THE COBA 2021 USER MANUAL

PART 4

TRAFFIC INPUT TO COBA

Contents

Chapter

1. NETWORK DESCRIPTION

1.1 The COBA user is required to provide a description of the highway network to cover both the existing situation and all proposed improvements. For computer coding purposes, a network is described as a series of links joining at, or terminating in, nodes. The following points should be considered when preparing a network description.

Extent of Network

1.2 The network should extend far enough from the improvement to include all links on which there is a substantial difference in the assigned traffic flows between 'Do-Minimum' and 'Do-Something' networks. If a scheme is expected to result in a significant change in the flow level on a competing route, the competing route should be included in the network. This concept should be balanced by the consideration that, as the network spreads, benefits arising at a distance from the scheme are inherently less plausible and more difficult to assess than local benefits. Generally the extent of the assignment network will determine the size of the COBA network.

1.3 The needs and methods of achieving compatibility between the networks are explained in Chapter 2 of this manual.

Links

1.4 A link is a length of road joining two nodes. A link should be a length of road of consistent layout along which the volume of traffic flow does not vary substantially; it is usual to model both traffic directions as a single, two way link.

Nodes

1.5 Nodes should be placed at major junctions, where speed limits change and where road layout changes (for example, from single to dual carriageway, but excluding local dualling at junctions).

Entry Links

1.6 These are links, not part of the main network, which serve to introduce traffic onto the network. They occur on the edges of a network, or at points within the network where a significant fixed amount of traffic joins or leaves the network. COBA requires that the flow on an entry link should be the same for the 'Do-Minimum' network and for all 'Do-Something' networks. In general, there should be at least two entry links in every network. For a further definition refer to Part 7 paragraph 7.6.

Program Capacity

1.7 The basic release version of COBA can be used for a maximum of about 10,000 links and 6,000 nodes. The exact number of links and nodes that can be included will depend on the complexity and type of junctions within the scheme. The running time can increase significantly if signalised roundabouts are modelled.

2. COMPATIBILITY BETWEEN THE TRAFFIC MODEL AND COBA

2.1 It is important to ensure that the basis for estimating changes in traffic patterns is compatible with the economic assessment method used. As explained in Part 1 Chapter 3 COBA computes benefits on the assumption that the travel demand (the trip matrix) does not change as a result of the introduction of the scheme into the network. This assumption allows the simplification that only changes in resource costs need to be considered in the benefit calculation. Prediction of travel behaviour, on the other hand, will usually be based on perceived costs (also called behavioural costs). The distinction between resource and perceived cost parameters has important implications in the economic assessment. Firstly, traffic will in some cases prefer routes which are not the best in terms of national resource costs. Secondly, because resource and perceived costs may change relative to one another over time, the extent to which routes which are uneconomic in national resource terms are chosen will also vary over time. These effects will generally only be important on larger networks where significant movements have a choice between distance saving and time saving routes.

2.2 Traffic flows derived from the traffic appraisal can be used directly in the economic evaluation. However, the best estimate of journey times should always be used. The best estimate will not always be produced from the traffic assignment model whose main function is to produce validated traffic <u>flows</u>. The journey times from most traffic models will be inadequate for economic appraisal since they represent averages which do not differentiate between travel at different times and in different traffic conditions. For some schemes, especially inter-urban ones, the flow group and speed-flow analysis incorporated in COBA is usually the most suitable method of calculating journey times. For more complex schemes, such as those requiring the use of congested assignment models, the best estimate of journey times may be taken directly from the assignment model. In areas where chronic congestion and interacting junctions are found it is important that the predictions of the traffic model are thoroughly validated. Methods of determining the accuracy of journey times and the number of journey time runs required to achieve a given level of accuracy are contained in Part 5 Chapters 10 and 11. A comprehensive check of observed junction delays and link journey times with those of the assignment network will be required in the Local Model Validation Report (LMVR).

Compatibility Between Networks

2.3 The assignment network and the COBA network need to be compatible in three respects:

i) extent of network;

ii) description of links and junctions and;

iii) incorporation of future changes to network.

2.4 The principles guiding the extent of the COBA network are discussed in the following paragraphs and in paragraph 1.2.

2.5 It is important that there are no major discrepancies between the assignment network and the COBA network but slight differences are inevitable given that link and junction descriptions in the two networks may be different. The assignment network incorporates speed/flow effects only where capacity restraint assignment procedures are used; and typically assignment networks do not explicitly model flow dependent delays at junctions. Furthermore, the assignment network and the COBA network operate for different parts of the day. The assignment network usually represents a 12 or 16 hour day whereas COBA models a 24 hour day using flow groups. The facility in COBA to print out journey speeds and times for each flow group in a specified year can be used to check that the two networks are broadly compatible.

2.6 Deleted.

Defining the Fixed Trip Matrix

2.7 A common source of error in the use of COBA occurs when the fixed trip matrix assumption is violated or when the wrong fixed trip matrix is chosen. This can happen when a large assignment network is simplified for economic assessment by:

a) omitting links whose flows only change by a small amount between ‘Do-Minimum’ and ‘Do-Something’;

b) cordon pointing the assignment i.e. drawing a cordon around the scheme in the network as modelled and forming a trip matrix of movements crossing the cordon in order to isolate reassignment effects within the cordon.

2.8 It is recommended that the general rule should be that the COBA network is the same as the assignment network, to avoid possible bias from a). Even the smallest differences in the matrix of trips used on the assessment networks can affect the results.

2.9 Errors from b) can occur when the cordon is drawn too close to the scheme through links with a significant flow change. When defining the extent of the cordon it is necessary to judge whether flow differences on a link are significant in terms of the scheme being evaluated or simply "noise" in the traffic model.

2.10 The recommended procedure to follow in order to determine the NPV relative to 'Do-Minimum' is either:

i) if the benefits/disbenefits to diverting traffic are likely to be significant, the COBA network should be extended to encompass the two routes;

or,

ii) if the benefits to diverting traffic are not likely to be significant, the ‘Do-Minimum’ assignment should be cordon pointed and the comparable ‘Do-Something’ flows should be derived by assigning the cordon point matrix to the reduced ‘Do-Something’ network.

2.11 When comparing several ‘Do-Something’ options which, although producing significant flow changes at the cordon compared to the ‘Do-Minimum’, have similar effects on the cordon it may be worthwhile to cordon point the ‘Do-Something’ matrix. This procedure is likely to overestimate scheme benefits by overstating the ‘Do-Minimum’ levels of congestion but the incremental economic results of the alternatives is valid.

3. AUTOMATIC INTERFACE PROGRAMS

3.1 The use of COBA together with large computer based traffic models creates a considerable problem of data preparation. To address this problem 'interface' programs can be developed to convert the output from specific traffic models to a form suitable for input to COBA with minimal manual involvement.

3.2 Interface programs should allow the automatic preparation of link data only for input to COBA. In general it is considered that the inclusion of junctions is not appropriate to the large scale strategic evaluations for which automatic interface programs are likely to be used. It is possible to model particular junctions in separate COBA runs if considered necessary.

