010 discounted prices)	Notes
Scenario 1	£11.828 million	PVBs and PVCs are presented in 2010 prices, as all monetised values (such as values of time) provided by the DfT in WebTAG are in 2010 prices.
Scenario 2	£14.271 million	

The estimated PVB for Scenario 2 is approximately £2.4 million higher than for Scenario 1. Scenario 2 has an increased Cardiff-Bristol rail service frequency, which means that a smaller proportion of 'through passengers' between Cardiff / Newport and Bristol would experience an increased journey time as a result of their train calling additionally at Magor & Undy.

The PVB has been estimated by summing the full range of net benefits. The proportional breakdown by benefit type is shown in **Figure 1** and **Figure 2**. The largest benefit (40-45% of the total PVB) is expected to arise from time and cost savings for commuter journeys.

Due to the reduced level of time disbenefits for ‘through passengers’, net time and cost benefits for business journeys are doubled in Scenario 2.

Figure 1: PVB breakdown for Scenario 1

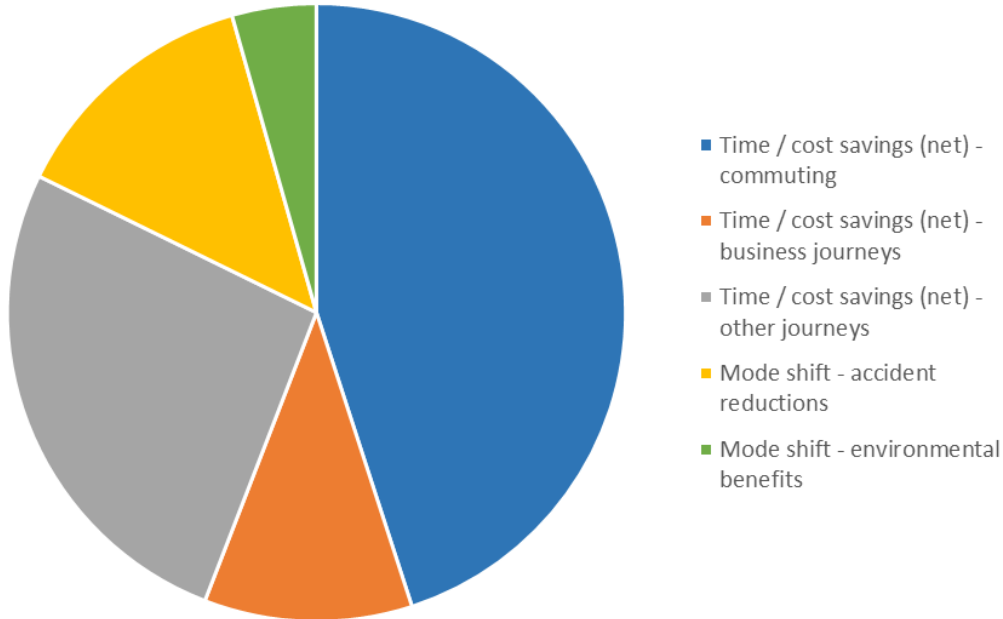
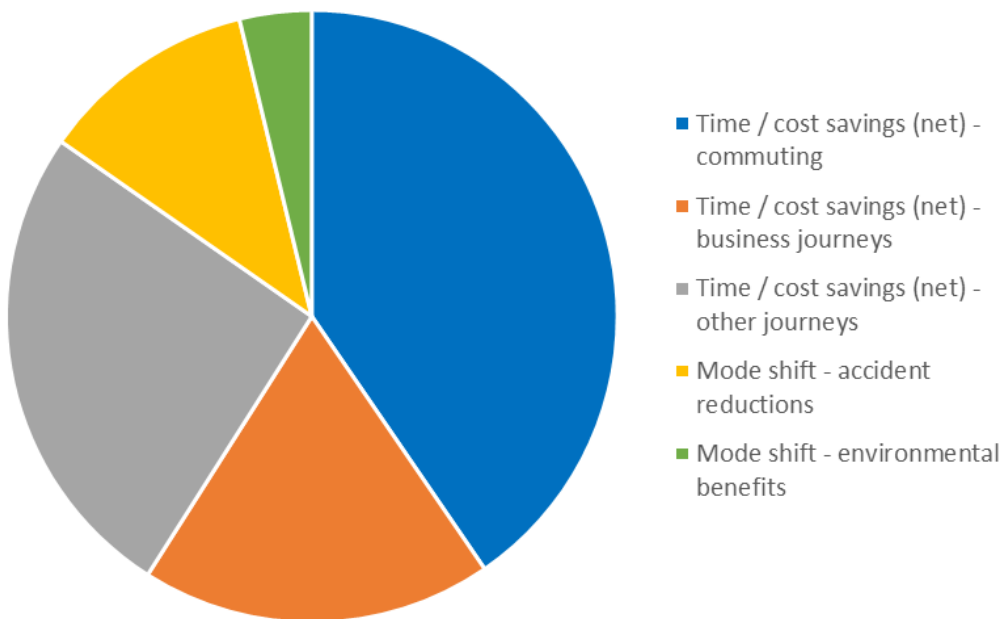


