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| Client | **Manchester City Council** |
| Report | **TfGM HFAS Report 1892** |
| Project | **NEQ Great Ancoats Street Scheme Design Options** |
| Subject | **Paramics Base Model Development Note** |

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Originator [redacted]

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| 04.04.16 | Manchester CC | [redacted] |

## 1. Executive Summary

1.1 This note details the development of a base year Paramics micro-simulation model covering A665 Gt Ancoats St in the regional centre.

1.2 The model was developed using traffic count data collected during January 2016 and was built for the weekday morning (07:00-09:00) and evening (16:00-18:00) peak hours. The time periods modelled were determined by calculating the busiest hours during the wider peak periods.

1.3 Two vehicle user classes were modelled; light vehicles (comprising cars and light goods vehicles) and heavy vehicles (comprising medium and heavy goods vehicles). Proportional splits within each user class were determined from observed count data in the modelled area. Light and heavy vehicle demand matrices were derived using traffic counts.

1.4 The model network was developed using a combination of base maps, aerial photographs and site visits. Traffic signal information was coded from detailed traffic signal logs extracted from the UTC system database in January 2016 and from detailed traffic signal site drawings.

1.5 Bus data was coded using information taken from TfGM's AS400 bus database, assuming that all buses stopped at each stop for 30 seconds.

1.6 In common with other micro-simulation models, warm up periods were modelled to ensure that traffic was already on the network at the start of each peak hour. Traffic entering the model from entry points that had counts on them was profiled according to the counted data in 15 minute segments. This models variations in traffic flows within the peak hours themselves.

1.7 Results from a statistically significant number of model runs were compared with observed turning counts (61 in total) and observed journey times using Bluetooth technology (for the period 14th-18th March 2016).

1.8 Counts validation for the model is very good with 95% and 92% of turning flows with a GEH of 5 or less for the morning and evening peak hours respectively. This shows the model displays a high degree of correlation between modelled and observed flows.

1.9 Journey time validation for the six defined routes meets WebTAG guidelines for 4 out of 4 routes during both modelled periods.

1.10 Overall the model replicates existing conditions very well and we consider it a suitable tool for modelling forecast year scenarios.

