Summary: Tourism is a buoyant sector in the Spanish economy, due both to its weight in the Gross Domestic Product and for its capacity to generate employment. The tourism sector also has a direct and striking effect on economic activity as well as an undeniable influence on the evolution of our society’s customs and lifestyles.

With the disappearance of European borders and the free circulation of people throughout the Schengen area, measurement of the tourist phenomenon along with its principle characteristics is becoming indispensable. In this way, with more accurate knowledge on the tourists who visit Spain, the necessary information on tourist demand can be provided, in order for the required services to be implemented.

Thus with this aim in mind, the “Spanish Inbound Tourism Survey (FRONTUR)” was born in 1996. Since that time it has become one of the basic tools of official statistical observation used by the Spanish Secretariat of State for Tourism. This survey is a statistical study which employs a mixed system to obtain its results. To do this it uses three types of information:

- Administrative information, supplied by different bodies and public companies responsible for the different ways of entering Spain (General Traffic Management, Aena, Ports of the State and RENFE).
- Manual vehicle counts on road border-crossings points (assessments)
- Random surveys at all points of entry

The principle aim has therefore been to gauge the number of entries into Spain by the main points of access to our country, on a monthly basis, as well as to supply a sample group for the “Tourism Expenditure Survey” (Egatur). Consequently the FRONTUR survey has seen significant improvements over recent years.

The object of both this paper and what is being implemented, is to improve the measurement of vehicle flows when they enter Spain at 22 border-crossing points with France and Portugal, by means of number plate recognition. Thus firstly we will give a brief methodological description of the road sub-operation, then we will move on to an explanation of the technical project carried out by the General Traffic Management (Spanish Traffic Authorities), followed by an evaluation of the effects that the new system of vehicle number plate recognition has on the quality of data compiled by the Institute of Tourism Studies.

Specifically, the improvements in this system will be analysed on vehicles crossing the borders with France and Portugal, since it entails obtaining basic information which up until now has only been estimated and which fundamentally is concerned with the vehicles’ nationality and the length of their stay in Spain. To this end, we will explain the process necessary to check the reliability of the registration plate identification with the information provided by the assessments, as well as the use of photographs to verify that the system functions properly.

All this will allow for advantageous improvements in the measurement of tourist flows by road.

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“Developing tourism statistics at the sub-national level: measuring flows of trips and visitors”

Measurement of tourism activity from the sub-national perspective, both in relation to basic statistics and the economic impact, is studied in the Recommendations on Tourism Statistics (IRTS, 2008) and in the Recommended Methodological Framework on the Tourism Satellite Account (TSA-RMF, 2008).

The sub-national focus of tourism statistics constitutes an extremely significant aspect. While data at national level is vital and paints an overall picture of the situation in each country, in some countries this overall information is not particularly representative of the circumstances. This limited representation is linked to both the surface area of the countries and the political/administrative organisations of the different countries in the world which are tourist destinations. In this last aspect there are many countries, especially the most developed, which confer a differing level of autonomy on the sub-national area, and this situation results in the need for instruments to measure tourism at the sub-national level.

Spain is the second country for international tourist arrivals and is of average size within the ensemble of tourist destinations on a world scale. It also boasts a considerable degree of autonomy on the administrative plane immediately below the national level, that is the Autonomous Communities (regions) recognised in the Spanish Constitution of 1978. For some time, in statistical demand operations at national level, Spain has been working on the measurement of tourism flows at the level below: the Spanish Inbound Tourism Survey (Frontur)2, the Spanish Domestic and Outbound Tourism Survey (Familtur)3 and the Tourism Expenditure Survey (Egatur)4.

Compiling tourism statistics of a sub-national nature from operations at a national level is therefore considered to be feasible (point 18).

However, compiling surveys in addition to those carried out at national level is also considered to be appropriate, since they can focus on the need for specific information. To this end Spain has recently been developing a project of information and awareness-raising of the regional tourism administrations5. The purpose of this is that in the potential statistical operations concerning tourism which may be carried out in the sub-national sphere (Autonomous Communities), they take into consideration the International Recommendations on Tourism Statistics (World Tourism Organisation, 2004)6 as well as the legal and methodological framework provided by the European Union’s Statistics Office (Eurostat).