Figure 2: PVB breakdown for Scenario 2



5. Potential Benefit to Cost Ratio Thresholds

With an estimated PVB it is possible to provide an indication of the maximum acceptable level of expenditure in order to achieve certain Benefit to Cost Ratios (BCRs). Table 4 presents the implementation costs in 2016 prices that would allow BCRs at four different Value for Money (VfM) levels to be achieved.

In calculating the implementation cost ranges shown in Table 4, the following ballpark costs are already accounted for and removed:

- Ongoing station operating costs of £50,000 per annum (2016 prices) over the full 60-year appraisal period¹;
- Capital renewal costs equivalent to 20% of the total implementation cost over the full appraisal period²;
- Parking scheme set-up and monitoring costs of up to £10,000 per annum on average, to cover the area within walking distance of Magor & Undy station.

In estimating the PVB and therefore the target PVC and BCRs, the working assumption for fare revenues is that the Train Operating Companies (TOCs) would break even – the additional revenues gained would cover their additional costs, with no additional profit gained or additional subsidy requirement. Based on the demand forecasts in Section 3, the TOCs are expected to make a revenue surplus on the new station, which would strengthen the overall business case.

The implementation costs shown in Table 4 would need to cover all costs between GRIP3 and station opening, including design, preliminaries, construction, supervision, commissioning, and risk budgets.

For example, to achieve a BCR of greater than 2.0 (High VfM) then implementation costs are estimated to need to fall within the range £7.0 million to £8.6 million in 2016 prices.

Table 4: Relationship between target BCRs and station implementation costs for Magor & Undy

Target BCR (VfM category)	Estimated PVB range (2010 discounted values)	PVC range to obtain target BCR (2010 discounted prices) – <i>implementation & operating costs</i>	Implementation cost to obtain target BCR (2016 prices)
>1.0 (Low)	£11.8 - £14.3 million	£11.8 - £14.3 million	£14.4 - £17.4 million
>1.5 (Medium)	£11.8 - £14.3 million	£7.8 - £9.5 million	£9.5 - £11.5 million
>2.0 (High)	£11.8 - £14.3 million	£5.9 - £7.1 million	£7.0 - £8.6 million
>4.0 (Very High)	£11.8 - £14.3 million	£2.9 - £3.5 million	£3.4 - £4.1 million

¹ Assuming that the TOC would operate the station then station operating costs would need to be offset by fare revenues. Passenger demand forecasts for Magor & Undy suggest that the £50,000 per annum assumed in this note is unlikely to be a major cause of concern.

² The GRIP2 report indicated that direct construction works are estimated to be approximately 40% of the total implementation cost. A 20% capital renewal assumption is therefore based on replacing half of the value of direct construction works over the appraisal period.