The Lake Lothing (Lowestoft) Third Crossing Order 201[*]

Document 7.2: Transport Assessment

Appendix F
Technical Note Synthetic Matrices

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TECHNICAL NOTE

DATE	04 May 2018		CONFIDENTIALITY	Internal
SUBJECT	**Lowestoft SCTM – Synthetic Trip Matrices**			
PROJECT	**AUTHOR**		**CHECKED**	**APPROVED**
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1. INTRODUCTION

1.1. A verification process was undertaken on the Mobile Network Data (MND) prior to its use to build the prior matrices for the Suffolk county Transport Model (SCTM). The verification process identified a shortfall in the short distance trips within the dataset.

1.2. The shortfall of trips is due to the reliance of mobile network data on capturing trips between mobile network cells. Trips within these cells are highly likely not to be captured as the mobile device doesn't appear to be moving when it isn't changing the cell it is contacting. The verification work and correspondence with the mobile network operator indicated that short distance trips would therefore be underrepresented, and a process was outlined to infill these short distance trips with a synthetic matrix.

1.3. In the Lowestoft transport model, the process used to develop the synthetic matrices is based upon the 2011 Census journey to work data and uses a 2km cut-off distance to split between the synthetic trips and the mobile network data. This technical note details this process and how the synthetic matrix process influences the trips in the Lowestoft area of the model.

2. SYNTHETIC MATRIX BUILD PROCESS

2.1. The synthetic matrix has been constructed using 2011 Census journey to work data at an output area level. This data provides a good level of detail on the outbound home-based work trips across the country. The highway element of the transport model contains 10 matrix levels:

1 Car Home Based Work (Inbound direction);
2 Car Home Based Work (Outbound direction);
3 Car Home Based Employers Business (Inbound direction);
4 Car Home Based Employers Business (Outbound direction);
5 Car Non-Home Based Employers Business (non-directional);
6 Car Home Based Other (Inbound direction);
7 Car Home Based Other (Outbound direction);
8 Car Non-Home Based Other (non-directional);
9 Light Goods Vehicles; and
10 Heavy Goods Vehicles.

2.2. The synthetic matrices have only been constructed for the car purposes for the highway model as the light goods vehicle and heavy goods vehicle trip numbers below 2km are considered to be insignificant.

2.3. The census journey to work dataset provides the matrix level 2 purpose directly. For the remaining matrix levels the following methodology was used:

§ For trips in an outbound direction, use the matrix distribution as per matrix level 2;
§ For trips in an inbound direction, transpose the matrix (swap the origins and destinations) so that the distribution of trips is in the opposite direction;

§ For trips without a direction, average the inbound and outbound matrices to provide a distribution with no specific weighting to or from home.

2.4. The trip matrices have then been factored to adjust them for both time of day (as Census data is 24 hour) and to scale the number of trips expected for that purpose. These factors have come from National Travel Survey data for the East of England region as a whole, with factors calculated as all-transport-mode factors due to sample rates being too low to split out factors by transport mode.

2.5. An additional factor has been used to adjust the matrices to include education trips as part of the home-based work matrix levels as education trips are not included in Census journey to work trip values. This factor has also come from National Travel Survey data, as above.

2.6. A final factoring has been applied to scale the matrices from 2011 values to 2016 values, using National Trip End Model 7.2 data calculated using TEMPro 7.2.

3. OVERALL MATRIX SUMMARY

3.1. The trip matrices for the highway model are split in to three time periods:

§ AM peak hour
§ Interpeak average hour
§ PM peak hour

3.2. Table 1, Table 2, and Table 3 provide the matrix totals per matrix level and overall for the Mobile Network Data matrix before being combined with the synthetic data, and the combined matrix. The values within Tables 1, 2 and 3 are at the step of combining the MND and synthetic data during the matrix construction process.

Table 1 - AM Matrix Totals

Matrix Level	MND Total	Combined Total	Change	% Change
1	148	1,615	1,467	991%
2	129,552	134,816	5,264	4%
3	786	745	-41	-5%
4	7,337	7,745	408	6%
5	7,888	9,778	1,890	24%
6	8,260	8,713	453	5%
7	76,821	77,829	1,008	1%
8	18,067	17,611	-456	-3%
Total	**248,859**	**258,852**	**9,993**	**4%**

Table 2 - IP Matrix Totals

Matrix Level	MND Total	Combined Total	Change	% Change
1	14,394	15,005	611	4%
2	11,954	12,501	547	5%
3	1,544	1,670	126	8%
4	1,602	1,654	52	3%
5	5,491	6,980	1,489	27%
6	43,694	46,342	2,648	6%
7	45,429	47,809	2,380	5%
8	20,229	21,586	1,357	7%
Total	**144,337**	**153,547**	**9,210**	**4%**

Table 3 - PM Matrix Totals

Matrix Level	MND Total	Combined Total	Change	% Change
1	129,220	133,380	4,160	3%
2	683	1,183	500	73%
3	5,839	6,550	711	12%
4	1,937	1,955	18	1%
5	5,798	7,873	2,075	36%
6	83,177	83,915	738	1%
7	27,584	28,692	1,108	4%
8	26,229	26,407	178	1%
Total	**280,467**	**289,955**	**9,488**	3%

3.3.   The change in each time period is a gain of between 9,000 and 10,000 trips across the matrix as a whole.

3.4. Once the MND and synthetic matrices have been combined, processes are applied to reassign rail trips (to include car trips that access rail stations) and to filter out external trips that don't enter the simulation area. This affects the overall size of the matrix and Table 4 illustrates the impact on the percentage change the synthetic matrices have against the final matrix totals.