In this sense, the definition of the “unit of territory”, which is smaller than the national unit is considered to be vital. The proposal for definition of “region” and “local tourist destination” is considered sufficient, as is discussed in point 10 of the document and indicated below:

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2 Since the implementation of this statistical operation in 1996, it has been considered important to obtain data from the sub-national sphere, i.e. relative to the Autonomous Communities.
3 This statistical operation was implemented in 1996 with national level results but it immediately became clear that it was necessary to work with regional level data, which is available from 1999.
4 Began in 2001; among other variables it supplies information on the main autonomous community of entry and destination.
5 Since 1996 the Institute of Tourism Studies of the Secretariat of State for Tourism from the Department of Industry, Tourism and Trade, has coordinated the designated “Working group on regional statistics from the tourism sector”, through which it implements the international recommendations and the rules and methodological guidelines on tourism statistics from the European level.
6 The same time the new conceptual framework will be expose: International Recommendations for Tourism Statistics (IRTS 2008) and Recommended Methodological framework of the Tourism Satellite Account (TSA:RMF 2008).
“the region, identified as the administrative unit corresponding to the first level of territorial desegregation of a country in terms of its political and administrative organization (for instance, level 2 of the NUTS in the European Union, the provinces of Canada and the states of USA and Brazil)

“the local tourism destination treated as a sub-regional territory (which might correspond to a single municipality or groups of them) with substantial tourism activity”.

On the contrary, the proposal of substituting the term “country” with the word “place” is considered to be unsuitable, given the confusion that the word “place” would give rise to and the difficulties that it provokes when it comes to taking it as a unit of reference (point 6). This possible change, discussed in point 2.3 of the IRTS 2008, with the following text:

“the term “county” can be transposed to a different geographical level using the term “place, instead (either a region, municipality or other sub-national geographical location), and its application, could mean that the data at the international level is not comparable.”

The new methodological framework on tourism statistics was approved by the United Nations Statistical Commission this year. It also contributes to updating the definition of the System of Tourism Statistics (STS), associated with the implementation of a Tourism Satellite Account, as part of a National System of Statistics and its connection with the National Accounting System. The structure and links of the STS (Appendix 1), the characteristics of which are based on the harmonisation, coordination and integration of the statistical information on tourism, opens a new path for the improvement of knowledge on tourist activity.

Concerning this issue, Spain has been working for some years on integrating the data resulting from the tourism statistics into a single system. Thus, with the support of information and communication technologies, the data relative to tourist activity in Spain is centralised in the designated “Datawarehouse for the Analysis and Distribution of Statistical Tourism Information in Spain (Datatur)”, and is made accessible through the Tourism Studies Institute website. The information provided by Datatur contains both national and sub-national (Autonomous communities) level data. This information pools data from different sources and bodies, including the results from statistical operations carried out by the aforementioned Spanish government sources (Frontur, Familtur and Egatur), the reworking of data from external sources connected to tourist supply and occupancy (surveys of the different types of tourist accommodation, compiled by the National Institute of Statistics) and different issues connected to tourist activity: passengers transported by air, employment, price indices, and of course data relative to Spain’s Tourism Satellite Account, collected by the National Institute of Statistics.

Of the three aspects identified as amenable to measurement and international comparison of tourist activity: visitors’ consumption, the production of goods and services required by visitors and the level of employment in the tourism sector, the aforementioned document concentrates on visitors’ consumption as the most relevant aspect to be put into connection with the development of statistics at the sub-national level. Likewise in the aforementioned document, three observation units are indicated regarding the measurement of visitors’ consumption:

- The visitor (traveler that meets the specific requirements to be classified as a visitor).
- The trip
- Travel party
A series of characteristics are associated with these observation units. As regards visitors: typology (tourists and same-day trippers), country of origin, etc. As regards the trip: the reason, length, point of origin and destination, means of transport, types of accommodation, cost, organisation of the trip, etc. And as regards the travel party, size is indicated as a characteristic.

The new methodological framework on tourism statistics introduced in 2008 places the visitor at the heart of the data structure and constitutes the information base for the STS, as well as including the “travel party” as an innovation and an observation unit. Spain views these as an important benchmark. In this sense, statistics on tourism demands which are being compiled in Spain already include these aspects.