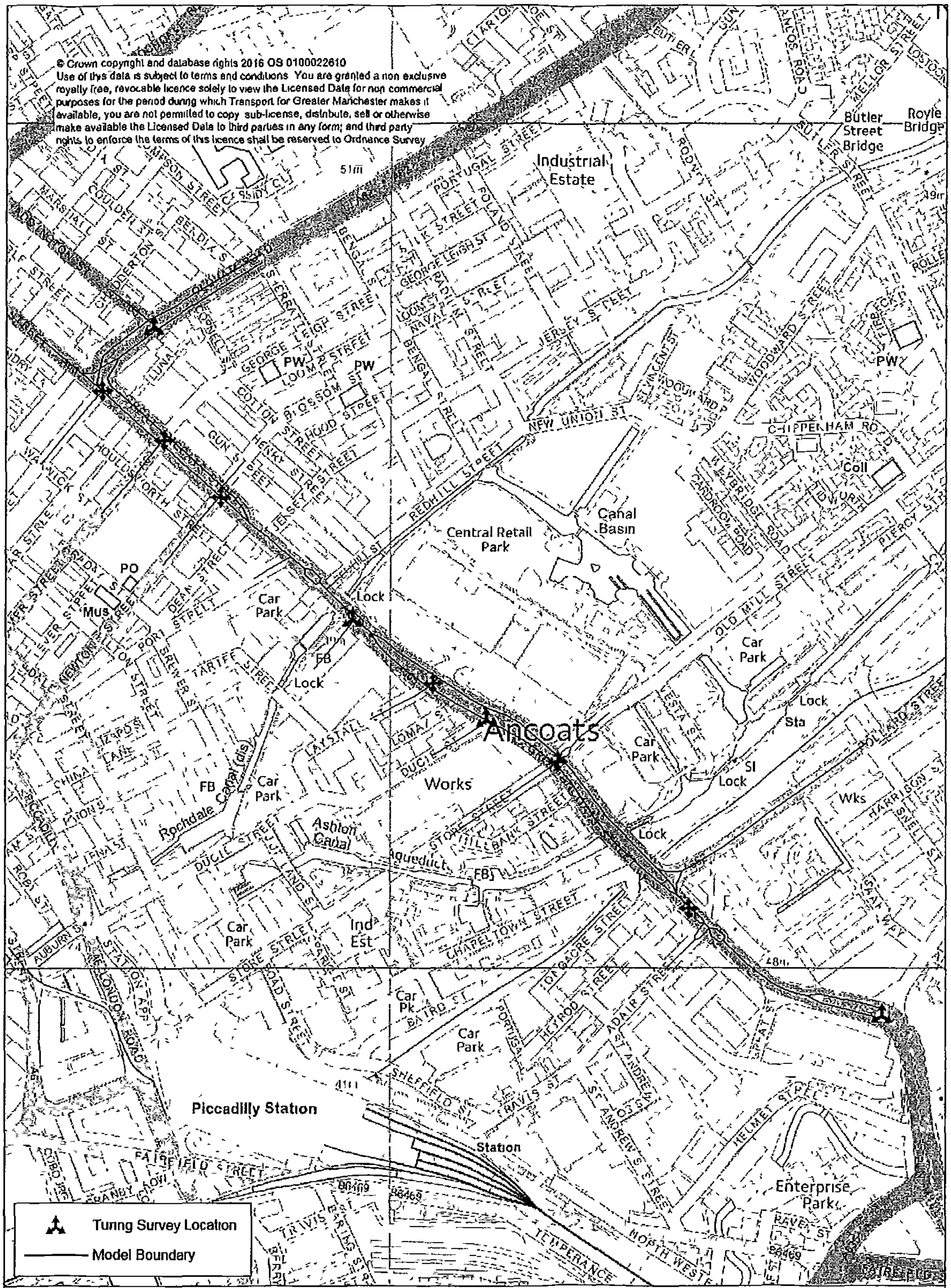
## 2. Introduction

2.1 This technical note explains the development and calibration / validation of the base model for A665 Gt Ancoats St, regional centre. The model has been built for the AM and PM peak time periods and each period has been calibrated / validated to existing traffic conditions using PARAMICS microsimulation software.

2.2 The purpose of this model is to provide a solid base, on which to determine the impact of any future developments and associated mitigation works.

2.3 The model includes the following key junctions (Figure 1):

- A665 Addington St/A62 Oldham Rd;
- A665 Swan St/A665 Gt Ancoats St/U Oldham St
- A665 Gt Ancoats St/A62 Lever St
- A665 Gt Ancoats St/A62 Newton St/U Blossom St
- A665 Gt Ancoats St/U Port St
- A665 Gt Ancoats St/U Redhill St
- A665 Gt Ancoats St/Urban Exchange
- A665 Gt Ancoats St/U Laystall St/Central Retail Park
- A665 Gt Ancoats St/U Ducie St
- A665 Gt Ancoats St/U Store St/U Old Mill St
- A665 Gt Ancoats St/A662 Pollard St
- A665 Gt Ancoats St/U Adair St

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| Transport for Greater Manchester<br>2 Piccadilly Place,<br>Manchester,<br>M1 3BG | Drawn By atkinsonm | Date · 24/03/2016 |
| | Scale NTS | Report 1892 Figure 1 |

## 3. Model Development

3.1 S-Paramics is a suite of high performance software modelling tools and represents a new approach to the understanding, representation and analysis of road traffic. Individual vehicles are modelled in fine detail for the duration of their entire trip, providing accurate traffic flow information necessary for the analysis of congested road networks.

3.2 This model has been calibrated using site observations and traffic turning surveys collected on Wednesday 20th January 2016, as illustrated in Figure 1 above.

3.3 Journey time data from Bluetooth detectors was extracted for the period 14th-18th March 2016 and modelled times were compared with observed Bluetooth journey times.

