Appendices

Appendix B – Network Analysis Tool

1. Introduction

This technical note provides a summary of the Highways England Network Analysis Tool (NAT) and the process used to provide data from the tool and make it suitable for the West Yorkshire MESO model. The West Yorkshire MESO model has been developed for assessment of the West Yorkshire Strategic Road Network to understand the future year infrastructure requirements.

This note will provide a summary of the following areas:

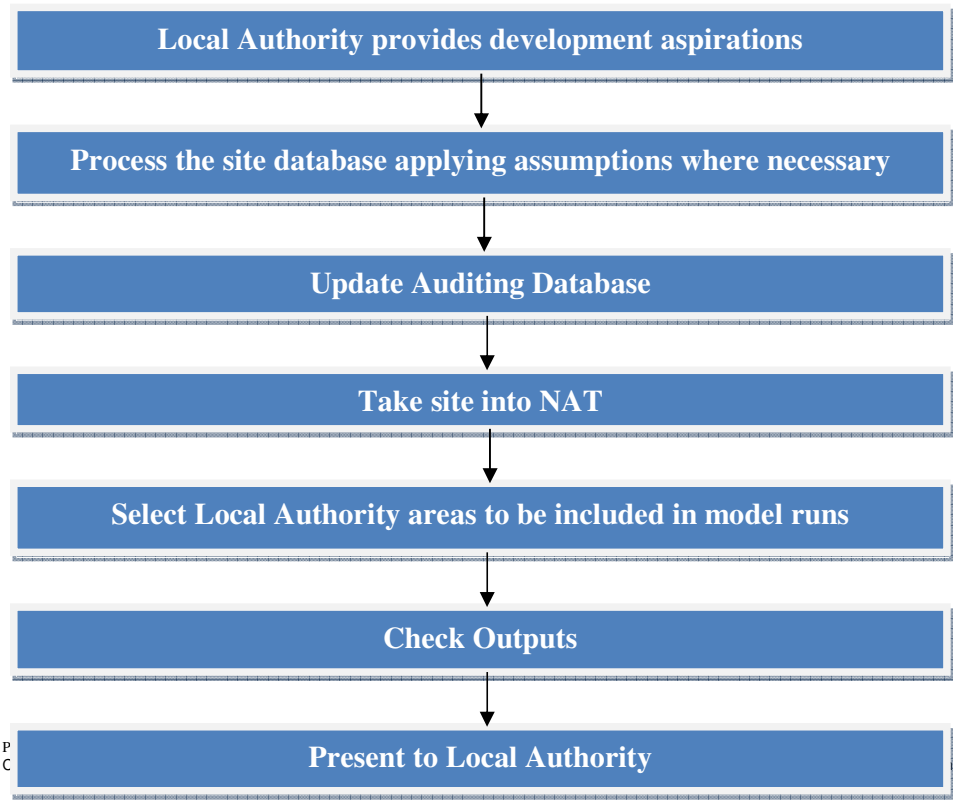
1. How the Network Analysis Tool works
2. The Base Network
3. The future network, including the schemes
4. The development data, and in particular the development data used in the West Yorkshire Infrastructure Study
5. The process of conversion to MESO

2. Summary of the Network Analysis Tool (NAT)

NAT is a *Microsoft Excel* based forecasting model used to identify the impact of trips on the Strategic Road Network resulting from Local Authority development aspirations. Within this, the feasibility of the development sites can be assessed and those with the largest impact identified, allowing for a more efficient planning process. NAT reports the likely number of vehicles on each link of the Strategic Road Network and the relative stress that this is likely to cause. The likely impact of development aspirations can be forecast between 2011 and 2031.

NAT covers the whole of Yorkshire and Humber and was originally built in 2007, but was updated in January 2012 to predominantly take account of the changing economic climate. Figure 1 summarises how NAT works.