However, centring the development of the sub-national perspective of tourism statistics on visitor consumption seems rather biased. It would also entail having to analyse the structure and components of this aspect (that of visitors’ consumption) in order to identify its potential application to other information needs (drawing up policies, planning, etc). As regards this issue, Spain displays particular interest in analysing the possibilities of applying the resulting information, given the focus and content of the Spanish Tourism Plan “Horizon 2020” and its application through four-year plans, such as the 2008-2012 plan, the implementation of which began at the start of this year.

For the measurement of visitors’ activity at the sub-national level, concentrating on consumption, two observation units are established: visitors and trips and one single characteristic associated with trips: the route, that is, the point of origin and destination of the trip (point 36). Spain already includes these guidelines in its tourism demand statistics, especially when it comes to the route, both for the measurement of receptor tourism as well as inbound and outbound tourism, relative to the sub-national level, i.e. the Autonomous Communities.

In the same way, for the measurement of inbound and outbound tourism (domestic tourism), in the aforementioned statistical operation “Spanish Domestic and Outbound Tourism Survey (Familtur)” the system of home survey is used, in order to collect all types of information, including the route (origin-destination matrix) of the journey (point 64).

The exploration of sources of a non-tourist nature, as the mobility surveys may be, are of great interest, not just to broaden the perspectives of the analysis of tourist flows but as a possible comparison framework.

The development of tourism statistics by regional governments is also considered to be of importance. Spain is already working on drawing up data on tourism, beginning with government records which belong to different organisations such as Spanish Airports and Aerial Navigation (AENA) as regards the traffic of passengers by air and types of companies used; General Traffic Management on flows via road, Ports of the State and the railway network. These are highly valued sources, given the information that they provide for the estimation of a sample of non-resident visitors.

The reflection process on the development of tourism statistics at the sub-national level is highly valued by Spain, based on the possibilities afforded by the new conceptual framework of tourism statistics.

Thus collaboration with the Institute of Tourism Studies of the Secretariat of State of the Department of Industry, Tourism and Trade is on the cards. It will participate in the future network of organisations, professionals and researchers who are expected to carry out this reflection process, to which Spain wishes to contribute with its knowledge and experience.
INTRODUCTION

The Institute of Tourism Studies focuses mainly on the study and analysis of the economic and socio-demographic aspects of tourism. To this end it has developed various statistical operations, among others FRONTUR/EGATUR, the “Spanish Inbound Tourism Survey”. This operation is a source of primary information, with national scope. From the point of view of the tourism climate it is a basic and vital tool for the observation of foreign tourism in Spain.

FRONTUR is an essential survey, not only for the Secretariat of State for Tourism but also for the autonomous governments, universities, researchers and so on and so forth. Consequently it deduces the number of tourists that arrive in Spain via its different borders on a monthly basis, among other variables such as their basic characteristics in connection with country of residence, autonomous community of destination, duration of stay, accommodation and reason for trip.

FRONTUR is an operation which combines the use of government records and the completion of surveys. Given the different ways of accessing our country, four sub-operations may be determined, according to the point of operation of the survey:

- Road operation at border-crossing points
- Operation in airports
- Operation on international trains
- Operation in sea ports

The differences which justify establishing four sub-operations can be found fundamentally in the sample design and in the method of contact with the person at the time of carrying out the survey. However, the organisation of information collection, its treatment, management, verification and the content of the information itself, expressed in the corresponding questionnaires, are activities which are methodologically comparable for both sub-operations.

The population framework used for the FRONTUR survey to estimate the results is provided by the government records, compiled by General Traffic Management, AENA, RENFE and Ports of the State. But the government records alone are not sufficient to determine the population framework of the different statistical sub-operations which FRONTUR/EGATUR is made up of. This is why, in order to estimate the sample group it is necessary to carry out a series of random surveys which help to attain said population framework. In any case, the importance of the government records in FRONTUR’s statistical study is significant, since without them it would be impossible to carry out this operation.

Without entering into detail on this statistical operation, it is necessary to explain, albeit succinctly, its methodological context, in order to understand the improvements to be introduced with the new project of measuring vehicle flows implemented by the General Traffic Management.