4. CHOICE OF YEARS FOR TRAFFIC FLOW DATA

4.1 Traffic flow information for economic assessment will be derived from a traffic model. The other end of the spectrum would be a fully synthetic model taking account of changes in zonal trip ends, trip distribution and assignment.

4.2 Traffic flows for each link in the network must be input to COBA by the user. There is no automatic procedure within COBA for adjusting the pattern of traffic flows on a 'Do-Minimum' or 'Do-Something' network. Thus the traffic assignment remains fixed for 'Do-Minimum' and 'Do-Something' networks unless the user changes it.

4.3 Traffic flow data may be entered for a single year or for several years, the traffic flow level in other years in the appraisal period being determined by the traffic growth profile which may be the national profile or a local profile.

4.4 COBA applies the same traffic growth factor to the vehicle flows in up to three Vehicle Mix Groups (see paragraph 9.2) for each link in the network. This will be an oversimplification for many situations where the traffic flow pattern is likely to change over the 60 year appraisal period and in these instances consideration should be given to inputting traffic flows for two or more years during the appraisal period. These additional year traffic assignments are usually undertaken for the following reasons:

i) if the road network becomes heavily congested, on particular links or at particular junctions, which is likely to affect the routing of traffic;

ii) if the effect of local trip end growth results in traffic growing at differential rates over the network;

iii) changes occur to the internal road network during the 60 year appraisal period which affect the routing of traffic;

iv) changes occur to the external road network which can affect the number of trips passing through the COBA network. The normal restriction of using the same trip matrix for 'Do-Minimum' and 'Do-Something' assignments should of course be observed.

4.5 If it is considered that traffic flows over the assessment period can be adequately represented by assignments for a single year then that year is usually taken to be the traffic model base year or a year close to the opening year.

The Reassignment Process

4.6 If changes to the flow pattern over the assessment period are expected these are handled in COBA by a process known as "Reassignment" by which the user can input assignments for several different years to reflect the changing traffic flow patterns over time. When this facility is used to reflect the general change in flow patterns due to congestion or differential growth then the changed flow pattern should usually be applied from a year intermediate between assignment years. For example, if assignments have been carried out for 2013 and 2043, and 2015 is the first scheme year, then the 2013 assignment could be used for, say, the period 2015 - 2040 and the 2043 assignment for 2041 - 2087. In this example the year for scheme data changes, or reassignment, is 2041 and the traffic flow year for the reassigned traffic flows is 2043. COBA will automatically back project the 2043 link traffic flows to 2041 using the network traffic growth factors. The process is shown diagrammatically on Figure 4/1.

4.7 When the facility is used to reflect sudden changes in flow patterns, for example a town centre pedestrianisation, then the year for scheme data changes should be the year of the expected change; the traffic flow input year can be either before or after this date or even the original traffic flow year.

4.8 The reassignment process is instigated by use of the input record KEY 089 (NEXT YEAR FOR SCHEME DATA CHANGES).

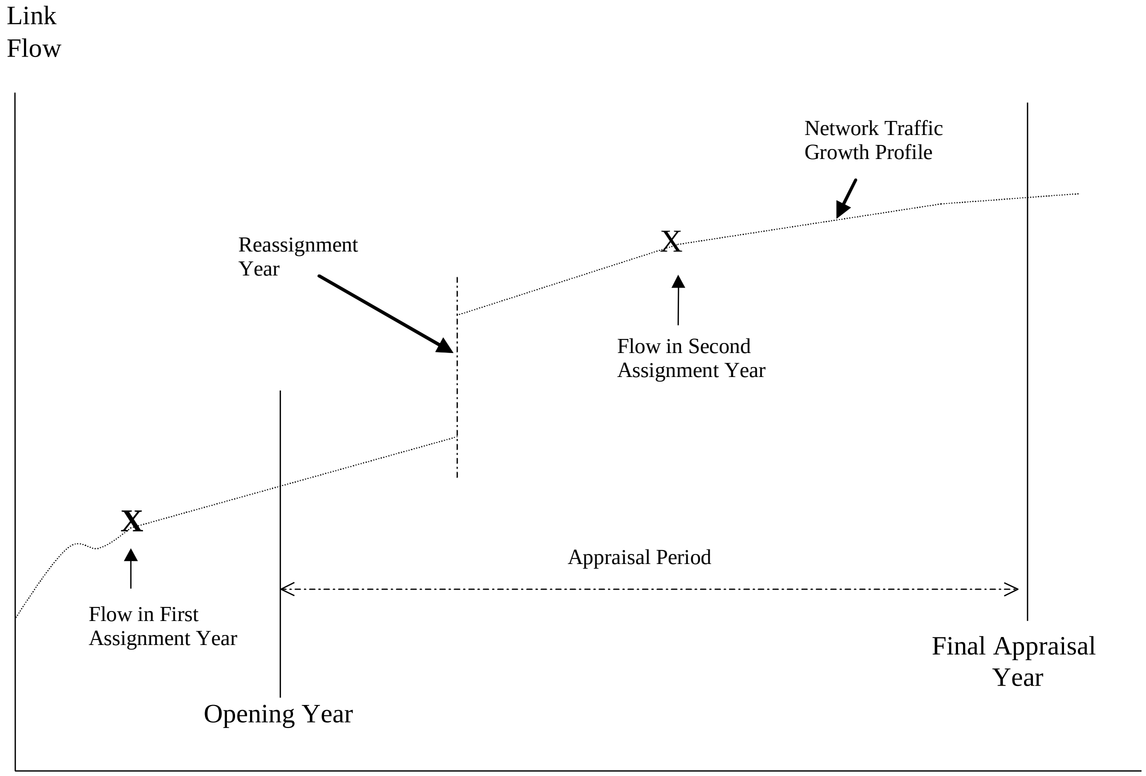

Figure 4/1: The Reassignment Process

5. VARIATION IN TRAFFIC FLOW

5.1 If any site at the roadside is chosen and the traffic passing it is observed, it can be seen that the total number of vehicles varies from hour to hour, day to day, week to week and from month to month. Not only does the total traffic flow vary in this way but also the proportion of the different types of vehicle that it contains. For example, the relative proportion of cars to goods vehicles is likely to be higher during peak hours than in other hours of the day. These observed variations are specific to the site chosen; had another site been selected then the pattern of variation might well have been different. For example, a road in a holiday area, with its high level of cars in summer, has a different pattern of variation from a road serving an industrial area on which the flow of both cars and goods vehicles might be much more even throughout the year.

5.2 There are, therefore, two broad types of variation that COBA takes into account:

i) variation of total hourly vehicle flow throughout the year;

ii) variation in vehicle type composition in each hour.

5.3 The operation of the road network is dependent on the levels of traffic flow at different times of the day. At peak periods the traffic level may reach levels of congestion where vehicles cannot travel at free flow speeds, thus causing delay. The savings made by eliminating or minimising this delay contributes to the benefits in an economic appraisal. Therefore in COBA it is necessary to model the varying traffic flows on the network for all hours of the year so that total costs can be calculated. This modelling is done by using FLOW GROUPS (see Chapter 7) to represent the volumetric variation that occurs throughout the year. The SEASONALITY INDEX (see Chapter 6) of the network under consideration determines the level of flow in each flow group.

