

Appendix 4 - Details of Modelling process used for forecast of economic benefits

The existing Sheaf Valley Aimsun model was originally built as a 'results based' static model (user input vehicle flows and turning percentages) by MVA and later updated to a 2008 base model and converted to a full dynamic assignment model by Faber Maunsell/Aecom, with the matrices from the SRTM2 SATURN model.

For this study Arup have built a simplified network for the Sheffield end of the A61 corridor (see inset).

The 2012 Base year model time periods are as follows: AM peak: 08:00 to 09:00 hours; Inter peak: 10:00 to 11:00 hours; and PM peak: 17:00 to 18:00 hours. Current signal timings were provided by SCC.

All bus infrastructure within the modelled area (including bus lanes and bus stops) were checked and updated if necessary using sources including OS digital mapping, and aerial photographs. Bus routes have been coded into the model bases on timetable and routing information provided on the Travel South Yorkshire website. Dwell times for buses at each bus stop have been coded with both an average and standard deviation of 20 seconds. This results in a variation in bus stop dwell times, with some buses stopping for short periods (for example for passengers to alight), some buses stopping for longer periods (for example for passengers to board) and, in some cases, buses not stopping at all.

SCC provided comprehensive traffic data for the model study area. Seven junctions were surveyed on 6 November 2012 with one junction surveyed on 19 March 2012. The surveys were undertaken from 7am to 7pm at 15 minute intervals and were manual turning counts. In total 53 link counts were available for the AM, inter peak and PM peak hours.

Traffic demand for the model has been input in the form of origin-destination matrices. O-D matrices for three vehicle types were output: Cars; Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs).

The 2012 Sheaf Valley Aimsun microsimulation traffic model has been calibrated using Aimsun 7.0.3 (R20766). The calibration of the model has been assessed quantitatively by comparing modelled and observed link flows using the GEH statistic. All three modelling peak periods meet the requirement set out in DMRB for both the GEH statistics and the regression line analysis. Queue length and lane use validation was undertaken by eye by the modelling team and SCC officers using combined professional judgement and knowledge of the observed situation.

Arup considered that the calibrated and validated 2012 Sheaf Valley Aimsun microsimulation traffic model is a suitable tool for detailed testing of local highway schemes.

The initial purpose of the Sheaf Valley Aimsun model was to test proposals to remove the tidal flow lane currently operating along the A61 in the evening peak, together with junction improvements at the Wolseley Road/Queens Road/London Road junction. These measures are committed within the Streets Ahead programme and are hence included in the 'do-minimum' scenario for this latest project. They demonstrate the Council's intent to continued improvements in this corridor

To provide a comparison between the existing and proposed highway layout at Sheaf Valley, journey times have been collected for 8 sub-paths in the Do Minimum model and the proposed scheme model. Five replications of the Aimsun model have been undertaken for the AM and PM peak hours. Each of the replications is unique, based on randomly generated seed and represents day-to-day variation.

The BCR process was undertaken based upon the Department for Transport (DfT) Transport Analysis Guidance known as WebTAG. The values used were from the WebTAG Databook Version 1.7 published in March 2017. The guidance used was from:

- TAG UNIT A1.1 Cost Benefit Analysis (November 2014)

- TAG UNIT A1.2 Scheme Costs (November 2014)
- TAG UNIT A1.3 User and Provider Impacts (March 2017)

These documents were all the latest versions at the time of the assessment. For all calculations, prices were to be discounted to the current DfT Base Year of 2010.

Travel time savings have been based on Aimsun model output for the morning and evening peak hours and factored to peak period periods using local ATC data.

As the Value of Time (VoT) for each vehicle class increases each year, a delay saving was required for each year to apply the relevant VoT to. The vehicle class delay difference per period was growthed to an annual equivalent by multiplying it by 253 working days. This figure is calculated using the formula:

$$\text{Working days} = 365(\text{days/year}) - [52(\text{weeks/year}) \times 2(\text{days/weekend})] - 8(\text{bank holidays/year})$$

Travel time savings for the inter peak, off peak and weekend have not been quantified. Travel time savings have instead been monetised and extrapolated over a 60-year appraisal period in line with WebTAG Databook March 2017 Release v1.7 to reflect default values for journey purpose, occupancy etc, assuming a 2020 opening year for the scheme. No account has been made for traffic growth. Discounting was undertaken within a spreadsheet over the 60-year period using a 3.5% discount rate for the first 30 years and then a 3% discount rate for the next 30 years, as defined in WebTAG, and in line with Treasury Green Book guidance.

The scheme is estimated to be £3.052 million at 2017 prices. The scheme is assumed to be constructed in 2019 with an adjustment for a real costs increase of 5.2% per annum for construction relative to an economy wide inflation rate of 2.5% per annum. An Optimism Bias of 44% was applied to reflect “a demonstrated systematic, tendency for project appraisers to be overly optimistic” [HMT Green Book, 2003, p.29] at this stage of scheme development. As project-specific risks become better understood, quantified and valued, it will be possible to better capture the factors that contribute to optimism bias within the risk management process. Therefore, as risk analysis improves as the scheme develops, it is expected that the risk-adjusted scheme cost estimate will become more certain while the applicable level of optimism bias will decrease. In order to convert the cost to present value of cost at 2010 market prices discounted to 2010, appropriate deflation, discount and taxation factors were applied.

In summary the scheme is estimated to generate a present value of benefits (PVB) of at least £16.785 million relative to a present of costs (PVC) of £3.644 million, providing a net present value (NPV) of £13.141 million and a benefit to cost ratio (BCR) of 4.61 which can be categorised as provide a very high value for money (greater than 4.0).