Consequently this document will go over the key methodological principles of FRONTUR, since it is this operation which uses the government records for the estimation of the sample group, focussing on the road sub-operation. We will explain how the government record on vehicle transit currently functions, as it is used by this operation. We shall then discuss the project of improving the measurement of vehicles at border-crossing points and finally, highlight the contributions to the estimation of the road framework sample of the FRONTUR statistical survey, introduced by said system.
MEASUREMENT OF FLOWS OF TOURISTS BY ROAD IN SPAIN

Objectives

The main objectives of the statistical survey FRONTUR/EGATUR are:

1. To deduce the amount of visitors arriving in Spain on a monthly basis, via the different entry points (road, airport, sea port or railway).
2. Classify them according to their visitor typology, distinguishing between tourists (who stay for at least one night) and same-day visitors (visitors who come for one day and do not stay overnight).
3. To become aware of the basic characteristics of trips made by non-resident tourists around Spain.
4. Provide the sample group for the presentation of the Tourism Expenditure Survey for non-residents (EGATUR)

General characteristics

FRONTUR is a continual border operation which is carried out on a monthly basis at the main border-crossing points on roads, in airports, international trains and sea ports. The survey is carried out by means of a brief personal interview with the vehicle drivers (road), at the entry point into Spain and through questionnaires filled in independently in airports, trains and ports on exit from Spain.

As has already been mentioned, FRONTUR avails of a mixed system to attain its results, including government records, manual counts at Spain’s entry points (France, Portugal and Morocco at 22 border-crossings) and random surveys at all entry roads.

This document will discuss the most relevant methodological aspects of this statistical operation, dealing with non-residents’ entry by road.

The forecast size of annual samples by road is approximately:

- 2,500,000 manual assessments
- 72,000 personal surveys
- 28,800 surveys filled in independently

Government information provided by the General Traffic Management

The file supplied by the DGT is sent directly by this body to the Institute of Tourism Studies on a monthly basis, referring to the automatic counting of vehicles every quarter of an hour, every hour and every day.

The information is collected by means of the so-called “spires” located at the foot of the road at the border-crossing points with France and Portugal which figure in point IV of this document. The information obtained through these spires is automatically sent to the Information Analysis Centre to be digitally processed. Said file is not strictly a file obtained in the field and therefore its use as a support tool for the subsequent presentations means its content must be checked, to detect potential information gaps. These basically come down to a lack of information for certain time periods, or defects in the automatic recounting, by too much or too little: in the first case detection is simple, whilst in the second it can only be done by comparing the data with that obtained in the monthly assessments, when they coincide with temporary terms of monthly work.
The revision made by the IET of the file submitted by the DGT will begin by determining, on an hourly basis, the existence or lack thereof of the breakdown per quarter of an hour of each period, to then move to a comparison of the DGT with the sample assessment information. That is, those periods of a quarter of an hour where there exists a sample assessment, compared with the corresponding data supplied by the DGT. Where there is a lack of information or sharp descent in the flow of vehicles, estimates are made using the typology of days carried out in the sample, based on the data supplied by the DGT. We will not go into further detail given that it is not relevant to the content of this paper.

All in all, the importance of the use of this government record should be highlighted, not only because it helps with the estimate of the sample group to be able to proceed to the presentation of the FRONTUR/EGATUR data but also because it provides sufficiently relevant information to be able to detect, correct and estimate the lack or excess of information on the flow of vehicles.

Concerning the estimation of the road sample group, the utility of carrying out the assessments in order to supplement the information supplied by the DGT should also be mentioned.

The assessments

Given that the government information available refers to the number of vehicles that pass through a specific point (border), it is necessary to perform manual counts or assessments.

By means of the road assessments, the number of occupants of the vehicles crossing the border can be determined, and it is therefore possible to estimate the total number of travellers accessing the country this way. The assessment is carried out alongside the survey because it is much more intense (all the vehicles passing by this point are included) and quicker (less information).

In this case, the information collected is:

a) Nationality of the number plate
b) Type of vehicle: light/heavy (car/bus)
c) Number of occupants
d) Exact date when the information was collected (year, month, day, hour, minute).

The information contained in the vehicle assessment file is that which is collected in the field as well as the marks of a lack of information amenable to imputation, either because some of the information is missing or because some inconsistencies have been noted (see previous section).