Table 4 - Post External Filter Trip Increase Assessment

Time Period	Synthetic Change	Post External Filter	Percentage of Final Trips Added by Synthetic
AM	9,993	129,011	8%
IP	9,210	88,756	10%
PM	9,488	143,988	7%

4. LOWESTOFT MATRIX CHANGES

4.1. Those zones that sit within sector 720 of the model which represents the Lowestoft area have been used to investigate the effect of the synthetic matrix process on Lowestoft specifically. Sector 720 covers 110 zones in the model. Figure 1 shows the geographic area that this sector covers.

Figure 4-1 - Lowestoft Sector
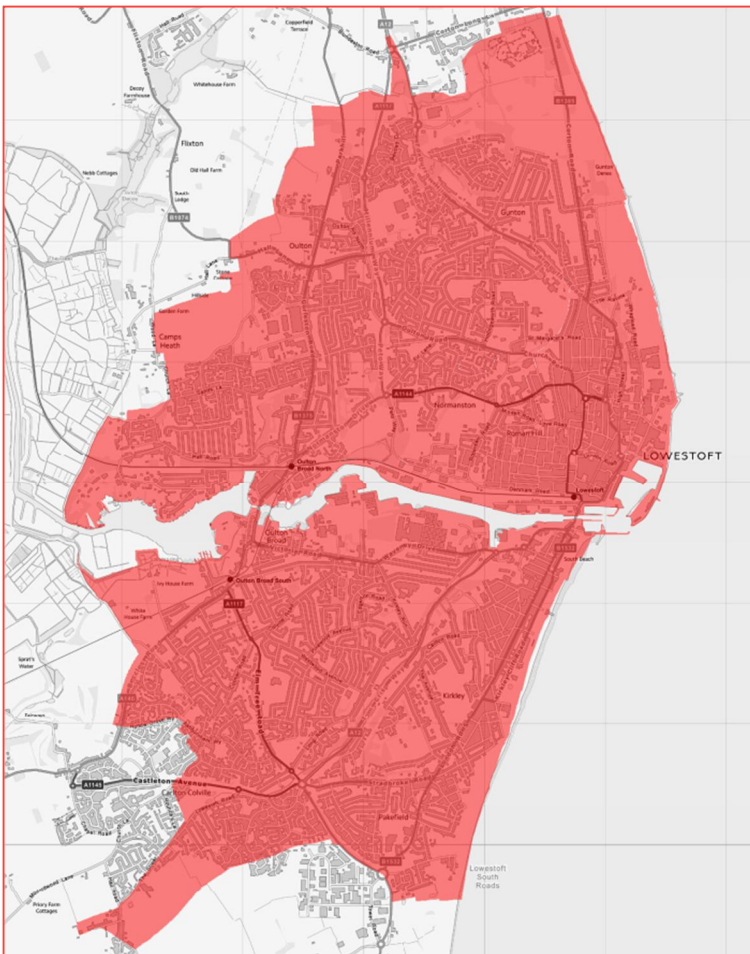
4.2. Similar to section 3 of this technical note, an assessment of the number of trips that occur within Lowestoft as a result of the synthetic infill process is provided in Table 5 and Table 6 below. These are provided as trips that have an origin within the area, and trips that have a destination in the area.

Table 5 - Lowestoft Trip Change Summary – By Trip Origin

	MND	Combined	Difference	%Diff
AM	5,987	7,334	1,347	22%
IP	4,144	5,277	1,133	27%
PM	6,184	7,401	1,217	20%

Table 6 - Lowestoft Trip Change Summary – By Trip Destination

	MND	Combined	Difference	%Diff
AM	5,072	6,386	1,314	26%
IP	4,243	5,376	1,133	27%
PM	7,021	8,271	1,250	18%

4.3. The tables show that there is an increased effect from combining the matrices when considering only the trips with an origin or destination in Lowestoft and varies between 18% and 27% in each time period.

5. SUMMARY

5.1. The analysis within this technical note has demonstrated that synthetic matrix infill process has increased the overall quantum of trips within the trip matrix. This is consistent with expectations given the known underrepresentation of trips with the MND.

5.2. Overall, the synthetic matrix is a minor proportion of the overall quantum of trips with the matrix both at a local and county level, with a significant majority of trips based upon the MND.