**Model Inputs / Adjustments**

3.4 The models have been developed to reflect actual driving behaviour and replicate traffic flows in the area.

3.5 Bus routes and associated schedules have been included using information from TfGM's AS400 bus database. All bus services timed to start their journey within the modelled time periods have been included within the model.

3.6 All bus stops have been included in the study area. A dwell time of 30 seconds has been assumed for each service at its scheduled bus stops.

3.7 Traffic signal operation data is based on observed detailed signal timing logs collected w/c 18th January 2016 and UTC plans. The logged data indicates that the pedestrian stages run frequently, so they have been included in this model.

4.1 Base year traffic demand matrices were derived using observed turning counts,

4.2 Demand matrices were produced for the two busiest hours during the AM & PM peaks, as determined using the observed count results across the modelled area:

- Weekday AM Peak: 08:00-09:00
- Weekday PM Peak: 17:00-18:00

4.3 The model includes a 60 minute warm-up to ensure a representative amount of traffic on the network at the beginning of the peak period.

4.4 Two user classes were modelled for each time period.

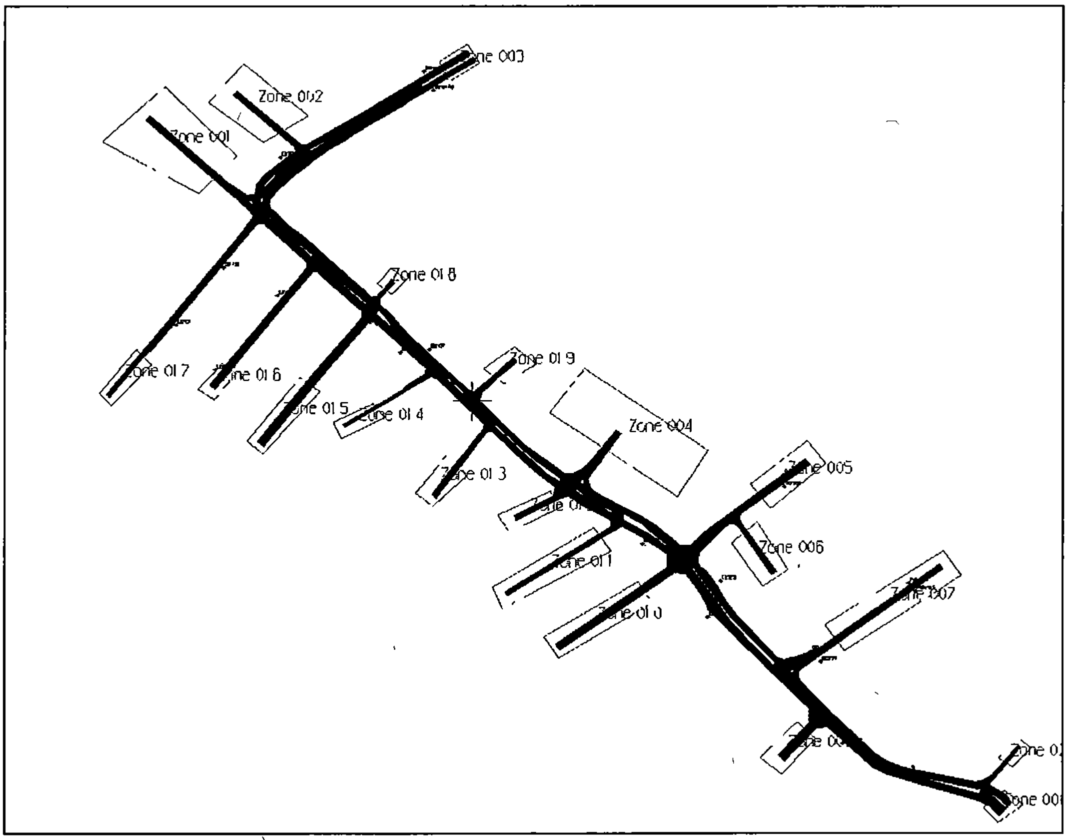
- Lights (Cars & LGV's)
- Heavies (MGV's & OGV's)

4.5 The following table details the vehicle type proportions assumed for each of the demand matrices in each of the two modelled time periods. These values were derived from classified link counts available within the AOI.

