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COUNTRY NOTES FOR 1995 E ROAD CENSUS

Note prepared by the Secretariat

Note: The following methodological information was provided by ECE member countries participating in the "1995 Census of Motor Traffic on Main International Traffic Arteries (E Road Census)". The English version of these country notes can be found in the introductory part of the publication of the same title (Sales No. E/F/.97.11/E20) (GE.97-24374, November 1997).

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1995 CENSUS OF MOTOR TRAFFIC ON MAIN INTERNATIONAL TRAFFIC ARTERIES

COUNTRY NOTES

BELGIUM

Introduction

In accordance with the guidelines contained in TRANS/WP.6/AC.2/12/Add.1, a general traffic census was conducted in Belgium in 1995. This report has been compiled on the basis of the results obtained at counting posts located on E roads listed in the European Agreement on Main International Traffic Arteries (AGR) of 1975 and successive amendments thereto. A general census of traffic on other main non-urban roads was also conducted in Belgium in 1995 using the same principles as described below for E roads. The results of this five-yearly census (with vehicle categorization) and those of the annual census (without vehicle categorization) are contained in a separate publication.

Counting Methods

The 1995 census involved various counting methods:

(a) Continuous automatic counting: Since 1984, Belgium has had a permanent traffic census network consisting of single magnetic-loop metres. Along ordinary roads, these metres record only traffic density per hour in each direction (type B metres included in tables 7 and 3). Along motorways, these metres are equipped with processors which carry out a real-time sort of long and short vehicles based on the time taken by vehicles to pass the single loop and on a number of assumptions concerning vehicle speed and the number of private cars as a percentage of all vehicles.

Since 1992, these metres have been used in two ways: for 11 months of the year to metre lorries with semi-trailers or trailers as "long vehicles"; for one month in autumn to metre all heavy vehicles (category C in this report) as "long vehicles". In light of the experience acquired since 1992, sufficient correlations have been established to enable these metres to be used for partial categorization of vehicles (type A metres included in tables 7 and 3).

(b) Non-continuous automatic counting: These involve the use of single-tube metres located for one or more weeks on main roads at points not equipped with metres or of double-tube metres, or of camera metres used also for traffic control (respectively, types T, TT and C in tables 7 and 3). These last two types of metre allow for partial categorization and were used solely in the south (Walloon region) from about mid-1995 to the end of 1996.

(c) Visual (or manual) counts combined with automatic counts: In 1995, this type of count was conducted solely in the northern part of the country and around Brussels (Flemish region), and the number of visual posts on E roads was reduced from 71 in 1990 to 36 in 1995, and from 294 to 70 on E and other roads combined.

These posts operated on a four-day timetable for a total of 24 hours (i.e. equivalent to 1.5 16-hour days), as follows:

Day of the week	Dates	Counting times
Tuesday	16 May 1995 or 27 April 1995	6 to 8 a.m., 10 to 11 a.m., 4 to 7 p.m., 8 to 9 p.m.
Thursday	19 September 1995 or 5 October 1995	6 to 8 a.m., 10 to 11 a.m., 4 to 7 p.m., 8 to 9 p.m.
Saturday	20 May 1995 or 10 June 1995	10 a.m. to noon, 5 to 7 p.m.
Sunday	7 May 1995 or 24 September 1995	8 to 10 a.m., 7 to 9 p.m.

For 5% of the posts, counts took place on other dates until June and September 1996. Hours when there was no counting were calculated as follows: hourly density for all vehicles was determined on the basis of (the nearest) automatic counts (if possible) on the same date; figures for categories were determined on the basis of average percentages by category during the closest visual count times. The sharp reduction in visual counting hours, combined with the difficulties of correlation with automatic counting and operating problems at automatic posts, gave rise to innumerable difficulties.

Vehicle categories

The categories are based on those defined in TRANS/WP.6/AC.2/12/Add.1, with some additional breakdowns, as follows:

Category A: motorcycles
Category B: passenger and light goods vehicles [1/]
Category C: All lorries. (For a better analysis of the effects of traffic and in particular load effects according to Eurocode 1.3, it was preferable to divide this category into C.1: rigid lorries (two or more axles), and C.2: lorries with trailer or semi-trailer);
Category D: motor buses and coaches
Category E: special vehicles (bulldozers, agricultural tractors, military vehicles, wide or long loads).

In accordance with the above-mentioned guidelines, categories A, B and E were treated as light traffic, except in one minor case (percentage column of table 7), in spite of the approach, adopted in 1990, of including this category in heavy traffic, which makes complete sense in the case of Belgium.

E roads covered

All the E roads in the 1995 network are covered in this report, i.e., the network covered in 1990, including indicated E roads and E roads not indicated, namely the Brussels and Antwerp ringroads and the Liège transit route via the E 25, N 46 and N 421; roads classified as "E" between 1990 and 1995 (approved at the AGR meeting in May 1994 in Geneva and shown as "1993 roads" or "93 roads" in this report). As a result, most of the tables include two columns for E roads in 1995: the first column covers the whole network and the second covers the part corresponding to the 1990 network, thus enabling a comparison to be made with 1990. These same two columns are used for E roads extended or modified by the AGR meeting in May 1994, namely the E 34, E 314 and E 411. As in 1990, sections common to a number of E roads (roughly 15% of the total) have been taken into account for each E road, but have been included only once in the total for E roads. Where necessary, the tables show the "total with double sections counted twice" and the actual "net total".

[1/] As explained in 1990, the Belgian definition of light goods vehicle (less than 1.5 tonnes load capacity) differs slightly from the definition in the document (less than 3.5 tonnes permissible maximum weight).

List of tables and additional comments

Tables 1-4: Total traffic densities given are average daily densities (6 a.m. to 10 p.m.) calculated for the whole of each road in proportion to the length of each section; in other words, they are average densities needed for the calculation of vehicles/km. Densities by vehicle category have been obtained in the same way, using the partial categorization posts in Table 7.

Table 4 bis: This table was not included in the 1990 census. As a result, references to 1990 are not available in the form requested.