6. NETWORK CLASSIFICATION AND SEASONALITY INDEX

6.1 COBA uses the following categories to classify the various types of road comprising a COBA network:

i) Motorways;

ii) Built-up Trunk Roads (40 mph speed limit or less);

iii) Built-up Principal Roads (40 mph speed limit or less);

iv) Non Built-up Trunk Roads (speed limits above 40 mph);

v) Non Built-up Principal Roads (speed limits above 40 mph).

6.2 COBA contains default parameters which describe the average traffic conditions on roads falling into the above five categories and it is necessary to define the NETWORK CLASSIFICATION that best describes the scheme being assessed. The NETWORK CLASSIFICATION is used to call default values for SEASONALITY INDEX, Vehicle Category Proportions (Chapter 8) and E-FACTOR (paragraph 9.8), all of which can be overwritten by the user when local information is available.

6.3 The most important descriptor of annual traffic flow patterns is the SEASONALITY INDEX (SI) which is defined as the ratio of the average August weekday flow to the average weekday flow (Monday to Friday) in the neutral months, April, May, June, September and October (excluding periods affected by bank holidays). The SI defines the Flow Group Structure (Chapter 7) and M-FACTOR (paragraph 9.10), both of which can be overwritten if local information is available (this will usually consist of a whole years traffic count information). Research on 43 busy roads indicated that a range of SI values are likely on each NETWORK CLASSIFICATION. Table 6/1 gives the range of SI values likely to be encountered on roads falling into each NETWORK CLASSIFICATION; values outside the ranges are possible.

Network Classification		Range of Seasonality Index (SI) Encountered	Typical Values (Default)
Motorway	(MWY)	0.95 – 1.35	1.06
Built-up Trunk	(TBU)	0.95 – 1.10	1.00
Built-up Principal	(PBU)	0.95 – 1.15	1.00
Non Built-up Trunk	(TNB)	1.00 – 1.50	1.10
Non Built-up Principal	(PNB)	1.00 – 1.40	1.10

Table 6/1: Network Classification and Seasonality Index

6.4 Ideally the SEASONALITY INDEX (SI) should be determined from long term ATC data. However a good estimate can be obtained by comparing the weekday traffic flows (Monday to Friday) of three week continuous counts in August and late May/June or October.

6.5 At the early stages of scheme preparation data to calculate the local SI value may not be available and then typical values may be used, these are given in Table 6/1 and are contained as defaults within the COBA program.

7. FLOW GROUPS

7.1 To take account of the variation in the level of traffic flow and its vehicle composition, the 8760 hours of the year are divided into different portions (numbers of hours) called 'FLOW GROUPS'. Each represents a different level of flow. The level of flow is much higher in the peak period than during the night. To take account of the variation in flow ten flow groups are used, five for weekdays and five for weekends, see Table 7/1. The level of traffic flow in each is determined from multipliers which are dependent upon the Seasonality Index (SI). The methodology was developed from the results of research undertaken in 1988 and is reported in a Transport and Road Research laboratory working paper WP/TO77 entitled "The Revision of Hourly Traffic Flow Patterns for COBA and QUADRO". The analysis was repeated using 1992 data from the STC automatic Core traffic census and the default parameters used to describe the flow group structure in the program are taken from this work. The method used to allocate the total flow into vehicle categories is described in Chapter 8.

7.2 A typical distribution of the hourly flow levels on weekdays over a year is given on Figure 7/1. Superimposed on this is a pictorial representation of the flow levels COBA will calculate for the four weekday standard flow groups. No particular relevance is attributed to the number of hours in each flow group, however the number of hours and the flow in each flow group must balance to ensure the correct total annual flow. COBA assessments assume that the total flow in each flow group relative to the Annual Average Hourly Traffic flow (AAHT) is assumed not to vary through time.

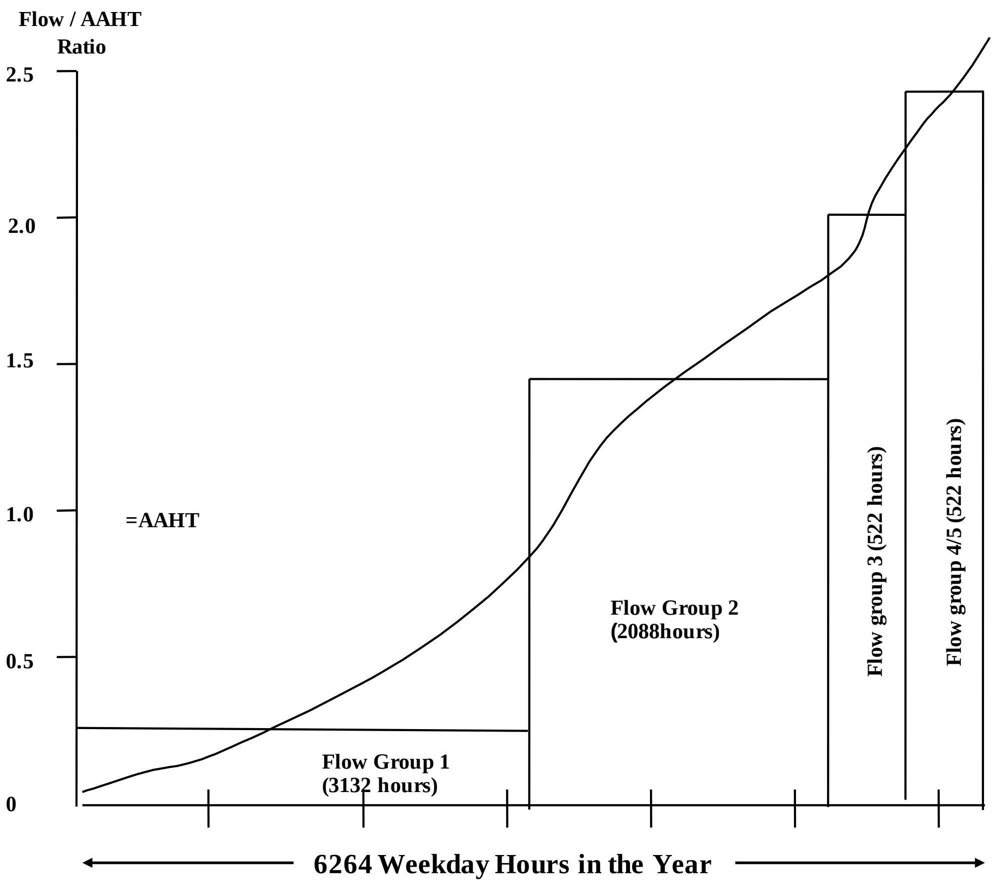

Figure 7/1: Flow Groups Representing Annual Weekday Flow

7.3 If the user elects to model tidality at junctions the program will automatically split flow groups 4 and 9 creating flow groups 5 and 10 with the same flow level as the original flow groups but of half the duration. The factors used to convert the AAHT to the total flow in each flow group are known as the Flow Group Multipliers. They are based on two-way traffic flows and were found to be independent of the Network Classification. The COBA program calculates the Flow Group Multiplier based on the relationship FGM = d + n.SI. The default values for parameters 'd' and 'n' for each flow group are given in Table 7/1. Figure 7/2 gives a pictorial representation of these straight-line relationships illustrating how the Seasonality Index affects the flow levels in each flow group.