Figure 1: Summary of NAT



3. The Base Network

NAT is based on the SWYMBUS SATURN model and this has been transposed into excel so the tool does not require access to SATURN to be run. The SATURN model was updated in 2012. The SATURN model has all Strategic Road Network and the A roads across Yorkshire and Humber.

Traffic monitoring loops are in place on the Strategic Road Network. These are used to provide the base traffic counts and journey times for the strategic road network included in NAT. The update to NAT has used the data from June 2011 to form the base year for the model. AECOM have been supplied with data from the journey time database for the whole of 2011 broken down by 15 minute time periods. Only data from the eight 15 minute periods between 0800-0900 and 1700-1800 were used for determining stress levels within NAT. The morning and evening peaks are analysed separately.

4. The Future Network

The future network in NAT uses the base network and considers three important factors:

a. Future year transport schemes
b. Future year Local Authority Development aspirations and trip growth

4a. Future Year Transport Schemes

A number of road schemes have been included in the NAT model. For the majority of cases, these are accommodated within the NAT tool by increasing the capacity on the relevant links. Table 1 provides a summary of the future Year Transport Schemes included in NAT.

Table 1: Summary of the Transport Schemes by Opening Year

Scheme	Year Activated	Scheme	Year Activated	Scheme	Year Activated
A1 Dishforth to Barton	2013	M62 J20-25 SMART MOTORWAY	2022	M62-M606 Chain Bar	2030
M62 Motorway Improvements (J25-30)	2016	M1 J41 Ardsley	2022	Brighouse_Bypass	2022
M1 J30-31	2013	M621 Jun1-2	2022	M621_JUNC24A	2022
M1 J32-35A Managed Motorways	2012	M621 Jun2A-3	2022	Cooper Bridge Junction	2030
M1 J35A-39 Managed Motorways	2020	Glasshoughton Southern Link	2022	M1-M62 Lofthouse Interchange	2030
M1 J39-42 Managed Motorways	2016	Pontefract Northern Bypass	2022	ELOR	2030

A63 Castle Street	2017	Wakefield Eastern Bypass	2022	York ORR	2022
A160	2017	Ravensthorpe Relief Road	2022	White Rose Way	2022
FARRRS	2022	Hatfield Link	2022		

4b. Future Year Local Authority Planning Aspirations

The planning data used to forecast future year trips and stress on the Network is based upon the latest information provided to the Highways England by the Local Authority. This is continually updated as the Local Authority refines their planning aspirations.

To translate the data provided by the Local Authority into a format that is suitable for NAT, a series of assumptions have to be used. This includes the following:

- Each site is allocated to one of the 754 zones in NAT;
- Each site is allocated a trip rate. The trip rates in NAT have been generated using TRICS 2008(b) and the trip rate allocated to a site is determined by the likely land use of the site and how far away it is from the nearest main urban area; and
- The distribution of traffic across the country is determined by the 2011 Census Journey to Work Database. For a given Local Authority, this determines where the trips come from and where they travel to.

Where both housing and employment trips are loaded into NAT, the trips are only counted at their origin end to make sure the trips are not counted twice. NAT then works by finding the least congested route for each journey. This ensures that we can represent some of the normal travel behaviour habits of those travelling between housing and employment sites.

Every zone is allocated a location code, either centre, edge of centre, suburbs or out of town. Where the type of employment land use is not specified then an assumption has to be made. Table 2 outlines the allocation of assumed land use by location.

Table 2: Land Use Class Assumptions Based on Location Type

Service Centre	
Centre	B1
Edge of centre	B1, B2
Suburbs	B1, B2, B8
Out-of-town/village	B2, B8

Where the number of dwellings was not specified, an assumption was made that for every hectare 30 dwellings would be built. This is the minimum requirement according to PPS3.

For the West Yorkshire Infrastructure Study, the future years of 2022 and 2030 were assessed for both the committed and proposed networks, in the morning and evening peak. The assessment years were determined through a review of the local authorities' core strategy programmes. In each forecast year the following development scenarios have been included are set out in Table 3.