Night traffic: Night traffic densities were obtained by simple averaging of available visual posts and are therefore not compatible with the "daytime" densities shown in table 4. The same calculation as in table 4 is actually impossible on the basis of visual posts alone, as "single magnetic loop" partial categorization posts do not provide reliable night categories. However, the total E roads column has been adjusted for compatibility with the E roads total in table 4.

Holiday traffic: Only total traffic density has been calculated here, in the same way as in table 4, but without categories, as no visual posts were operating in the holiday period. The July-August period was used throughout the country (school holiday period), although understandably it is a period when traffic increases sharply near holiday resorts (Belgian coast and Ardennes) and falls appreciably in urban areas (Brussels, Antwerp, Louvain). These rises and falls sometimes occur on successive sections of the same road (E 40, for example).

Peak traffic: As in the case of night traffic, automatic partial categorization metres do not provide reliable categories for lines of vehicles or traffic jams. It was possible to calculate an average for the visual posts alone, as in the case of night traffic, but it is difficult to see how the average of posts which are saturated with traffic and others which are not can be a meaningful figure. We have used only the most saturated visual post for each E road, and for one direction only, in the absence of clearer guidelines. The question of a "peak-hour traffic" figure for E roads should be discussed. One possibility might be the average of the hours of half-posts where density exceeds a certain level (e.g. 1,600 vehicles per lane), excluding all half-posts and hours below that level. The number of hours taken into account should be specified to show overall road saturation.

BULGARIA

Introduction

The 1995 Census was carried out on the national road network on road sections located within the boundaries of populated areas with more than 10,000 citizens. Automatic counts were used, as well as visual monitoring to determine the composition of traffic flows. The methodology was based on a study of total traffic flow and its irregularities over a given time period at selected counting posts, as well as short-term surveillance over a large number of counting posts.

Types and location of counting posts

(1) Posts for determination of irregularities in the passing of road traffic = mail counting posts (MCP);
(2) Posts for which the value of average daily traffic volume is determined = additional counting posts (ACP). The road network covered by the traffic count is divided into sections with similar traffic volumes. Border sections are chosen where there is an expected change in traffic volumes and in the composition of traffic flow (intersection, junction, populated place, etc.).

Duration of count

The count of motor vehicles at each MCP had a minimum duration of 7 consecutive days (from Monday to Sunday) during the months from May to September, and 4 consecutive days (from Thursday to Sunday) during all the other months of the year. The count of motor vehicles at each ACP had a minimum duration of 4 working days in the year lasting 14 hours (Wednesday or Thursday) from which 2 days are during the months April and May and 2 days are during the months of July and August, as well as 2 Sundays during the months of July and August.

Types and groups of motor vehicles

Motor vehicles are classified into 7 groups with the determination of design loading of pavements and of design volume per hour (Table 1)

Calculation of road traffic

Variations in volume over a given period of time (days, weeks, year) are taken into consideration in the determination of traffic on the road network. These variations are determined from the road function and are expressed through relative values (coefficients and unevenness) of holiday traffic and that in the end of the week bv and characteristics of traffic on which these calculations are based.

(1) The coefficient y indicates the traffic increase in the working days during the tourist season compared with that in the months with the average traffic volume (May and June) and is determined by the formula:

$$y = T_{mt,1} / T_{mt,2} \qquad (1)$$

where $T_{mt,1}$ = the average daily traffic volume in the working days in July and August as a total number of motor vehicles per day (24 hours); $T_{mt,2}$ = average daily traffic volume in the working days in May and June as a total number of motor vehicles per day.

(2) The coefficient bv indicates the increase of car traffic during the weekends in July and August over that in the working days of the same months and is determined by the formula:

$$bv = T_{mt,3} / T_{mt,4} \qquad (2)$$

where $T_{mt,3}$ = average daily traffic volume of cars during the holidays in July and August as a number of cars per day; $T_{mt,4}$ = average daily traffic volume of cars in the working days in July and August as a number of cars per day; For more accurate reporting of holiday traffic and of weekend traffic, a differentiation of the values of parameters y and bv are shown in Table 2 below:

Parameters y and b_v;		**1** **bv<1.0**	**2** **1.0#bv<1.0**	**3** **1.5#bv#2.0**	**4** **2.0#b_v**
A	y <1.5	A1	A2	A3	A4
B	1.5< y <2.0	B1	B2	B3	B4
C	2.0< y <2.5	C1	C2	C3	C4
D	2.5 < y	D1	D2	D3	D4

Determination of coefficients for traffic irregularity:

(1) The coefficient a_x shows the traffic irregularity during a day (24 hours) and is determined by the formula:

$$a_x = N_{24} / N_x \qquad (3)$$

where N_{24} = The daily traffic volume as a number for each type of motor vehicle; Nx = the traffic volume for x hours as a number for each type of motor vehicle (MOT/x h, CAR/x h, T1/x h, T2/x h, T3/x h, T4/x h, BUS/x h). The minimum value of x is 14h. This coefficient is determined for each character of traffic, for each type of motor vehicle and month.

(2) The coefficient bi indicates the irregularity of traffic during the i-day of the week and is determined by the formula:

$$b_i = (\sum_{m=1,n} Nc / Ni) / n \qquad (4)$$

where N_c = the average weekly traffic volume for the week m for which full weekly surveillance are carried out, as a number for each type of motor vehicles per day (MOT/24h, CAR/24 h, T1/24 h, T2/24 h, T3/24 h, T4/24 h, BUS/24 h); m = the index of the week during which a traffic count is carried out (values from 1 to n). The coefficient Bi is determined for each character of traffic, type of motor vehicle, month during which a count on ACP is done, and day of the week.

(3) The coefficient c_j indicates the irregularity during the j-month of the year and is determined by the formula:

$$c_j = N_p / N_j \qquad (5)$$

where N_p = the average annual traffic volume as a number for each type of motor vehicle per day (MOT/24 h, CAR/24 h, T1/24 h, T2/24 h, T3/24 h, T4/24 h, BUS/24 h); Nj = the average monthly traffic volume in the j-month with dimensions as a Np; J = the index of the month during which the traffic count is carried out (values from 1 to 12). The coefficient cj is determined for each character of traffic, type of motor vehicle and month during ACP counting.