Estimation of the sample of entries by road

In order to obtain the sample of entries by road, the following procedure is adhered to:

- The DGT’s automatic counters are of a people-based nature. But these counts only provide information on the flow of vehicles and on some occasions this information must be tweaked, as we mentioned earlier, due to exceptional circumstances which imply a significant increase or decrease in the amount of vehicle traffic with no apparent justified cause.
- The manual counts or assessments which are performed obtain the number of occupants of a vehicle, the nationality of the number plate and the type of vehicle (car/bus).

- Together with the information provided by the DGT, a cluster analysis of the monthly distribution of each border-crossing point can be carried out. Subsequently days are selected within each point and month configured by the calendar.

- The total number of travellers will be deduced using the number of vehicles and average occupants, according to entrance and type of vehicle. With this information, the necessary framework for the presentation of data obtained from the entrance surveys will be obtained. The FRONTUR statistical study then uses it, as does consequently the sample framework for the presentation of the EGATUR operation.

THE SYSTEM OF BORDER TRAFFIC CONTROL THROUGH NUMBER PLATE RECOGNITION: IMPROVEMENT IN THE INFORMATION SUPPLIED BY THE GOVERNMENT RECORDS COMPiled BY THE DGT

Objectives

The project that the DGT is carrying out aims to implement a system of compilation, analysis and presentation of information, with the purpose of availing of data on vehicle transit across Spanish borders.

The basis of this study is the recognition of the number plates of vehicles crossing the borders, both on entering and leaving Spain, by means of equipment established on the roads at points near various border-crossings.

Pooling this information in a centralised location together with time-based and statistical analysis of said information will permit estimation of a measurement of visitors received in a specified time period, the average length of stay of said visitors, their nationality, whether they use Spain as an access route to Portugal or Morocco for example, as well as other information of interest.

Components

The components needed to fulfil the proposed aim are outlined below:

- **Acquisition and recognition systems (SAR):** Systems installed at the foot of the road capable of detecting vehicles, acquiring images of said vehicles, analysing and recognising the number plates and storing them for their periodic transmission to the Information Analysis Centre. They would be installed on the main border access roads.

- **Information Analysis Centres (IAC):** Centralised system of mass information analysis, located in a Control Centre. It will receive information from the SARs on a periodic basis and will analyse said information, extracting points of interest for the aim in question and presenting it in an appropriate format.

- **Communications Systems:** In charge of the link between the SARs and the IAC. Any normal system currently available may be used: GPRS (network coverage permitting), RTC, ADSL...
In the following diagram we can see a plan of the components of the Acquisition and Recognition System:

![Diagram of Acquisition and Recognition System](image)

Where:
- ETD (Data Collecting Stations): obtain the basic parameters of road traffic, starting with those that, during processing, extract information on the state of vehicle circulation on these roads.
- ERU (Universal Remote Stations): Data storage Unit
- ERM (Number Plate Recognition Equipment): Detects the vehicles by means of the mechanism which analyses the captured images.

Bearing this mind, this number plate recognition system operates in the following way:

**Acquisition and recognition system**

The main components of the Acquisition and Recognition System will be Number Plate Recognition Equipment (ERM) and a Universal Remote System (ERU). As its name indicates, the first of these captures the images of the vehicles which cross at this point, analysing them and providing information such as the recognised number plate, the vehicle’s nationality, etc.

The vehicle’s number plate is stored until all the information is sent to the Analysis Centre. Full information on vehicles will include:

- Vehicle number plate
- Vehicle country of origin
- Date/time of detection of this information
- Percentage rate of reliability of the information regarding the identification

The ERM has the option of sending the vehicle’s image to the Analysis Centre and/or a detailed image of the vehicle’s registration plate.
Improving the information on flows of tourists by road at the borders with France and Portugal, by means of number plate recognition

**Information analysis centre**

The IAC is made up of the following elements:

- **Communications system**: The Communications system constitutes the element of connection between the Information Analysis Centre and the different Acquisition and Recognition Systems (SAR). Its task will be to facilitate communication with each of the SARs, recuperate information from said SARs and record the information obtained in the database of the Information Analysis Centre.

- **Database**: In the database the following basic information will be stored, collected as it is by the Acquisition and Recognition Systems:
  - Information on each of the vehicles captured by each item of number plate reading equipment
  - Hourly classification relative to the vehicle classification
  - In this database additional statistical information will also be stored, drawn up according to the basic information.