	Hourly Flow Group (HFG)	**Number of Hours**	**Flow Group Multiplier (parameter 'd' and 'n')**
Weekdays	1	3132	0.446 - 0.159 x SI
	2	2088	1.581 - 0.089 x SI
	3	522	1.630 + 0.326 x SI
	4/5*	522	1.371 + 0.981 x SI
Weekends	6	1248	1.187 - 0.554 x SI
	7	832	1.078 + 0.072 x SI
	8	208	0.744 + 0.894 x SI
	9/10*	208	- 0.178 + 2.146 x SI

* Ten flow groups are automatically used when junction tidality is modelled.

Table 7/1: Flow Group Multipliers

7.4 There are facilities within the program which enable the user to change the hours per flow group and the flow in each flow group to reflect local conditions (see KEY030). This cannot be done without, at least, one years continuous traffic count data. The number of hours in each flow group must not be changed without making compensatory changes to the flow level.

7.5 When calculating junction delays the program needs to know which flow groups are off-peak, adjacent-to-peak and peak in order to know what maximum delay cut-offs are applicable and what allowance to make for any queue that may exist at the end of the previous period. Therefore in addition to the flow group number each is also allocated a Flow Group Type (weekdays and weekends are considered independently):

Type 1	Ordinary flow group (off-peak)
Type 2	Adjacent-to-peak flow group
Type 3	AM Peak flow group
Type 4	PM Peak flow group

there is no restriction on the number of off-peak flow groups but if tidality is being modelled there must be two peak flow groups.

7.6 Generally the peak flow groups are assumed to be the traditional morning and evening weekday, Saturday lunchtime and Sunday evening peaks. However similar peak flows do occur at other times.

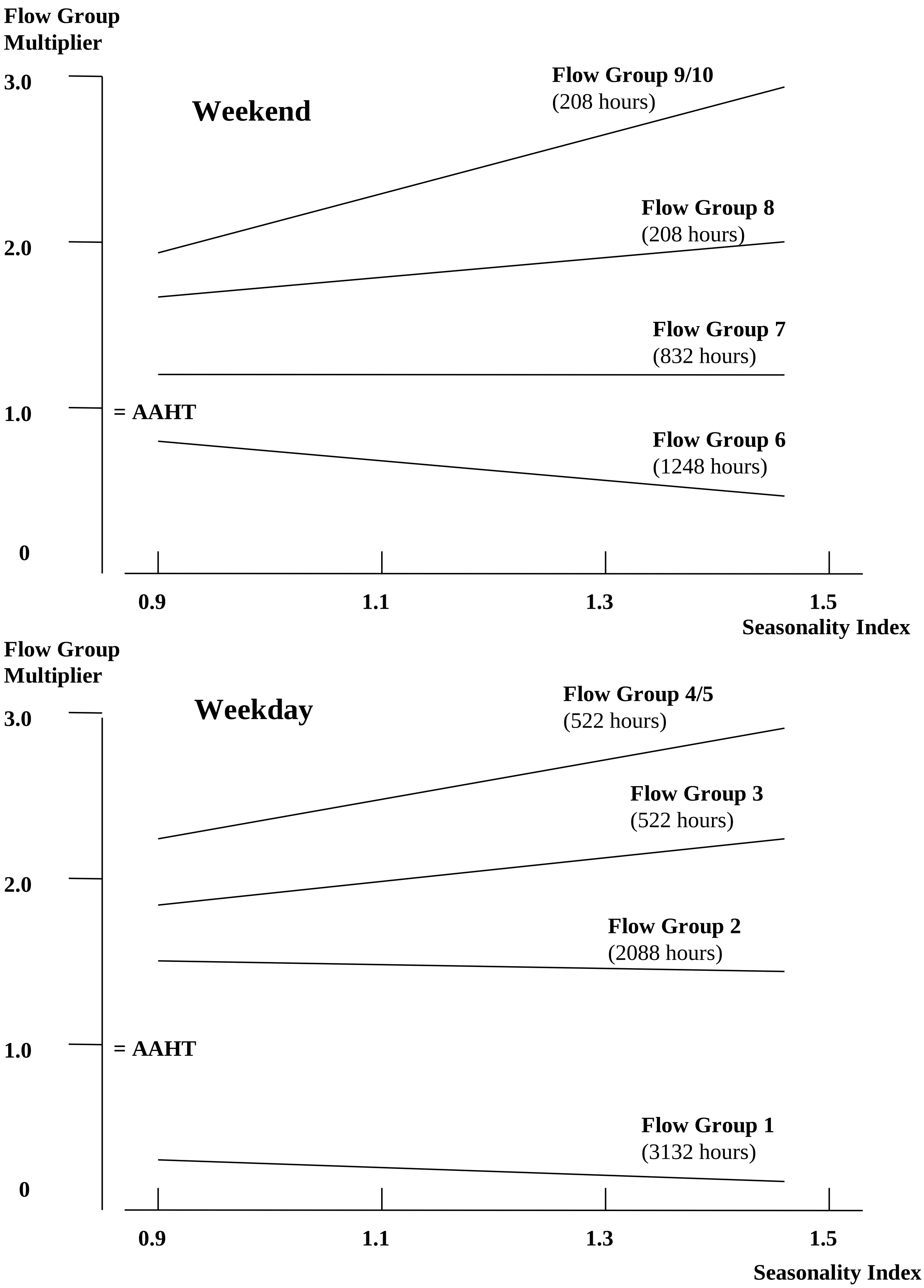

Figure 7/2: Variation in the Flow Group Multipliers with Seasonality Index

8. VEHICLE CATEGORIES

Definition of Categories

8.1 The various components of traffic have different characteristics in terms of operating costs, growth and occupancy. Figure 8/1 illustrates the most common categories into which the traffic is split in COBA. These are defined as:

Cars	**(CARS)** including taxis, estate cars, 'people carriers' and other passenger vehicles (for example, minibuses and camper vans) with a gross vehicle weight of less than 3.5 tonnes, normally ones which can accommodate not more than 15 seats. Three-wheeled cars, motor invalid carriages, Land Rovers, Range Rovers and Jeeps and smaller ambulances are included. Cars towing caravans or trailers are counted as one vehicle unless included as a separate class (see User Specified Category below);
Light Goods Vehicles	**(LGV)** Includes all goods vehicles up to 3.5 tonnes gross vehicle weight (goods vehicles over 3.5 tonnes have sideguards fitted between axles), including those towing a trailer or caravan. This includes all car delivery vans and those of the next larger carrying capacity such as transit vans. Included here are small pickup vans, three-wheeled goods vehicles, milk floats and pedestrian controlled motor vehicles. Most of this group are delivery vans of one type or another;
Other Goods Vehicles	**(OGV 1)** Includes all rigid vehicles over 3.5 tonnes gross vehicle weight with two or three axles Includes larger ambulances, tractors (without trailers), road rollers for tarmac pressing, box vans and similar large vans. A two or three axle motor tractive unit without a trailer is also included;
	(OGV 2) Includes all rigid vehicles with four or more axles and all articulated vehicles. Also included in this class are OGV1 goods vehicles towing a caravan or trailer;
Buses and Coaches	**(PSV)** Includes all public service vehicles and works buses with a gross vehicle weight of 3.5 tonnes or more, usually vehicles with more than 16 seats;
User Specified	There is a facility within the program for the user to input an additional vehicle category, however its use will be a rare occurrence. It can only be used if the appropriate values of time, occupancy, vehicle operating costs and vehicle proportions by flow group are available for the input category. An example of its use could be to test the sensitivity of a high proportion of cars with trailers in the traffic mix.