Determination of the average annual daily traffic volumes. The value is determined for ACPs. Values are found separately for the amount of the average annual daily traffic volume at ACPson the basis of data for each month during which a count is carried out.

$$Nm = a_x^m \bullet b_i^m \bullet c_j^m N_x^m \qquad (6)$$

where Nm = the average annual daily traffic volume at the ACP on the basis of the data for the month m as a number for each type of motor vehicle/24 h; Nxm = x-hour traffic volume at a certain ACP for the month m for each type of motor vehicles/xh; m = the index of the months during the counts (values from 1 to n); ax, bi, cj = as in formulas (3) (4) (5). The final value of the average annual daily traffic volume (AADT) is obtained by the formula:

$$N = (\sum_{m=1,n} N^m) / n \qquad (7)$$

where N = the final value of AADT as a number for each type of motor vehicles/24 h; N^m = as in formula (6).

Determination of the traffic volume reduced to units of cars: The reduction of AADT to units of cars is made on the basis of the transfer coefficients shown in Table 3:

Type of motor vehicles, s	Transfer coefficient, k_s
1. MOT	0.5
2. CAR	1.0
3. BUS	2.5
4. TI	2.0
5. T2	2.0
6. T3	2.0
7. T4	3.5

The determination of the average daily traffic volume reduced to car units is done by the formula:

$$N' = \sum_{s=1,7} (N_s \cdot k_s) \qquad (8)$$

where N' = AADT reduced to car units, number of car units/24 h; Ns = AADT of the s-type of motor vehicles (MV) as a number for each type of MV/24 h; ks = the transfer coefficient for the s-type of MV; s = the index of the type of MV (values from 1 to 7).

Determination of peak hour traffic volume: Peak hour traffic volume is the highest hour volume reached or over-reached during t hours in the year. It is determined by the formula:

$$N_0 = T_t \cdot N' \qquad (9)$$

where N = the peak hour traffic volume, number of car units/h; N' = as in formula (8);
Tt = the coefficient of peak hour volume which is determined for each counting post through the formula:

$$Tt = N_t / N_p \qquad (10)$$

where N_t = the hour traffic volume for a given counting post (MCP) which is overreached during t hours in the year, as a total number of motor vehicles/hour; t = time in hours (accepts values 30, 50 and 100; when planning the development of the road network and the design of road sites, t = 50 h; the values 30 and 100 are used during special investigations; N_p = AADT determined for the corresponding counting post as a total number of motor vehicles/24 h.

CZECH REPUBLIC

Introduction

1995 Census data in the Czech Republic is based on the results of general traffic counts taken on the entire motorway network of the country and on a major part of other roads on the Czech territory. The Census was undertaken by means of statistical samples representing the period April-October, with each sample comprised of four hours of different time periods during the day (a.m. or p.m.). Using these samples and empirical factors, values of average daily traffic (ADT) in 1995 were calculated. Supplementary night counts

beyond normal limits of the Census were carried out only at selected counting posts on the E roads. Traffic was counted during one counting period in spring and one in summer. Counting posts on the E network were selected in conformity with the data obtained; as a rule, the same locations were used as for the national traffic census in 1990. The earlier numbering of counting posts was also retained. Changes have been made only at places where new road construction projects or route modifications of E roads caused substantial changes of condition. Lengths of road section, numbers of traffic lanes and carriageway widths have been changed for the same reasons.

Notes to the tables and the map

Table 1: The distribution by carriageway widths refers to non-urban (rural) E roads only. The length of the E roads in urban areas is given in Part 3 of the table as "unknown". Classification by carriageway widths was not available here.

Table 2: The break-up of lengths of the E roads by their traffic volumes has been carried out for non-urban E roads only.

Table 3: All lengths of single E roads are given including sections which are common with other E roads. Lengths of common sections are shown in brackets. The same applies to the numbering of counting posts.

Table 4: The values of average traffic have been ascertained for sections of the E roads in non-urban (rural) areas.

Table 4bis: The values of average traffic have been ascertained for sections of the E roads in non-urban (rural) areas. Since night counts were not effected in 1990, the required comparison of night ADT was not possible. Holiday traffic and peak-hour traffic were not estimated in 1995. Traffic on motorways was counted by automatic traffic counters, registering only total numbers of vehicles. Supplementary manual counts by categories of vehicles were executed only to a limited extent; therefore it was not always possible to find out the pattern of holiday traffic composition in summer, so that the required data to characterize traffic composition on some routes are missing. The respective data are also not shown for the 50th hour because the methodology used for 50th hour traffic estimation in the Czech Republic does not allow for such details.

Table 5: All motorways and most express roads in the Czech Republic form part of the E road network. Therefore, there are no data in the rows for motorways in Table 5, while in the rows for express roads only such data are shown which refer to express roads not included in the E network. Traffic performance was estimated by means of a detailed analysis and comparison of results of national traffic censuses in 1990 and 1995 for all motorways and all-purpose roads, including sections in urban areas.

Table 6 (Map) and Table 7: The sections are numbered identically with the 1990 Census to facilitate comparison. Changes of routes of the E roads due to new construction or route modification (shift to other roads) were included. Therefore some section numbers have been dropped or cancelled. Some section numbers have disappeared also because the numbering of sections is based on a system used in the former Czech and Slovak Federal Republic and the respective sections are now on Slovak territory.

ESTONIA

The Estonian national road network consists of 15, 394 kms of which 1190 kms are main roads (E 20 Talinn-Narva, 199.5 km and E 67 Tallinn-Pärnu-Ikla 167.6 kms. There are 35 counting posts -- 21 on E 20 and 14 on E 67. The 1995 census included data from 32 counting posts. As there was no road census carried out in 1990, comparisons with 1995 are not possible. However, from 1994, the census programme was established with the following classification of vehicles: passenger cars, lights goods vehicles, medium good trucks, heavy good trucks, road trains, motor buses and coaches. Up until 1996, only manual traffic censuses were in use. On main census points (6 on E roads) counting has been carried out 4 X 24 hours (1x 24 h per season) and on the other points 3 x 24 h (not in winter season). Average annual daily traffic has been calculated for other points on the basis of these main points.