Table 3: Development scenario by Local Authority

Local Authority	Development Option	Date Data Received
Bradford	Preferred Core Strategy development option. The data is spatial aspirations by ward.	January 2014
Calderdale	Core Strategy option 1 of the four options from the 'Issues and Options'.	February 2011
Kirklees	Preferred Core Strategy development option. The data is spatial aspirations by ward.	December 2012
Leeds	Preferred Core Strategy development option. The data is by site	March 2014
Wakefield	Specific sites as agreed in the Development Plan Document and approved at Enquiry.	July 2014 (2011 DPD document)

The 2022 development scenario contained the trips from all development sites that are likely to start having an impact. As 2030 is the end (and in some cases beyond) the plan period then this development scenario contains all development information as specified in Table 3, above. It should be noted that where spatial aspirations by ward have been provided by the Local Authority then the exact time at which these locations are likely to have an impact upon the network is unknown. In this case a gradual impact from 2012 through to 2028 is assumed. Where specific developments site are provided then their expected build years are included in the scenario.

Trip generations from Local Authorities sitting outside of West Yorkshire have been increased using TEMPRO.

Development trips are distributed using the observed distribution in the 2011 Census Journey to Work Database. This origin-destination matrix is then furnessed to remove the double counting of trips. This matrix details how many trips travel between every zone to zone movement. Route information from the SATURN model determines the most likely route between two zone pairs and then the development flow for each link is calculated as follows:

1. Each link starts with no development flow;
2. Identify how many trips travel from zone A to zone B;
3. Identify which links are used to travel from zones A to B;
4. For each of these links add these trips to the running total;
5. Move onto the next zone pair until each zone pair has been considered

This is repeated for all of the 64,516 zone pairs, giving the total number of trips travelling on each link of the SRN.

Trips are assumed to take the same route in the AM and PM peak hours, though the number of trips will be based on their respective development matrix. A limitation of the routing process is that no reassignment of existing traffic occurs as a result of additional congestion created by the development traffic. Equally, the development traffic continues to follow the routes from the base SATURN model even though in reality these may come more congested as a result of the development flows.

This then provides the future year trip matrix that can be used to display the impact on the strategic road network and is also used for inputting into other models.

5. Process to Transfer Data to the MESO Model

To ensure the development information from NAT is in a suitable format for assessment in the MESO Model, a conversion process has to take place. This is done by running NAT spreadsheet model to extract the demand matrices, and assigning the SATURN element. The NAT assignment performs the following tasks:

- Converts future year land use into trip ends:
- Furnesses the matrices to generate a future year development demand matrices (these are TEMPRO constraint): and
- Assigns the NAT model.

The future demand matrices generated by the NAT model are extracted and combined with the base year matrices; this then becomes future year matrix which is used to assign the SATURN model.

To undertake the SATURN assignment a two step methodology has been devised as follows:

- Assign and simulate the base year matrix to a future year network. The future year network will include all the do minimum proposed mitigations: and
- Assign and simulate the future year matrices to a future year network.

The two stage methodology enables the user to use a certain parameter within the SATURN software. This parameter enables the user to undertake an assignment whereby the assignment paths are extracted from the first assignment using the base year matrix. However, the demand being assigned is from the second assignment which is based on the future development demand matrices. The purpose of this study is to demonstrate where highway interventions are required once all proposed Highway mitigations and land use scenarios have been built and developed. This methodology, therefore limits the re-routing of the development flows to provide indication of where congestion is likely to materialize in the future. The outputs from the assignment will show congestion hotspots with high levels of delay, indicating a possible location for future year Highway Mitigation.

Post the model assignments, the SATURN model was cordoned to the external limits of the MESO model study area as indicated in
Figure 1 and **Figure 2**.

Figure 1: The below plot indicates the extents of the full Saturn model as used within the NAT model

Figure 2: SATURN cordon model based on the External Limits of the MESO model extents.