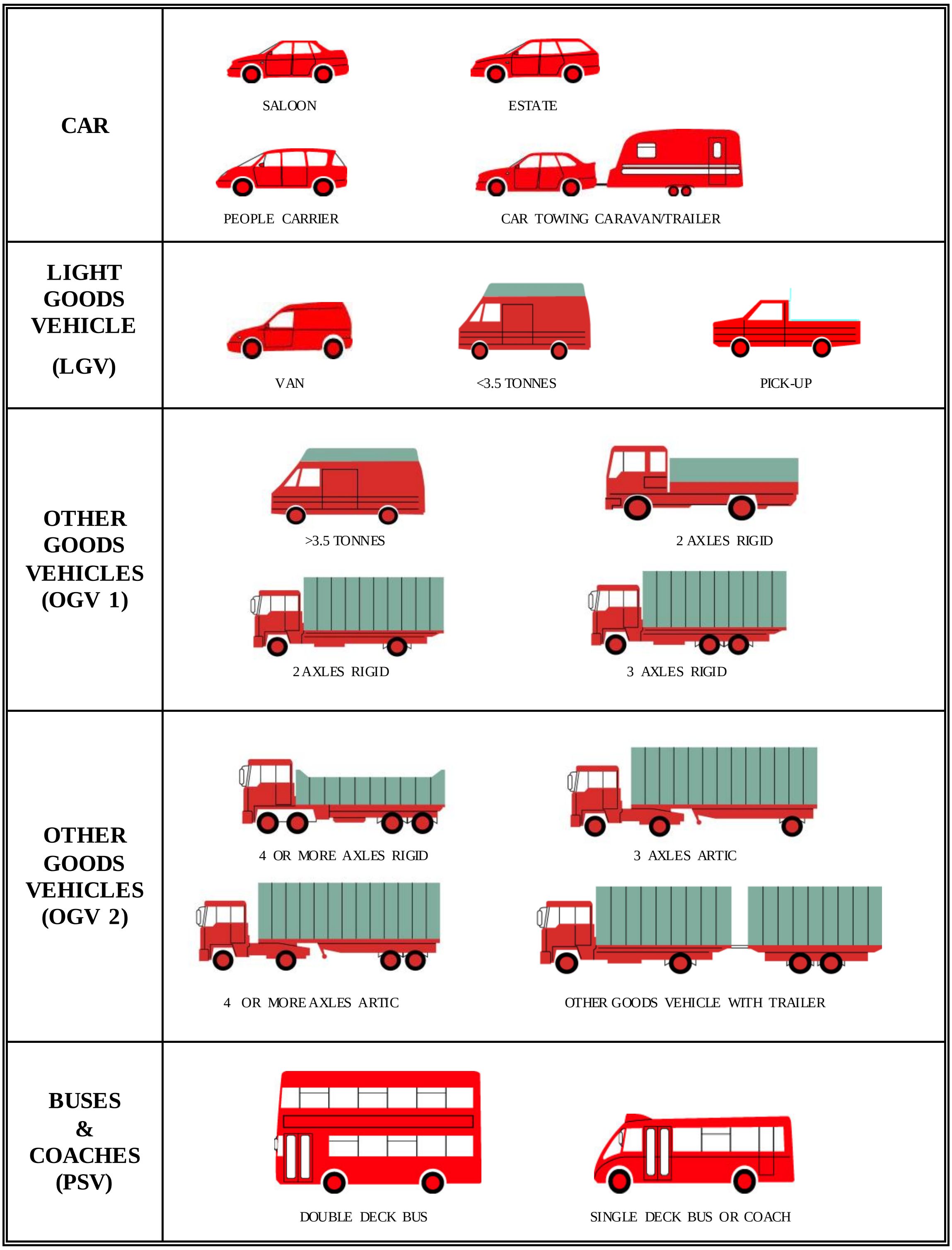

Figure 8/1: COBA Vehicle Categories

8.2 The average vehicle category proportions for 2002 by class of road are given in Table 8/1.

CLASS OF ROAD	**CARS (1)**	**LGV (2)**	**OGV1 (3)**	**OGV2 (4)**	**PSV (5)**
Motorways	0.762	0.107	0.041	0.085	0.005
Built-up Trunk	0.825	0.112	0.030	0.024	0.009
Built-up Principal	0.848	0.103	0.022	0.010	0.017
Non Built-up Trunk	0.787	0.110	0.038	0.059	0.006
Non Built-up Principal	0.826	0.113	0.031	0.022	0.008
Average All Roads (Includes Minor Roads)	0.816	0.114	0.028	0.031	0.011

Table 8/1: Annual Average Category Proportions by Class of Road (2002)

Input of Vehicle Category Proportions

8.3 The user is required to input to the program network average proportions of the various vehicle categories in the traffic flow. If the traffic flows are input as the total vehicles on each link then the vehicle proportions entered will apply to each link in the network. If the link flows are entered as vehicles in up to three vehicle mix groups (see paragraph 9.3) then the network average proportions entered are used to allocate the vehicle mix group flows on each link into the relevant vehicle category proportions. Separate growth rates are incorporated within the program for each vehicle category (see Table 10/1) and are applicable in terms of vehicle kilometres. The network average composition used should therefore be a weighted average taking into account the lengths of the various links and the total flow on them throughout the year (i.e. vehicle kilometres) and should be representative of the proposed scheme.

8.4 The traffic proportions can be input as either 12 or 16 hour weekday values or the annual average daily traffic (AADT) proportions. If either 12 or 16 hour weekday values are entered the program will convert them to AADT proportions as described below.

8.5 The proportion of traffic for each vehicle category (except cars) is estimated as follows:

Estimated annual proportion = A(I) X observed traffic proportion in a neutral month,

where A(I) is the adjustment factor for vehicle category I, the defaults held in the program are given in Table 8/2. The traffic proportion for cars is estimated by subtracting from unity the sum of the estimated proportions for the other vehicle categories.