LITHUANIA

There are three E roads in Lithuania:

(1) Part of E67: Helsinki - Talinn - Riga - Panevezys - Kaunas - Warszawa - Piotrkow - Trybunalski - Wroclaw - Klodzko - Beloves - Nachod - Hradec Kralove - Praha;

(2) Part of E271: Klaipeda - Kaunas - Vilnius - Minsk - Gomel;

(3) E272: Panevezys - Ukmerge - Vilnius

No comparisons were possible with 1990 data as the Census was implemented in Lithuania for the first time in 1995. Almost all counting posts were located at intersections. Only one counting post (CP07) was not at an intersection. In calculating the average traffic density, it was assumed that on one half of road sections between two counting posts traffic density was equal to the value at the first counting post and on the second half equal to the value at the second post.

The calculation of vehicle kilometres for the whole road network was as follows:

Calculation of vehicle-kilometres for whole road network in 1995

Type of road	**AADT vehicle per day**	**Length of road km**	**AADT* length*365 106 veh.*km**
Main roads	3,837	1,456	2,039
National roads	1,878	3,410	2,337
Regional roads	822	16,245	4,874
Total		**21,111**	**9,250**

As is indicated on accompanying maps, counting post CCP15 is common for roads E67 and E271 and counting posts CP08 is common for roads E67 and E272.

THE NETHERLANDS

Multiple sources were used to collect the required data for the 1995 Census. Data for 1990 is not given in some cases because of the lack of comparability due to rerouting and renumbering of roads. E roads are divided into road sections, some of which are part of more than one E-road, thus some E road sections appear in the table more than once. In the Netherlands there is a system of permanent counting posts. Some of these posts collect data per day for the total amount of traffic and some collect data per hour in three categories (passenger cars, light goods vehicles and heavy goods vehicles). To convert these data into four categories we have organized some additional counts. Data is only included for four categories (A-D), because category E from the UN Recommendations represents a relatively small amount on the Dutch E road network and was difficult to measure. Motorways and expressways have been combined because it is difficult to distinguish between the two road types.

POLAND

A census was taken in 1995 of the traffic flow on the national road network in Poland and this included motor traffic on main international arteries (E roads). The total length of E roads covered by the test facilities was 4496 km. Automatic counting was carried out at 525 counting posts and manual counting was carried out at 31 counting posts. In an effort to conserve resources, the year test cycle complying with the original Geneva formula was reduced to nine "day" periods and two "night" periods. The day period counts were performed from 8 00 to 16 00 (with some selected locations from 6 00 to 22 00) and night period counts from 22 00 to 6 00. Dates of traffic counts were chosen so as to define the annual average daily traffic with the required accuracy. In the table shown below, the schedule for the 1995 traffic census is indicated.

Schedule of traffic census in 1995

Number of count	**Data of counting**	**Day of week**	**Character of counting**
X_1	26 January	Thursday	day
X_2	28 March	Tuesday	day
X_3	24 May	Wednesday	day
X_4	13 July	Thursday	day
X_5	16 July	Sunday	day
X_6	22 August	Tuesday	day
X_7	27 August	Tuesday	day
X_8	27 September	Wednesday	day
X_9	10 December	Sunday	day
X_{10}	24/25 May	Wednesday/ Thursday	night
X_{11}	27/28 September	Wednesday/ Thursday	night

Method used for calculation of daily averages:

AADT = ((MR N1 + O,8 MR N2 + MN N3) / N) + RN

where:

AADT = Annual Average Daily Traffic
M_R = average "day" traffic per workday
M_N = average "day" traffic per Sundays and holidays
R_N = average "night" traffic
N_1 = number of working days in year, $N_1 = 250$
N_2 = number of Saturdays and pre-holiday days, $N_2 = 53$
N_3 = number of Sundays and official holidays, $N_3 = 62$
$M_R = 1/3\ (x_1 + x_4)/2 + (x_2 + x_6)/2 + (x_3 + x_8)/2$
$M_N = ½\ (x_5 + x_7)/2 + x_9$
$R_N = (x_{10} + x_{11})\ /2$

where:

$x_1, x_2 \ldots .x_9$ = "day" traffic (6.00 - 22.00),
x_{10}, x_{11} = "night" traffic (22.00 - 6.00) on the counting days in the Schedule of Traffic above.

PORTUGAL

Introduction

The 1995 traffic census made it possible to evaluate the annual average daily traffic (AADT) on European roads in Portugal. However, that census was organized in a way somewhat different from the usual system that followed in 1990. Four kinds of counting stations (principal and covering manual stations, automatic and toll stations) were considered in the counting system of 1995, whereas in 1990 only principal manual stations were considered. In 1995, in the principal stations, counting was carried out following the method recommended by UN/ECE for the Main International Traffic Arteries, except for the night countings which were estimated. In the covering stations a simplified method was used based on five countings only during eight hours per day. In this case, the AADT was estimated by using sampling methods. Tables were drawn up accordingly, showing some of the characteristics of the E roads (number of lanes, carriageways and respective widths), the corresponding length and results of the census for motor traffic. Also, whenever possible, their comparison with figures recorded in 1990 were noted.

When preparing these tables and the traffic map, the recommendations used were those in TRANS/WP.6/AC.2/12/Add.1, with the exception of the figures about night traffic, holiday traffic and peak-hour traffic.

As a result of a new classification and of changes in some routes, the E roads in Portugal were grouped into three categories:

C Reference roads

E80 - Lisboa, Santarém, Leiria, Coimbra, Aveiro (Albergaria), Viseu, Guarda, V.Formoso (border with Spain);
E90 - Lisboa, ... , Setúbal, Évora, Caia (border with Spain).

C Intermediate roads

E01 - Valença, Porto, Aveiro (Albergaria), Coimbra, Lisboa, Setúbal, Faro, Vila Real de Santo António (border with Spain).
E82 - Porto, Vila Real, Bragança, Quintanilha (border with Spain).

C Connecting roads

E801 - Coimbra, Viseu, Vila Real, Chaves, V.Verde Raia (border with Spain);
E802 - Bragança, Guarda, Castelo Branco, Portalegre, Évora, Beja, Ourique;
E805 - Famalicão, Chaves;
E806- Torres Novas, Abrantes, Castelo Branco, Guarda.