**Table 1 – Vehicle Type Proportions**

| **User Classes** | **AM Peak** | **PM Peak** |
|---|---|---|
| Light Vehicles | Car (95%) | Car (95%) |
| | LGV (5%) | LGV (5%) |
| Heavy Vehicles | MGV (100%) | MGV (100%) |

4.6 The modelled area was divided into 18 zones representing all roads entering the study area. Figure 2 below shows the modelled area.



4.7 In order to replicate accurately the peaking of traffic flows, the peak period matrices were profiled, (i.e. the rate of release of vehicles into the microsimulation network was varied over the time period). Profiles define the proportion of trips starting their journey in each 5-minute time slice over the modelled time period.

4.8 Individual flow profiles were developed for the traffic model based on manual classified count data which provided counts in 15-minute periods. These 15 minute profiles were applied to 5 minute periods.

5. **Model Calibration / Validation**The calibration/validation of the models has been carried out using two main parameters: observed traffic flows and journey times.

5.2 The model has been validated against comparable observed conditions. To gain a suitable average and ensure that the Paramics modelled data is representative, all validation data is based on an average of 10 modelled runs using different random seeds.

**Turning Movements**

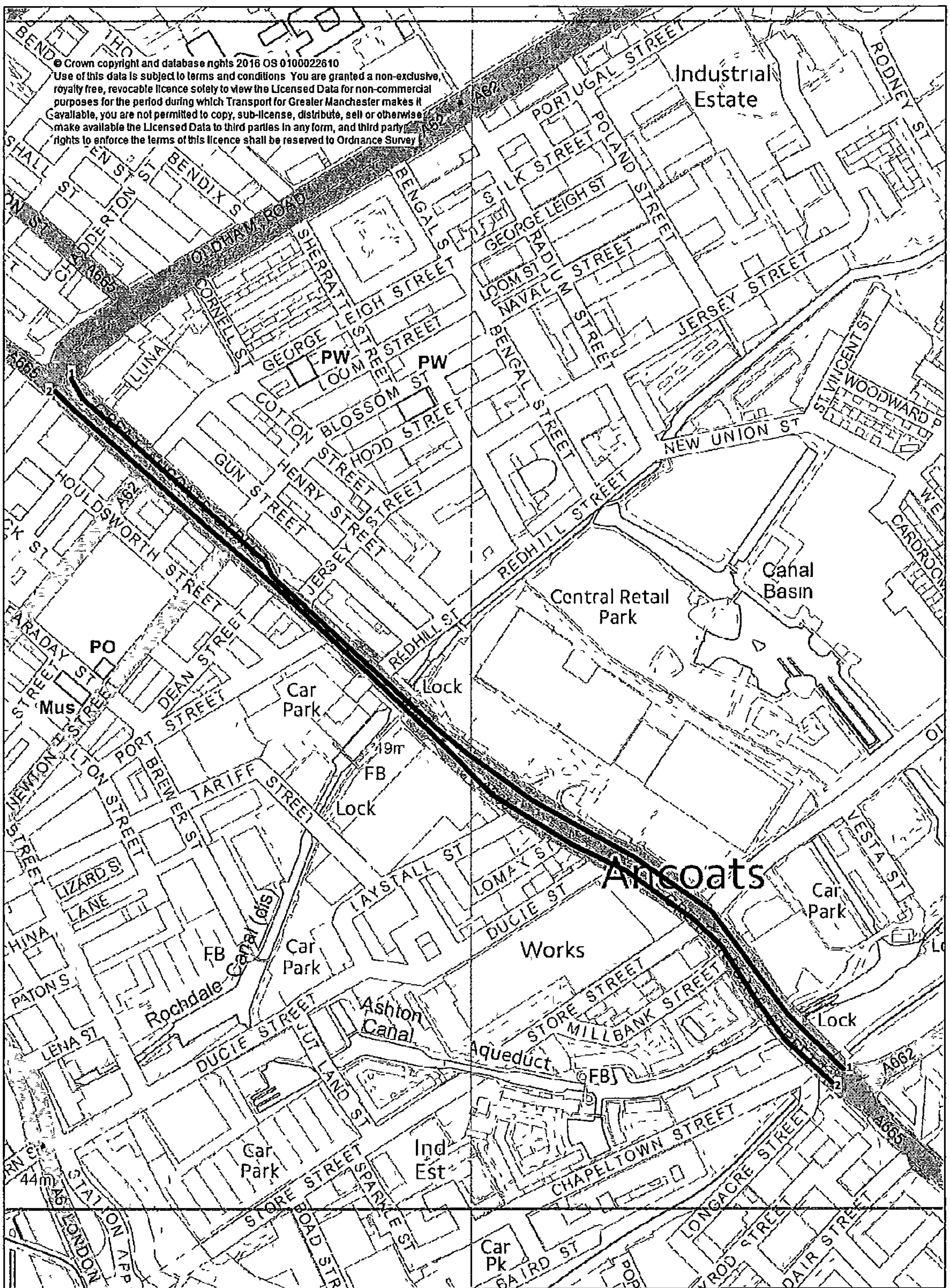
5.3 For each time period the modelled flows compare well with the counted turning movements, with the GEH statistic for the majority of turning movements being 2 or lower. This is significantly lower than the recommended maximum GEH of 5 in WebTAG guidelines and indicates a very good fit between the modelled and the observed flows.