Period of Neutral Month Weekday Count	Network Classification	Adjustment Factors A(I)			
		LGV(2)	OGV1(3)	OGV2(4)	PSV(5)
12 Hour (0700-1900)	MWY	0.86	0.80	0.84	1.19
	TBU	0.83	0.73	0.75	0.90
	PBU	0.83	0.73	0.75	0.90
	TNB	0.84	0.77	0.84	0.98
	PNB	0.84	0.77	0.84	0.98
16 Hour (0600-2200)	MWY	0.89	0.84	0.83	1.16
	TBU	0.89	0.81	0.79	0.92
	PBU	0.89	0.81	0.79	0.92
	TNB	0.89	0.82	0.83	0.89
	PNB	0.89	0.82	0.83	0.89

Table 8/2: Adjustment Factors to Estimate Annual Vehicle Category Proportions

Vehicle Category Proportions by Flow Group

8.6 First of all, the program will split the AADT proportions, either input directly or calculated internally, into weekday and weekend proportions. Research using STC Core sites has shown that the overall **weekday** vehicle category proportion is given by the AADT proportion multiplied by a factor 'x'. Values of x contained within the program are given in Table 8/3. The traffic proportion for cars is estimated by subtracting from unity the sum of the calculated proportions for the other vehicle categories.

Vehicle Category	x
LGV	1.12
OGV1	1.20
OGV2	1.20
PSV	0.97

Table 8/3: Values of 'x' used to calculate Weekday Proportions

8.7 Secondly, the program will allocate vehicle category proportions to the total vehicle flow in each flow group. This is accomplished by means of vehicle category proportion correction factors. The defaults which are held within the program are given in Table 8/4. These were derived from an analysis of the STC automatic core traffic count sites, and although it is unlikely that the user will have sufficient data to develop local factors, they can nonetheless be changed by use of the Basic Data KEY 018, see Part 7 Chapter 4.

8.8 The vehicle category proportions (except cars) in flow groups 2-4/5 and 7-9/10 are determined by applying the vehicle category proportion correction factors to the **annual average** vehicle category proportions. The proportion of cars is obtained by subtracting from unity the sum of the other vehicle category proportions. The proportions in flow groups 1 and 5 are obtained by a balancing procedure which ensures the correct total weekday and weekend flow of each vehicle category.

Flow Group	Vehicle Category				
	Cars	LGV	OGV1	OGV2	PSV
Motorways					
1	*	*	*	*	*
2	*	1.14	1.29	1.17	0.88
3	*	1.13	1.16	1.02	0.85
4/5	*	1.11	1.01	0.87	0.73
6	*	*	*	*	*
7	*	0.60	0.32	0.29	1.39
8	*	0.59	0.28	0.25	1.38
9/10	*	0.60	0.31	0.27	1.40
Built-up Roads					
1	*	*	*	*	*
2	*	1.14	1.44	1.22	1.12
3	*	1.12	1.31	1.08	1.09
4/5	*	1.10	1.04	0.87	0.98
6	*	*	*	*	*
7	*	0.62	0.39	0.30	0.84
8	*	0.64	0.43	0.30	0.88
9/10	*	0.67	0.45	0.29	0.86
Non Built-up Roads					
1	*	*	*	*	*
2	*	1.16	1.41	1.30	1.07
3	*	1.14	1.16	1.07	1.08
4/5	*	1.10	0.92	0.84	1.02
6	*	*	*	*	*
7	*	0.60	0.35	0.35	1.02
8	*	0.60	0.33	0.30	0.98
9/10	*	0.61	0.34	0.29	0.90

* Balancing Values

Table 8/4: Vehicle Category Proportion Correction Factors

8.9 The following example shows the total vehicle flow and category proportions by flow group that the program will calculate for a road with a Seasonality Index (SI) of 1.10. Local vehicle category proportions should always be used when available.

(a) For example, if the **annual average** vehicle category proportions for the non built-up trunk road are,
Cars 0.787, LGV 0.110, OGV1 0.038, OGV2 0.059, PSV 0.006.

(b) Using the 'x' factors given in Table 8/3, the **weekday** proportions are,

LGV	= 0.110 x 1.12 = 0.123
OGV1	= 0.038 x 1.20 = 0.046
OGV2	= 0.059 x 1.20 = 0.071
PSV	= 0.006 x 0.97 = <u>0.006</u>
	0.246

therefore, Cars = 1 - 0.246 = 0.754.

(c) Using the Flow Group Multipliers for a road with an SI of 1.10 from Table 7/1 and the Vehicle Category Proportion Correction Factors from Table 8/4, the program calculates the Total Vehicle Flow and Vehicle Category Proportions by Flow Group shown in Table 8/5.

Flow Group	Hours	Flow AAHT	% of Annual Flow	Vehicle Category Proportions				
				Cars	LGV	OGV1	OGV2	PSV
1	3132	0.271	9.69	0.770	0.090	0.050	0.088	0.003
2	2088	1.483	35.35	0.734	0.107	0.078	0.074	0.007
3	522	1.989	11.85	0.763	0.105	0.064	0.061	0.008
4	522	2.450	14.60	0.793	0.101	0.051	0.048	0.007
Weekday	6264		71.49	0.756	0.103	0.066	0.068	0.007
6	1248	0.578	8.24	0.803	0.086	0.048	0.053	0.009
7	832	1.157	10.99	0.898	0.055	0.019	0.020	0.007
8	208	1.727	4.10	0.903	0.055	0.018	0.017	0.007
9	208	2.183	5.18	0.902	0.056	0.019	0.017	0.006
Weekend	2496		28.51	0.872	0.064	0.027	0.028	0.008
Annual Average	8760		100.0	0.789	0.092	0.055	0.057	0.007

Table 8/5: Total Vehicle Flow and Vehicle Category Proportions by Flow Group for a Non Built-up Road with an SI of 1.10

9. CONVERSION OF INPUT DATA TO AAHT

9.1 There are several input bases which can be used to input traffic flow data to the program. Whichever one is chosen the program will convert it to an annual average hourly flow for each vehicle category. This section describes the conversion method and the factors used.

Vehicle Mix Groups

9.2 If the traffic model is capable of producing link flows for more than one combination of vehicle categories, for example, 'light' and 'heavy' vehicles then the separate assignments can be input into COBA using the facility of VEHICLE MIX GROUPS (VMGs). Each VMG represents either a single vehicle category or an aggregation of vehicle categories; the user details the aggregation used in a particular COBA run in the basic data input.

Traffic Input

9.3 For a link to be included in the COBA assessment it must have a traffic flow input, this flow must be equivalent to an annual average hourly flow of more than one vehicle in the earliest year used in the assessment otherwise the program will register an error. There are four methods of inputting traffic flow information into COBA, either as total vehicle flows or separate flows for up to three Vehicle Mix Groups:

i) a 12 hour traffic flow (0700 - 1900) for year y in a neutral month;

ii) a 16 hour traffic flow (0600 - 2200) for year y in a neutral month;

iii) Annual Average Daily Traffic (AADT) for year y;

iv) Annual Average Hourly Traffic (AAHT) for year y.