- **Information Publication System**: By means of a server which will lend support to the Information Analysis Centre.

  Once the statistical analysis is complete the files containing individual data will be deleted. This will therefore result in an anonymous file which can be submitted to other users such as the Institute of Tourism Studies for example.

**Communications system**

Communication between the Analysis Centre and the Number Plate Recognition Equipment will happen by means of one of these systems:

- GPRS Communication
- Communication by means of exclusive telephone lines
- Ethernet Communication via SDH

As has been previously mentioned, the communications elements carry out the task of linking the equipment installed on the ground with the Analysis centre for the periodic transmission of information.

**APPLYING THE NEW SYSTEM TO THE FRONTUR/EGATUR STATISTICAL STUDY**

Recognition of the number plates of vehicles which cross the borders with France and Portugal entails securing important information which up until now has always been estimated, such as the vehicles' nationality and the length of stay in Spain for example.

The places selected by the DGT for the identification of the number plates largely coincide with the points of survey and/or assessments carried out by the IET for its FRONTUR and EGATUR operations. There are only two places (Puigcerdá-Llivia and the Somport Tunnel) where new devices for identifying number plates will be installed and where the IET does not carry out its work on the ground. Once the system is up and running, assessments will be carried out in these places to avail of contrasting information.
Below follows the table with the border crossing points surveyed/assessed by the IET linked to the DGT’s number plate recognition system:

<table>
<thead>
<tr>
<th>FRONTUR. Assessments and surveys</th>
<th>DGT. Number plate recognition system</th>
</tr>
</thead>
<tbody>
<tr>
<td>BORDER WITH FRANCE</td>
<td></td>
</tr>
<tr>
<td>1 E001 Portbou</td>
<td>5 PORTBOU, N-260 P.K. 1+900</td>
</tr>
<tr>
<td>2 E002 La Junquera A-7</td>
<td>6 LA JUNQUERA, AP-7 P.K. 0</td>
</tr>
<tr>
<td>3 E003 La Junquera N-II</td>
<td>4 LA JUNQUERA, N-II P.K. 779+500</td>
</tr>
<tr>
<td>4 E004 Puigcerdá-Bourgmadame</td>
<td>2 PUIGCERDÁ-BOURGMADAME, N-152 P.K. 169</td>
</tr>
<tr>
<td></td>
<td>3 PUIGCERDÁ-LLIVIA, N-154 P.K. 0+300</td>
</tr>
<tr>
<td>5 E006 Seo de Urgel</td>
<td>1 SEO DE URGEL, N-145 P.K. 8+900</td>
</tr>
<tr>
<td>6 E007 Les N-230</td>
<td>7 LES, N-230 P.K. 186+650</td>
</tr>
<tr>
<td>7 E008 Canfranc N-330</td>
<td>8 CANFRANC, N-330 P.K. 675+150</td>
</tr>
<tr>
<td></td>
<td>9 TÚNEL SOMPORT (BOCA SUR)</td>
</tr>
<tr>
<td>8 E009 Valcarlos N-135</td>
<td>13 PEKOTXETA, N-135 P.K. 166+500</td>
</tr>
<tr>
<td>9 E010 Dancharinea N-121-b</td>
<td>14 LANDIBAR, N-121-B P.K. 80</td>
</tr>
<tr>
<td>10 E011 Biriatou A-8</td>
<td>11 IRUN, AP-8 P.K. 0</td>
</tr>
<tr>
<td>11 E012 Behovia N-121-a</td>
<td>10 BEHOVIA, N-I P.K. 468</td>
</tr>
<tr>
<td>12 E013 Pte. de Santiago N-I</td>
<td>12 PUENTE DE SANTIAGO, N-121 P.K. 87</td>
</tr>
<tr>
<td>BORDER WITH PORTUGAL</td>
<td></td>
</tr>
<tr>
<td>13 E014 Tuy Puente Viejo N-550</td>
<td>16 TUY (PUENTE VIEJO), N-550 P.K. 172+500</td>
</tr>
<tr>
<td>14 E024 Tuy Puente Nuevo</td>
<td>15 TUY (PUENTE INTERNACIONAL), A-55 P.K. 31</td>
</tr>
<tr>
<td>15 E015 Feces de Abajo N-532</td>
<td>17 VERIN (FECES DE ABAIXO, N-532 P.K. 15)</td>
</tr>
<tr>
<td>16 E016 Alcañices (San Martín del Pedroso N-122)</td>
<td>18 SAN MARTIN DEL PEDROSO, N-122 P.K. 538</td>
</tr>
<tr>
<td>17 E017 Fuentes de Onoro N-620</td>
<td>19 FUENTES DE ONORO, N-620 P.K. 530+500</td>
</tr>
<tr>
<td>18 E018 Valencia de Alcántara N-521</td>
<td>VALENCIA DE ALCÁNTARA, N-521 P.K. 151</td>
</tr>
<tr>
<td>19 E019 Badajoz-Caya A-5</td>
<td>21 BADAJOZ, A-5 P.K. 405</td>
</tr>
<tr>
<td>20 E020 Rosal de la Frontera N-433</td>
<td>EL ROSAL DE LA FRONTERA, N-433 P.K. 155</td>
</tr>
<tr>
<td>21 E021 Ayamonte N-431</td>
<td>22 AYAMONTE, N-431 P.K. 131+500</td>
</tr>
<tr>
<td>BORDER WITH AFRICA</td>
<td></td>
</tr>
<tr>
<td>22 E022 Algeciras - Desembarcacion</td>
<td></td>
</tr>
</tbody>
</table>