**Table 2 – Turn Flow Validation - GEH Statistic**

| Time Period | No of Turning Movements | % of Counts With: | | |
|---|---|---|---|---|
| | | GEH < 5 | GEH 5-7.5 | GEH > 7.5 |
| AM Peak Hour | 61 | 95% | 3% | 2% |
| PM Peak Hour | 61 | 92% | 5% | 3% |

**Journey Times**

5.6 The comparison of observed and modelled journey times for routes through the network can be seen in the graphs below. The journey times have been measured on the approaches and exits for two routes, as illustrated in Figure 3 below.

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| | Scale NTS | Report 1892 Figure 3 |

5.7 There is generally a good fit for all routes, as can be seen in the following graphs.

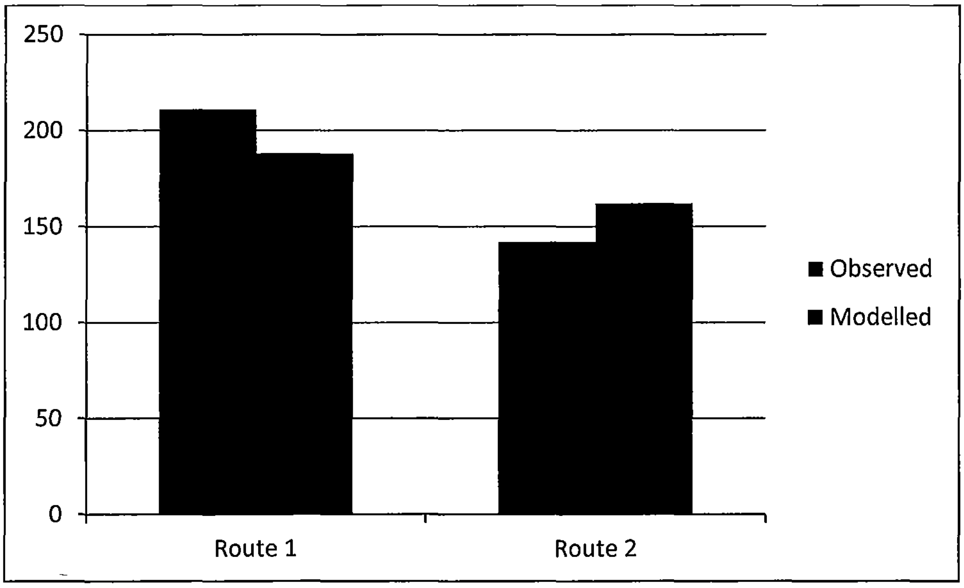
5.8 The observed journey times have been derived from Bluetooth detectors on Great Ancoats Street for the period 14th-18th March 2016 from the C2 database.