Annual Average Hourly Traffic (AAHT)

9.4 The basic unit for traffic flow calculations within the COBA program is the Annual Average Hourly Traffic flow (AAHT). This is required for every link in the network for each year of the evaluation period. The following paragraphs describe how traffic flow data may be input to the program in various ways and how the program then converts these data to the required form.

9.5 If a 12 hour flow is input an E factor is applied to produce a 16 hour flow. Then an M factor is applied to the 16 hour flows to produce an estimate of the total annual traffic flow. E and M factors are discussed later in this chapter.

9.6 Figure 9/1 shows the diagrammatic layout of the related procedures within the program to produce the AAHT, for each link by vehicle category. The base year for calculations is the year for which the traffic flows are input. The program will then project the flows input either backwards or forwards by vehicle category using the national road traffic forecasts, or local forecasts where these are used, to produce traffic flow estimates for each link for each year of the assessment period.

9.7 Traffic flow data can be for any year. If 12 or 16 hour flows are input a warning will be given if they are not for a neutral month; April, May, June, September or October. Generally traffic models not based on neutral months data are considered less reliable in terms of establishing annual flows.

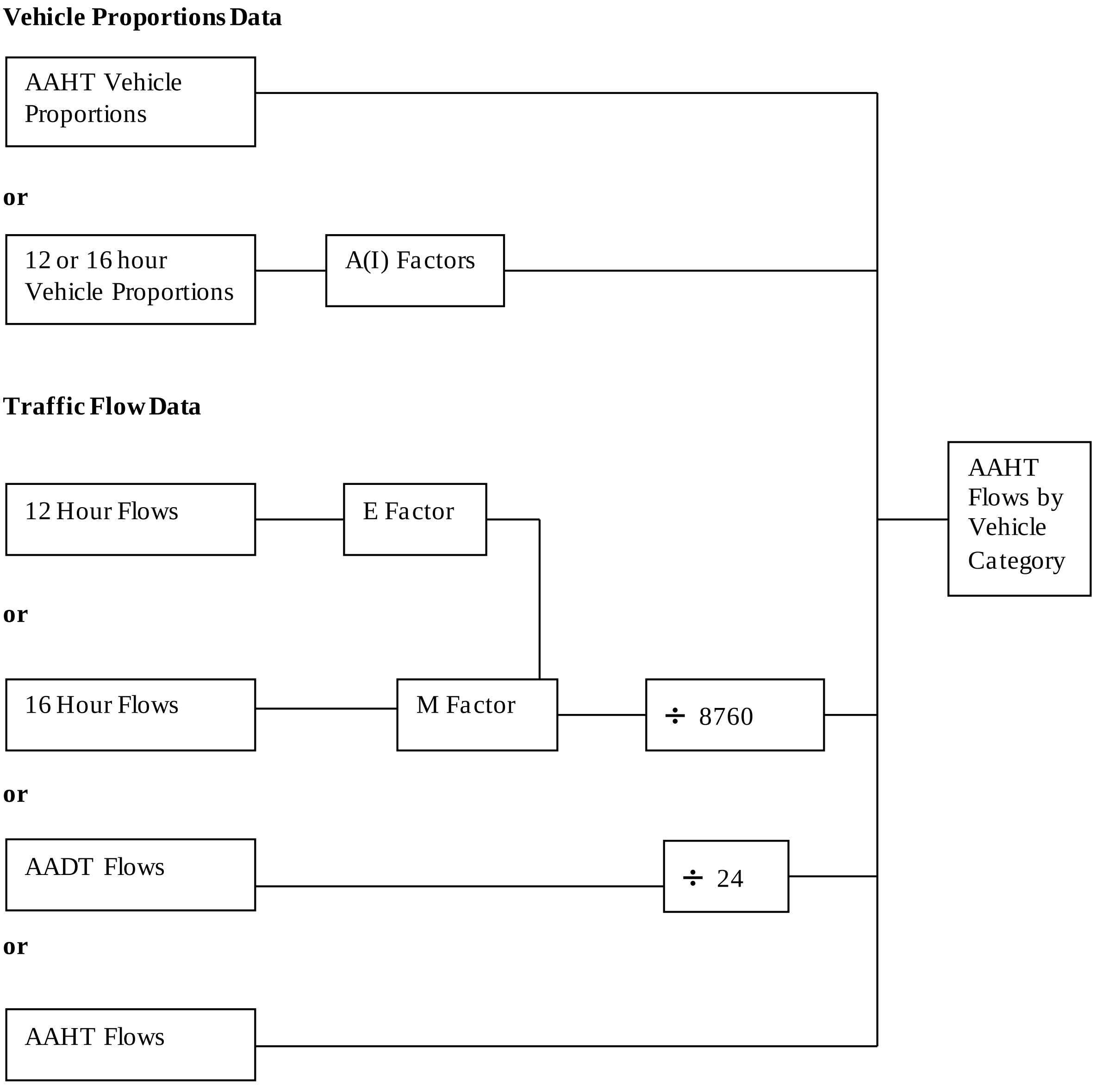

Figure 9/1: Calculation of AAHT Flows by Flow Group

12 Hour Traffic Flow Input, E-Factors

9.8 The default values held within the program assume that if a 12 hour flow is input it represents an average 12 hour (0700 - 1900) weekday (Mon - Fri) flow in the month specified. The program will then convert the flows to a 16 hour equivalent by the application of an E-FACTOR and then follow the procedure used if a 16 hour flow were input. The default E-factors are independent of the month and Seasonality Index, the defaults held in the program for the different Network Classifications are given in Table 9/1. The facility exists for the user to input a local E-Factor.

Network Classification		E-FACTOR
Motorway	(MWY)	1.15
Built-up Trunk	(TBU)	1.15
Built-up Principal	(PBU)	1.15
Non Built-up Trunk	(TNB)	1.15
Non Built-up Principal	(PNB)	1.15

Table 9/1: E Factors

16 Hour Traffic Flow Input, M-Factors

9.9 The default parameters held in the program assume that if 16 hour flow is entered it represents an average 16 hour (0600-2200) weekday (Mon-Fri) flow in the month specified, excluding periods affected by Bank Holidays. The 16 hour flow is converted within the program to 'Annual All Vehicle Flow' by the application of an M-Factor. These factors vary with the month in which the count was taken and by Seasonality Index. The COBA program calculates the M-factor based on the relationship M = a + b x SI where the parameters 'a' and 'b' for each month are given in Table 9/2. The program contains defaults for all months but a warning will be printed if the data is not for a neutral month (April, May, June, September and October). The straight line relationships for the neutral months are shown graphically in Figure 9/2.

Month (month number)		Parameter		M-FACTOR		
		a	b	SI = 1.0	SI = 1.25	SI = 1.5
January	(1)	126	276	402	471	541
February	(2)	105	261	366	431	496
March	(3)	149	244	394	455	516
April	(4)	287	73	360	378	397
May	(5)	316	33	349	357	367
June	(6)	408	-57	351	337	323
July	(7)	512	-163	350	309	268
August	(8)	639	-287	353	281	209
September	(9)	445	-102	343	318	292
October	(10)	297	61	358	373	389
November	(11)	268	121	389	419	449
December	(12)	285	130	415	448	480

Table 9/2: Variation of M-Factor with Seasonality Index (SI)

9.10 If reliable long term traffic data is available the use of a locally derived ‘M’ factor is recommended. The analysis of the counts will need to be included in the economic appraisal submission.