The last amendments proposed by the Government of Portugal were adopted by the Principal Working Party on Road Transport on its eighty-eighth session (26-28 October 1994) (TRANS/ SC.1/355).

Therefore 2319 Km, that is about 23% of the national road system, belong to the Main International Traffic Arteries. These roads have common sections on a total length of 596 Km, distributed as follows:

- E01 coincides with E80 and E90 on lengths of 246 Km and 56 Km respectively;
- E801 coincides with E805 on a length of 37 Km;
- E802 coincides with E80, E82, E90 and E806 on lengths of 15Km, 38 Km, 41 Km and 162 Km respectively.

With reference to some roads still under construction (Porto-Valença; Fafe-Chaves; Abrantes-Gardete; Lisboa-Setúbal), it is intended to use a temporary old itinerary as indicated.

Counting stations

In 1995 Manual Classified Traffic Counts were made along the national road network at 79 principal stations and 466 covering stations. Automatic counts were made at 59 stations and toll counts at 40 stations. On E roads, manual, automatic traffic counts and toll stations were made at 94, 27 and 34 stations respectively. These were distributed as shown on the traffic map, where the total number of vehicles in both directions were recorded. There are 38 counting stations that simultaneously serve equal road sections, of which 13 correspond to manual counting, 6 to automatic counting and 19 to toll stations, and are distributed as follows:

- E01 has 15 and 6 stations in common with E80 and E90 respectively;
- E801 has 2 stations in common with E805;
- E802 has 1, 2, 3 and 9 stations in common with E80, E82, E90 and E806 respectively .

Counting schedule

As in the earlier census, at Principal stations, manual classified counts were made on 14 days of the year in accordance with the schedule defined by UN/ECE; with the exception of night countings, which were not counted in 1995 (see Table I). At covering stations manual counts were made on 5 days of the year, during 8 hours as follows: period 12h-20h on 4 working days and 13h-21h on one Sunday (see Table II).

Table I
Principal manual stations

Code	Date	Weekday
A	28th January	Sunday
B	6th March	Monday
C	8th April	Saturday
D	21st April	Friday
E	23rd April	Sunday
F	18th May	Thursday
G	7th June	Wednesday
H	11th July	Tuesday
I	23rd July	Sunday
J	8th August	Tuesday
K	16th September	Saturday
L	29th October	Sunday
M	9th November	Thursday
N	15th December	Friday

Table II
Covering manual stations

Code	Date	Weekday
B	6th March	Monday
H	11th July	Tuesday
I	23rd July	Sunday
J	8th August	Tuesday
M	9th November	Thursday

Vehicle classification

The categories of vehicles considered were those corresponding to previous UN/ECE recommendations, but these were joined according to the revised vehicle classification recommended by UN/ECE, for the 1995 and future censuses (see table III).

Table III
Vehicle classification

Designation	Previous UN/ECE classification	Revised UN/ECE classification
Motor cycles	C	A
Passenger vehicles Light Goods vehicles	D E	B
Lorries without trailer Lorries with one or more trailers Tractors with trailers or semi-trailers	F G H	C
Motor buses and coaches	I	D
Special vehicles (agricultural vehicles)	J	E

Annual Average Daily Traffic

On the basis of the figures recorded in the different traffic counts during the year, the annual average daily traffic was determined for each station. In order to calculate the AADT at the principal manual stations the following formula was used:

Daily AADT (16 hours) = 1/28 (A+C+E+I+K+L)+1/14(D+G+F+H+J) + 1/7 (B+M+N)

AADT = Daily AADT x night factor
(the night factor was estimated based on automatic counting stations)

The AADT at the covering manual stations was estimated using sampling methods to extrapolate from AADT (8 hours) to AADT (16 hours). To estimate the AADT (24 hours) the night factor was used, based on automatic counting stations. Each E road was divided into several sections, each section belonging to a counting station. Based on the AADT at each station, and on the extent of the road system covered by that station, the corresponding vehicles x kilometres was determined. To determine the annual average daily traffic on a given road and for a given category, the number of vehicles x kilometres was added up and then divided by the total length. The national AADT was found in the same way. The existence of some reduction in, traffic related to 1990, is due to the following facts:

- Construction of new links of toll motorways (Posts P22, P23, P26, P27, P40, P89, P90, P92);
- Construction of motorways without toll but further away from urban centres (Posts P49, ..., P55A);
- Construction of by-passes to urban centres (P5, P41A);
- Taking new stations into consideration, traffic is measured from unequal points (P10, P44A, P116A, P116B, P118A).

These results affected some variations 1995/1990 (as shown in table 4), especially E01, E80 and E90. Consequently the total variations of the above-mentioned roads did not grow as much as expected.

ROMANIA

In Romania, censuses of road traffic on main international traffic arteries (E roads) are conducted at regular five-year intervals and are organized on the basis of the recommendations of the Economic Commission for Europe. These censuses have been carried out as part of the general censuses of traffic on the public road system. The most recent general traffic census, in 1995, covered 45,917 km of roads, including: main international traffic arteries (E roads); all other national roads; departmental roads; the most heavily used communal roads. The general road traffic census was carried out at 2,973 posts, of which 247 were on E roads. Romania has the following E roads: E 60, E 68, E 70, E 79, E 81, E 85, E 87, E 574, E 576, E 581, E 583, E 671, E 673 and E 771.

A combined census methodology was adopted, involving both manual and automatic counting. Counting posts were divided into three categories: category 1: main posts; category 2: secondary posts; category 3: back-up posts. Manual counts were made at all posts for a total of 14 days distributed throughout the traffic census year on the basis of sampling plan.

Manual counts were conducted for 8 hours per day on national roads and 14 hours per day on departmental and communal roads, with 24-hour traffic volumes being calculated using statistic correlation coefficients.