5.9 The DMRB requirement for journey time validation is that modelled times should be within 15% (or 1 minute if this is higher) of the observed time on more than 85% of routes.

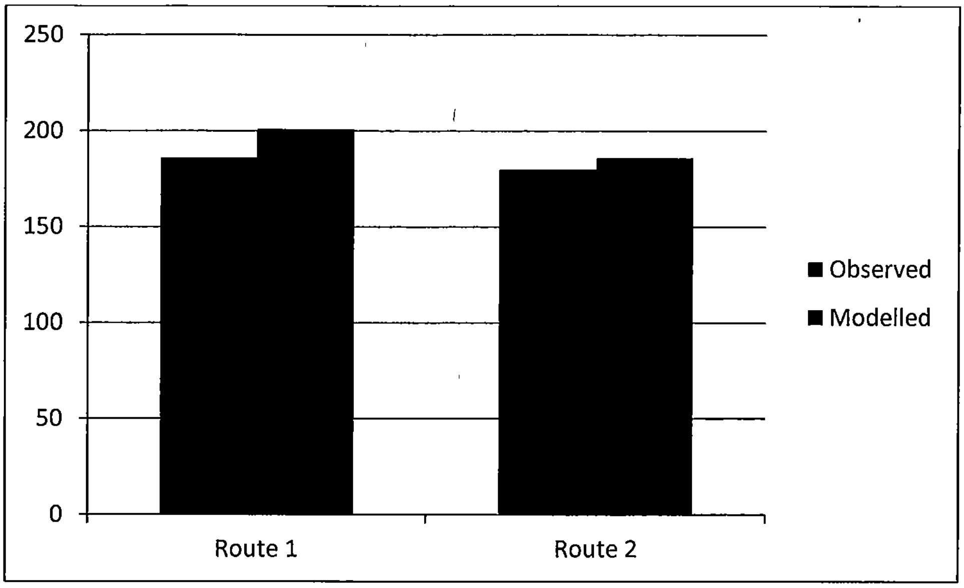
**Table 4– Modelled vs Observed Peak Hour Journey Times (mm:ss)**

| Time Period | Route No' | Direction | Observed Time | Modelled Time | Modelled - Observed | % Error | Within DMRB |
|---|---|---|---|---|---|---|---|
| AM Peak Hour | 1 | SE | 03:31 | 03 08 | -0 23 | 11% | Yes |
| | 2 | NW | 02:22 | 02:42 | 0 20 | 14% | Yes |
| | | **Total** | **05:53** | **05:50** | **-0:03** | **1%** | **Yes** |
| PM Peak Hour | 1 | SE | 03.06 | 03:21 | 0:15 | 8% | Yes |
| | 2 | NW | 03·00 | 03:06 | 0:06 | 3% | Yes |
| | | **Total** | **06:06** | **06:27** | **0:21** | **6%** | **Yes** |
| Number of routes satisfying DMRB criteria = 4 out of 4 (100%) | | | | | | | |

5.10 Weekday AM Peak Hour Journey Time Graph




5.11 Weekday PM Peak Hour Journey Time Graph




**6. Conclusions**The model provides a very good level of fit with observed on-site conditions, with modelled turning movements, and all journey times correlating extremely well with observed data.

6.2 The modelled outputs were taken as averages of 10 model runs during each time period. Performing multiple runs and averaging the data is statistically more robust than relying on a single run of the model. Analysis undertaken by HFAS indicates that a minimum of 5 runs would be statistically robust for this model.

6.3 We conclude that the model represents observed conditions well and that the model is robust and a suitable tool for testing the impact of changes to the network