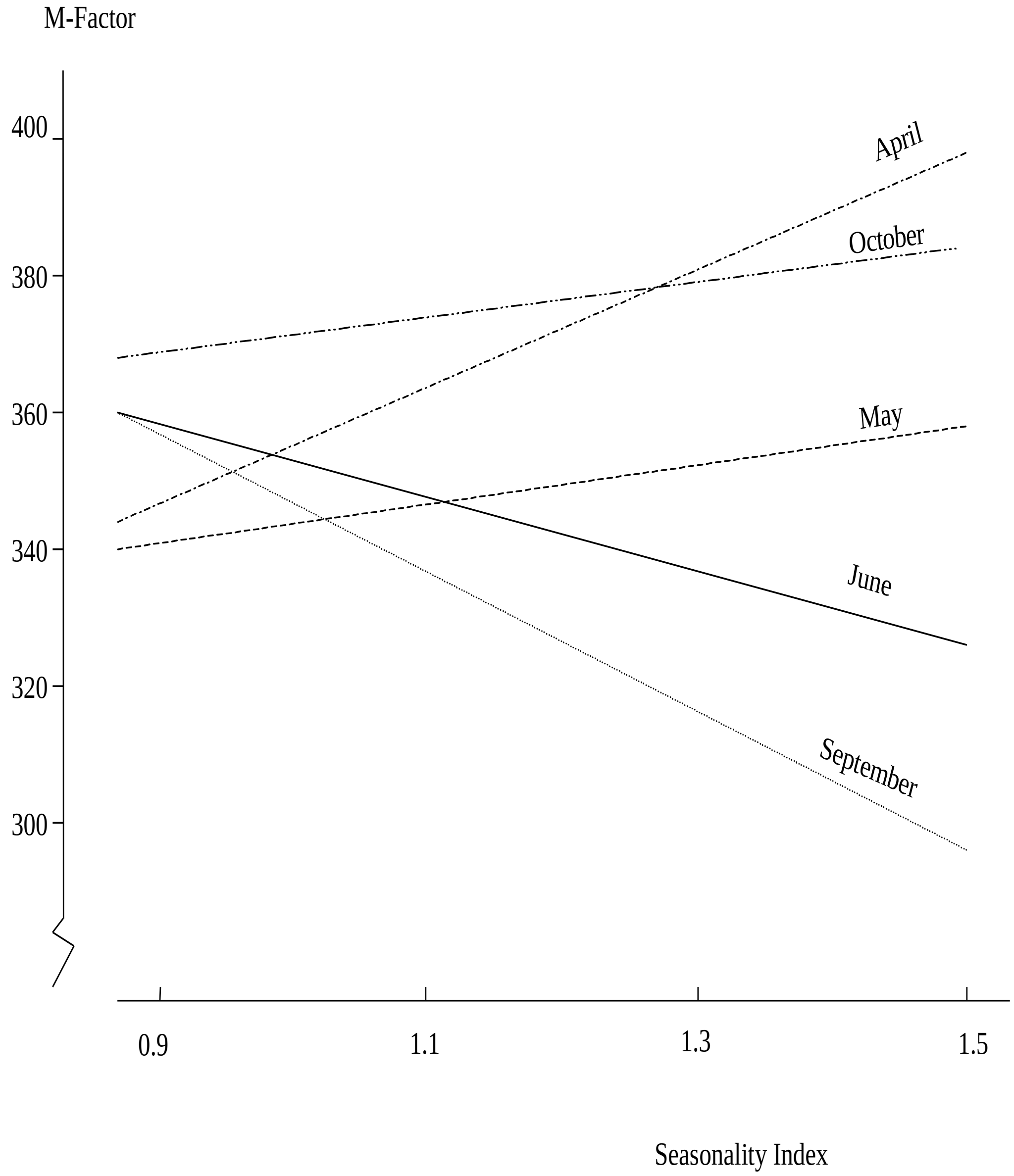

Figure 9/2: The Variation of M-Factor with Seasonality Index

Flow Factor

9.11 COBA will only accept AAHT, 12, 16, or 24 hour flows. However occasionally the link flows output from the traffic model will not exactly match one of these requirements, for example, if local circumstances dictated a fourteen hour traffic model. Provided that the traffic model flows can be converted to a required input solely by the application of a uniform factor this can be done within the COBA program by means of the FLOW FACTOR which is specified on Key 007 records.

10. THE NATIONAL TRAFFIC FORECASTS

10.1 The default traffic growth rates used in COBA are average values consistent with the Road Traffic Forecasts announced in 2018 for England and Wales. A full account of the forecasts and the basis of their derivation is contained in 'Road Transport Forecasts 2018 (see Bibliography).

10.2 Table 10/1 gives actual annual growth over recent years and the average forecast traffic growth profile expressed as annual percentage growth rates for each year up to 2050 for England and Wales. Zero growth is assumed post 2051.

10.3 Historically COBA has included 'Low' and 'High' traffic growth profiles. These are now replaced by a single 'central' default growth profile that is provided for cases where no congested assignment model is available to produce scheme specific reference case forecasts using the methodology set out in WebTAG Unit M4.

PERIOD (see note)	CARS	LGV	OGV1	OGV2	PSV
	ACTUAL GROWTH (% per year)				
1994	2.1	4.2	0.9	3.4	1.0
1995	1.8	2.7	0.8	4.5	5.0
1996	2.7	4.0	2.4	4.3	2.6
1997	1.5	4.9	0.4	3.7	1.6
1998	1.5	4.8	3.4	4.1	0.7
1999	1.5	1.3	1.5	0.2	-0.1
2000	-0.2	1.4	0.7	0.1	-2.1
2001	1.6	2.6	-1.3	-0.3	0.1
2002	2.7	2.6	1.5	1.0	-0.3
	GROWTH FORECASTS (% per year)				
RANGE OF YEARS					
2003 to 2010	-0.04	2.05	0.52	-2.64	-0.94
2011 to 2015	1.24	1.55	-0.34	0.51	-1.97
2016 to 2020	1.37	1.95	-0.02	-0.02	-1.82
2021 to 2025	0.97	1.04	0.06	0.06	0
2026 to 2030	0.84	1.07	0.20	0.20	0
2031 to 2035	0.85	1.36	0.36	0.36	0
2036 to 2040	0.72	1.27	0.40	0.40	0
2041 to 2045	0.62	1.00	0.38	0.38	0
2046 to 2050	0.55	0.76	0.35	0.35	0

NOTE: The 1994 growth factor is that used to convert a 1993 flow to a 1994 flow.

Table 10/1: Average Road Traffic Forecasts (annual percentage growth rate)

11. LOCAL TRAFFIC FORECASTS

Deleted