Automatic counts using traffic meters were made at category 1 and category 2 posts, as follows: category 1: continuous automatic counting; category 2: automatic counting over a 10-month period (March to December). Counting posts were sited in accordance with the ECE recommendations, allowing for variations in traffic distribution over the road system. Manual counts were made of the following nine vehicle types:

(a) bicycles, mopeds, motorcycles;
(b) passenger and light goods vehicles (not exceeding 3.5 t), with or without trailers;
(c) lorries and the like with two axles;
(d) lorries and the like with three axles;
(e) lorries and the like with more than three axles;
(f) motor buses with more than nine seats;
(g) agricultural tractors and special vehicles;
(h) trailers for lorries and tractors;
(i) vehicles drawn by animals.

SPAIN

Organization of counting posts and methodology

The 1995 Census of Motor Traffic on Main International Traffic Arteries was carried out within the National Motor Traffic Census program which the Directorate General for Roads designs and undertakes every five years over the whole national network and at some roads depending on regional governments.

The vehicle categories used were those specified in the TRANS/WP.6/AC.2/12/Add.1 document.

Counting posts of different types were used and located in such way that each road section with homogeneous traffic would have at least one post.

Several automatic posts, equipped with electronic counters and magnetic-loop metres, were implemented in order to collect traffic data from every single hour of the year and to classify this data in light vehicle traffic and heavy vehicle traffic. Complementary manual counts were undertaken during 6 days (in alternate months), in order to break the light and heavy vehicle data down into the specified categories.

Primary counting posts were equipped with the same kind of automatic metre as the permanent posts. Data was collected for 6 complete weeks during the year (one week every two months). Information about light and heavy vehicles was continuously recorded during those weeks. As in permanent posts, complementary manual counts were conducted to classify vehicles within the complete range of categories.

Secondary posts were equipped with automatic metres as well. Data was collected during 12 working days throughout the year, distributed in six alternate months (two days per month). During those days, information concerning light and heavy vehicles was continuously recorded and, as in permanent and primary posts, complementary manual counts were carried out.

Finally, extra traffic data were collected in "coverage" counting posts, either manually or using traffic metres. In those posts measurements were conducted during single working days.

In primary counting posts, the methodology is based on a sample of data during the above-mentioned counting days. With this data an average week of the year and average traffic for weekdays, Saturdays and Sundays were calculated. The average annual daily traffic on each counting post was also obtained.

On the other hand, a series of "expansion coefficients" were calculated by using data from permanent and primary counting posts. These coefficients, applied to secondary and "coverage" counting posts through some affinity criteria between posts, were used to calculate with quite acceptable accuracy the average annual daily traffic in those posts, as well as its breakdown into vehicle categories.

Finally, although there are no specific counting posts in toll-motorways, toll-gates have been taken as such posts for, as a result of their control systems, average daily traffic by vehicle categories can be measured.

In order to fill in Tables 4 and 5, a "road sections" database was used. This database contains information about geometric and functional characteristics of all road sections and about the counting posts located on them. Traffic data measured on these posts allows for calculation of vehicles-km on every E road and on the rest of the network.

In Table 4 "Distribution of motor traffic", vehicle-km figures on each road were taken into account. The average daily traffic for each vehicle category was calculated by dividing those vehicle-km by the E road length. This method produces real data because average daily traffic is weighed by the length of the road section where the post is located.

Data in Table 4bis was based on average daily traffic values (by vehicle category) on Table 4 and calculated by applying the following ratios to every E road (ratios calculated as the average values of those measured in permanent counting posts on every E road):

- For night traffic, the ratio was the result of dividing the 8-hour night traffic by the total average annual daily traffic.
- For holiday traffic, the ratio was calculated as the division between the average daily traffic of the "highest" month and the total average annual daily traffic.
- For peak hour traffic, the ratio was the result of dividing the traffic at the fiftieth highest hour of the year by the total average annual daily traffic.

In table 5, the road lengths and vehicle-km figure are shown in the following way:

- First section shows data corresponding to the E road network as a whole.
- The last section shows data corresponding to those roads in the National network that depend on Central Administration.

SWITZERLAND

Organization and execution of the count

Road traffic censuses are carried out at five-year intervals throughout Switzerland and provide data on the makeup of traffic and the origin of vehicles. Combined with continuous automatic counts, they are a major source of data for traffic planning at national, cantonal, regional and communal levels. They not only enable appropriate solutions to be found to road traffic problems but also help to determine criteria for studies of transport safety and economics, pollution and noise control and energy consumption. Regular and comparable counts provide a reference base applicable nationwide, which is a prerequisite for additional surveys. They

also provide ECE's Inland Transport Committee with the data necessary for coordinated planning of main continental arteries.

The method used in 1995 differs from earlier ones in the following respects:

(i) It uses two data sources: firstly, the results of manual counts conducted at Swiss road traffic counting posts, and secondly the results from automatic continuous counting posts of the Federal Roads Office (OFR) and the cantons;

(ii) The new method successfully combines the differentiated data obtained from manual counting posts with the general data recorded by automatic posts throughout the year. Sampling can thus be reduced considerably: in 1995 counts were conducted for 6 hours on working days and 4 hours on Sundays, compared with 14 hours in 1990.

(iii) Posts not equipped with automatic metres are included in groups of automatic metres with similar annual and daily traffic curve characteristics;

(iv) All counting posts are equal. There is no longer any distinction made between principal and secondary posts.

Counting days and duration of counts

Counts were conducted on the following days:

Working days: Monday 20 March, Friday 9 June, Wednesday 9 August
Sundays: 23 July and 29 October

Duration of counts

On working days, traffic was counted from 7 to 9 a.m., 11 a.m. to noon, 2 to 3 p.m. and 5 to 7 p.m. On Sundays, the morning counts were dispensed with, so that vehicles were counted for six hours on working days and four hours on Sundays.

Definitions

- Vehicle categories:

Motor cycles: motor cycles, motor tricycles, scooters (excluding mopeds);
Private passenger vehicles: private cars, with or without trailer, minibuses;
Motor buses and coaches: motor buses, motor coaches (including scheduled services);
Passenger vehicles: total of the three categories "motor cycles", "private passenger vehicles" and "motor buses and coaches";
Delivery vehicles: light goods vehicles (with or without trailer) with a maximum weight of not more than 3.5 t;
Lorries: heavy goods vehicles with a maximum weight exceeding 3.5 t, without trailer or semi-trailer;
Road trains and articulated vehicles: heavy motor vehicles with a total weight of more than 3.5 t, with trailer or semi-trailer;
Heavy goods vehicles: total of "lorries" and "road trains and articulated vehicles";
Goods vehicles: total of "delivery vehicles", "lorries" and "road trains and articulated vehicles".

