

**Appendix G**  
**Example of Forecast Trip End Calculation**



The example described below explains the process of computation of the target demand trip ends which are controlled to District level.

First of all, each modelled zone was assigned to a TEMPRO sector where base year trip ends were multiplied by the growth factor for each sector to produce forecast trip ends for each modelled zone (Sector Trip Ends). Table G.1 below shows the example of calculating forecast trip ends.

**Table G.1 Estimated Sector Trip Ends**

Zone	Sector	Base Year Trip Ends		Sector Growth Factor		Sector Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	405.4	484.7	1.0297	1.0339	417.5	501.1
58	12	267.3	457.8	1.0297	1.0339	275.3	473.3
59	28	117.7	44.1	1.0613	1.0350	125.0	45.6
60	28	56.0	25.6	1.0613	1.0350	59.4	26.5
67	31	30.5	8.3	1.0688	1.0424	32.6	8.7

As Lancaster District consists of zones inside Sectors 28-33, therefore, forecast trip ends of all the modelled zones from Sectors 28-33 were calculated by applying the Lancaster District Growth Factor to the base year trip ends. This produces trip ends for the modelled zones in Lancaster District. The Lancaster District growth factor was extracted from TEMPRO at Lancaster Authority level.

Trip ends for zones from Sectors 1-27 were calculated using the same growth factors as for the calculation of Sector trip ends. Table G.2 below shows the example of calculation of District trip ends.

**Table G.2 Estimated District Trip Ends**

Zone	Sector	Base Year Trip Ends		District Growth Factor		District Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	405.4	484.7	1.0297	1.0339	417.5	501.1
58	12	267.3	457.8	1.0297	1.0339	275.3	473.3
59	28	117.7	44.1	1.0466	1.0277	123.2	45.3
60	28	56.0	25.6	1.0466	1.0277	58.6	26.3
67	31	30.5	8.3	1.0466	1.0277	32.0	8.6

[Base + Development] trip ends were calculated by adding base year trip ends to new development trip ends, then was compared with the Sector trip ends (see Table G.3)

**Table G.3 Base Year Trip Ends + New Development Trip Ends**

Zone	Sector	Base Year Trip Ends		New Development Trip Ends		Base + Development Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	405.4	484.7	0.0	0.0	405.4	484.7
58	12	267.3	457.8	0.0	0.0	267.3	457.8
59	28	117.7	44.1	7.2	2.6	124.9	46.7
60	28	56.0	25.6	0.3	0.1	56.4	25.7
67	31	30.5	8.3	0.0	0.0	30.5	8.3

The [base + development] trip ends totals were compared against the Sector trip ends at sector level, as shown as an example in Table G.4 below.

**Table G.4 Comparison of [Base + Development] with Sector Trip Ends**

Zone	Sector	Base Year Trip Ends		Development Trip Ends		Sector Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57, 58	12	672.7	942.4	0.0	0.0	692.7	974.4
59, 60	28	173.7	69.7	7.5	2.7	184.4	72.1
67	31	30.5	8.3	0.0	0.0	32.6	8.7

A factor was calculated by dividing the [Sector Trip Ends – Base Year Trip Ends] by the [New Development Trip Ends] for each sector, following the formula:

$$\text{Factor} = \frac{\sum \text{Sector Trip Ends} - \sum \text{Development Trip Ends}}{\sum \text{Base Year Trip Ends}} \quad (1)$$

- If the factor calculated from (1) is greater than 1, i.e. there is still room for additional background traffic growth apart from the development growth. The background growth factor is therefore calculated from formula (1) above.
- If the factor calculated from (1) is smaller than 1, i.e. the growth from development is higher than the demand growth from TEMPRO, the background growth factor is set to 1 as the assumption is that there will be no reduction in existing traffic.

Having applied formula (1) to the data from Table G.4 above, the results are shown below:

For Sector 12 the Background Growth Factors will be:

$$F_{\text{Origin}} = \frac{(692.7 - 0.0)}{672.7} = 1.0297 \quad F_{\text{Destination}} = \frac{(974.4 - 0.0)}{942.4} = 1.0339$$

For Sector 28 the Background Growth Factors will be:

$$F_{\text{Origin}} = \frac{(184.4 - 7.5)}{173.7} = 1.0180 \quad F_{\text{Destination}} = \frac{(72.1 - 2.7)}{69.7} = 0.9957$$

The background growth factor for the destination will therefore be set to 1.

For Sector 31 the Background Growth Factors will be:

$$F_{\text{Origin}} = \frac{(32.6 - 0.0)}{30.5} = 1.0688 \quad F_{\text{Destination}} = \frac{(8.7 - 0.0)}{8.3} = 1.0424$$

These factors will be applied to all the zones inside these sectors to produce background trip ends for each zone (see Table G.5).

**Table G.5 Background Growth Trip Ends**

Zone	Sector	Base Year Trip Ends		Background Growth Factor		Background Growth Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	405.4	484.7	1.0297	1.0339	417.5	501.1
58	12	267.3	457.8	1.0297	1.0339	275.3	473.3
59	28	117.7	44.1	1.0180	1.0000	119.9	44.1
60	28	56.0	25.6	1.0180	1.0000	57.0	25.6
67	31	30.5	8.3	1.0688	1.0424	32.6	8.7

The target trip ends, which took into account the development trip ends, were calculated by adding background growth trip ends to development trip ends (see Table G.6).

**Table G.6 Estimated Trip Ends**

Zone	Sector	Background Growth Trip Ends		Development Trip Ends		Estimated Trip Ends	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	417.5	501.1	0.0	0.0	417.5	501.1
58	12	275.3	473.3	0.0	0.0	275.3	473.3
59	28	119.9	44.1	7.2	2.6	127.0	46.7
60	28	57.0	25.6	0.3	0.1	57.4	25.7
67	31	32.6	8.7	0.0	0.0	32.6	8.7

The estimated trip ends calculated from Table G.6 needed to be controlled back to TEMPRO at District level. In this example, Sector 28 and Sector 31 were inside Lancaster District, they were therefore factored to District trip ends as calculated from Table G.2. Adjustment factors were produced by comparing estimated trip ends with district trip ends at Lancaster District level, as below.

$$\text{Adjustment Factor} = \frac{\sum \text{District Trip Ends}}{\sum \text{Estimated Trip Ends}}$$

Detail of the adjustment factors calculated for Lancaster District is shown below.

**Table G.7 Estimated Trip Ends**

Sector	District	Estimated Trip Ends		District Trip Ends		Adjustment Factor	
		Orig	Dest	Orig	Dest	Orig	Dest
28,31	Lancs	217.0	81.1	213.8	80.2	0.9851	0.9885

The adjustment factors were applied for every zone inside Lancaster District (Sectors 28-33) to control target trip ends to district level. Detail of target trip ends controlled to District level is shown in Table G.8 below.

**Table G.8 Estimated Trip Ends**

Zone	Sector	Background Growth Trip Ends		Development Trip Ends		Target Trip Ends District Level	
		Orig	Dest	Orig	Dest	Orig	Dest
57	12	417.5	501.1	0.0	0.0	417.5	501.1
58	12	275.3	473.3	0.0	0.0	275.3	473.3
59	28	118.1	43.6	7.1	2.6	125.1	46.2
60	28	56.2	25.3	0.3	0.1	56.5	25.4
67	31	32.1	8.6	0.0	0.0	32.1	8.6

Table G.8 presents the resultant trip ends which are controlled to District level. The effect of this process may not be apparent due to the small numbers used in this example; however, the method is successful in controlling the number of estimated trips to the number of target trips for Lancaster District.