- Origin:

Swiss: vehicles registered in Switzerland;
Foreign: vehicles registered abroad.

(Experience has shown that, with the growth of traffic, it is increasingly difficult to differentiate the origins of vehicles without interfering with traffic flow and safety. Consequently, the only distinction made is between vehicles registered in Switzerland and those registered abroad).

Automatic metres (automats): These are continuous counting posts which record traffic volume automatically throughout the year. Volume metres record only the total number of passing vehicles, whereas other instruments automatically classify vehicles on the basis of length.

Daily traffic: in the tables, the average annual daily traffic flow (AADT) is shown for four daily periods: traffic throughout the day (24 hours); traffic flow outside the hours when the movement of heavy vehicles is prohibited (5 a.m. to 10 p.m.); daily traffic governed by noise abatement regulations (6 a.m. to 10 p.m.); and, to provide a comparison with earlier counts, the AADT-4 (7 a.m. to 9 p.m.);

Daily working day traffic: the average daily working day traffic (ADWT) represents average daily traffic from Monday to Friday (excluding general public holidays). It is determined for the same times as the AADT;

Daily traffic on Sundays and public holidays: this is the average of all Sundays and public holidays. The figures shown are for midnight to midnight and 7 a.m. to 9 p.m.;

Winter closures: for roads closed in winter, the three average figures are calculated on the basis of the periods when they are open to traffic.

Number and location of counting posts

The purpose of counting road traffic in Switzerland is to provide a periodic update of traffic trends on main non-urban roads. The number and location of counting posts must therefore be adjusted to take account of major changes, resulting from: coordination with the continuous automatic metres of the Federal Road Office and the cantons, as the data they provide is an essential part of the count; The opening of road sections on which the traffic volume cannot be determined using existing counting posts.

Analysis of statistics and processing results

The data recorded on counting days were input and checked as they came in and then subjected to a rudimentary plausibility check. The data acquired by counting posts and automatic counters at the same location were then compared. Where major discrepancies were noted, an attempt was made, with the assistance of the cantons, to determine the reasons and make the necessary corrections. A priori, the automatic counter data were used as target values for extrapolation. In many cases, however, it was quite clear that the automats had not recorded motor cycles, so that it was necessary to increase the totals for them on arteries where they represented a substantial proportion of traffic. There are also discrepancies between the automatic counter data and those used here, generally as a result of adjustments which it seemed advisable to make following discussions with cantonal officials. The differences between the data published here and the automat data are thus not errors, but intentional adjustments.

Extrapolation method

The new method uses count values to obtain reference data, in four stages:

1. Calculation of annual averages for counting periods;
2. Calculation of average daily traffic on working days, Sundays and public holidays;
3. Calculation of average Saturday traffic;
4. Plotting of curves to be used as a database for reference data.

Annual averages for counting periods

First, the values obtained over the different counting periods are extrapolated using an hourly factor (showing the counting days or periods in relation to the relevant annual average) arrived at on the basis of the annual curves provided by the automatic metres. This gives annual averages for each type of day (working or Sunday) over a six-hour counting period. We thus have six factors for working-day traffic and four for Sunday traffic for each automatic post. Multiplying them by count values gives annual averages for the counting periods. The data from manual counts can be extrapolated only if an annual curve can be attributed to a traffic counting post. This presents no problem when a counting post is located at the same point as an automatic metre, which is not the case for roughly half the counting posts. In such cases, the counting posts are included in automatic metre groups with similar annual traffic profile characteristics, and it is these that are used as a basis for calculation. Groups are created by the cluster method. The group characteristic is taken to be the hourly percentage of the total vehicles recorded over a four or six hour period (Sundays and working days). Checks based on the 1990 count have shown that this type of grouping can provide representative factors.

Average daily traffic by type of day

The second stage is to calculate the average daily curves for each type of day (working day or Sunday). This calculation is based partly on the average daily curves for each type of day provided by the automatic metres in the form of a relative distribution (per cent) over 24 hours and partly on the annual averages arrived at for counting periods in the first stage. Combining these various data gives hourly values for the curve outside counting periods. The comparison method used is based on the relation between absolute vehicle volumes for each counting hour and relative values for the same hours provided by the automats. However, this combination can operate directly only when counting posts are in the same location as automats. In all other cases, as in the first stage, counting posts must be assigned to groups of automats having the same daily traffic profile and allowing a relative distribution to be made.

Evaluation of average Saturday traffic

The first two stages produce daily average curves for working days and Sundays. Before curves for all days of the week can be obtained, average Saturday traffic must be calculated, as there is no counting on that day. The method proposed is based on the first stage and simply involves determining, for each group formed during that stage, the percentage breakdown of average Saturday traffic using the automatic counter data. An absolute curve for an average Saturday is then derived for each counting post on the basis of the absolute traffic volumes arrived at in the second stage for working days and Sundays and of factors specific to the Saturday/working day and Saturday/Sunday groups. Finally, this traffic volume is broken down by hours in accordance with the relative curve established for Saturdays. Once the daily curves are available for Saturday, the curve for the days of the week, which is the weighted average of the three others (working days, Saturdays, Sundays) can be obtained.

Plotting of curves as a basis for reference data

The result at the end of these three stages is average daily traffic in the form of three types of curve, namely: Curves for working days, for Sundays and for days of the week. This database can now be used to calculate the desired reference data. Extrapolation is applied separately to each category of vehicle and the two types of origin. Depending on the category, volume counter or automatic classification counter data are used. Data from 241 automatic counters was used, 183 of them belonging to OFR and 58 to the cantons. Of these, 57 automatically classified vehicles on the basis of the following criteria: Vehicles less than 6.0 m long; Vehicles between 6.0 and 12.5 m long; Vehicles more than 12.5 m long.

The data from volume counters was used as a basis for extrapolation for the "private passenger vehicles" and "motor buses and coaches" categories. As private passenger vehicles represent 88 per cent of all traffic, these data are accepted as representative for the evaluation of this category. In the case of motor buses and coaches, the situation is less clear. However, the analysis made on the basis of the data provided by the manual and automatic counts in 1990 showed that this method delivers satisfactory results which could not be improved on by any other method. A specific extrapolation base was created for motor cycles. An annual curve for motor cycles was obtained from a sampling of automatic vehicle classification metres capable of recording vehicles in the smallest class (< 2.5 m). The extrapolation base used for the various categories of goods vehicles is made up of data from automatic classification counters. For all goods vehicles, the annual curve for the over 12.5 m class is used as it is the least influenced by private passenger vehicles with trailers. For the daily curve, a differentiated approach is adopted. The "road train and articulated vehicles" category compares closely with the "over 12.5 m" class, while the "lorries" and "delivery vehicles" categories are more closely akin to the "vehicles more than 6.0 m long" class. In both cases, however, only the daily curve for the winter season is used in order to minimize distortions that might be caused by private passenger vehicles with trailers (mainly cars towing caravans or trailers for recreational use).

Comparison between manual and automatic counts

Automatic counters belonging to OFR or the cantons operate at 239 counting posts (52 per cent). However, for a number of reasons, discrepancies have been found between the results of the two types of count. In some cases, manual counts, although set up on the same section as the automatic count, were moved for reasons of better visibility, protection against the weather, etc. to other sections where traffic was not entirely comparable. Some of the automatic counters failed to provide complete annual data because of defects, traffic diversions for roadworks, etc. Some record motor cycles only partially, or not at all. In addition, double counts can occur when vehicles change lanes or cut corners close to the induction circuits. Finally, some isolated results of manual counts may also contain hidden errors. All these sources of error mean that the automatic counter data published by OFR and available in the cantons may diverge appreciably from the averages shown here.

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA (FYROM)

Introduction

The traffic census was made at 22 counting places: 8 places by manual counting, 11 places with automatic counters and for 3 places data from toll stations were used. The locations of the counting places were specified according to the AGR. In this counting and for future research FYROM will use the sign MK for the determination of counting places in our country.

Table of the additional counting on "E" roads to obtain traffic structure where there are automatic counters or toll stations in 1995

Counting code	Date	Day	Counting time hour (from-to)
D	20 February	Monday	06 - 08
E	14 May	Sunday	20 - 22
F	8 June	Thursday	13 - 15
G	19 July	Wednesday	11 - 13
J	29 August	Tuesday	08 - 11
K	16 September	Saturday	15 - 18
N	22 December	Friday	15 - 18
NB	20 February	Monday	22 - 24
NG	20 July	Thursday	00 - 03
NK	17 September	Sunday	03 - 06

The manual counts were performed by JP "Makedonijapat"-Skopje with staff trained for this counting (they also do the national counting). The hand counting was controlled daily by the Institute of Statistics staff to verify data.

Automatic counts

Permanent counting of the traffic by automatic counters was done at 11 counting places. There are two types of automatic counters on the roads in FYROM. The first type does not indicate classification during the counting, while the second type classifies by heavy (longer than 6m) and light (shorter than 6m). The record is made on tape for every hour of the day. To be able to specify the traffic structure there was 10 day additional hand counting at these counting places.

Table of hand traffic counting on the national and regional roads during 1995

Day counting				Night counting			
Code	**Date**	**Day**	**Time**	**Code**	**Date**	**Day**	**Time**
I. Table of traffic counting days on counting places with 5 day traffic counting							
C	18 March	Saturday	06-22	-	-	-	-
D	14 April	Friday	06-22	ND	14/15 April	Friday/Saturday	22-06
G	15 July	Wednesday	06-22	NB	15/16 July	Wednesday/Thursday	22-06
I	6 August	Sunday	06-22	NI	6/7 August	Sunday/Monday	22-06
M	2 November	Thursday	06-22	-	-	-	-
II.	Counting places where there is counting only one day in the year:						
G	5 July	Wednesday	06-22	NB	5/6 July	Wednesday/Thursday	22-06

Data from toll stations

Data on tickets sold at toll stations are used (up to 4 vehicle categories) increased for the number of toll-free vehicles. To determine the traffic structure there was 10 day hand counting at the toll stations according to the table for automatic counters.

Vehicle classification

The census was based on the following 10 classes of vehicles:

1. bicycles on pedals with and without motor;
2. motorcycles, scooters and motor tricycles;
3. cars with and without trailer including caravans with no more than 9 seats including driver's;
4. buses with and without trailer;
5. animal carts;
6. light freight vehicles with carrying capacity to 3.5 tons;
7. freight vehicles, carrying capacity from 3.5 - 7 tons without trailer;
8. freight vehicles, carrying capacity over 7 tons with and without trailer;
9. tractors with and without trailer or semi-trailer;
10. special vehicles (including construction machinery and tanks).

Method of calculation

Average annual daily traffic (AADT):

(1) AADT from hand counting was calculated by the following formula:

$$AADT = 1/4 (C + M) + 1/6 (D + G + I) + 1/3 (ND + NB + NI)$$

(2) AADT from automatic counters is calculated dividing the total vehicle number by the number of work days of the counter.

(3) AADT from toll stations is calculated dividing the total vehicle number by 365 days. AADT for every E road is calculated adding AADT from every counting place on that road and dividing that number by the total number of counting places on that road. The average night traffic at the counting places (Table 4 bis) is calculated by dividing the total traffic between 22 and 06 o'clock with the number of days for which there is data. The average number of vehicles per counting place during holidays is calculated by dividing the 24-hour traffic for two months (July and August) with the number of days in these two months for which there is data. The average number for traffic jams is calculated as the maximum one hour traffic at 15 o'clock.

The classification of the traffic was made as follows:

1. sum of light + heavy motor vehicles
1.1. light motor traffic (A+B+E)
1.2. heavy motor vehicles (C+D)

There was no comparison made in Table 4 and Table 4 (bis) between 1990 and 1995 as data from 1990 was not available. It should be noted that great decrease in traffic is due to the closure of the Macedonian borders towards the North and South in 1995, thus 1995 data do not express the maximum traffic density in the country.

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