Before incorporating this information into the road sub-operation of the FRONTUR/EGATUR statistical study, it is necessary to proceed to the validation of the information obtained by the DGT:

**Number plate Verification:** The information provided by the DGT up until now refers to:

- Volume of vehicles every 15 m.
- Volume of vehicles every hour
- Volume of vehicles every day of the benchmark month

This file will need to be completed with additional information including the nationality. Thus, using the information provided by the assessments carried out by the IET which, as has been mentioned previously, also provide the nationality of the number plate, the reliability of said plate’s identification can be verified.
Improving the information on flows of tourists by road at the borders with France and Portugal, by means of number plate recognition

Verification of the system’s functioning: Given that the number plate recognition system itself generates a reliability ratio (see Acquisition and Recognition System in section III), this must be contrasted with the data from the assessments to check that said system is working correctly. Hence the use of the number plate photographs to check at certain points that the equipment is working correctly.

Verification of the vehicles’ length of stay in Spain: Another of the contributions made by the number plate identification system corresponds to the establishment of the length of stay of the vehicles which enter the country via different border crossings.

Given that said system collects information on vehicle number plates both on entry into Spain and on exit, this information would help to determine the length of stay in Spain. However, by transmitting the information on a monthly basis, there will be a number of vehicles with an undetermined stay, given that the vehicles that have entered Spain will not necessarily have left within the benchmark period and vice versa (whether because the stay is longer than a month or because the dates of entry/exit fall in different months). It may be that a vehicle may enter or exit the country several times within a certain timeframe…

For these reasons

- It would be necessary to carry out a thorough fine-tuning of the different entries/exits of vehicles in the same day, an issue which needs to be raised with the DGT, taking certain variables collected by said body as a point of departure.

- It would be advisable to revise the calculation of the stay in Spain, completing the records in this situation, when the necessary time has elapsed for the implementation of this system, using the historical files in the DGT’s range to do so.

Even in the case of the system working correctly, the assessment of vehicles is still necessary because up until now it has been the only way of deducing the vehicles’ occupants and of distinguishing between lorries and buses. It would be possible to obtain these variables directly with the new number plate recognition system.

The information collected by the DGT following implementation of the number plate identification system will be:

- Number plate
- Nationality of the number plate
- Date/time
- % rate reliability of the number plate identification
- Vehicle speed
- Length of the vehicle
- The DGT will treat this data statistically (number plate and date), calculating the length of stay of each vehicle in the country.

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7 As regards the software mentioned in point IV, when it is applied to the photograph taken of the vehicle, it can determine the type of vehicle and the number of occupants. This could raise some problems, given that the DGT currently has no plans to install it in its equipment: likewise it is not known whether the photos taken are useful in improving the information supplied, or if it is necessary to take a photograph of the side of the vehicle. In any case, the DGT only plans to send these photos on an exceptional basis, when there are doubts on the identification or for a precise reason. They will not be sent en masse (they will be kept on site and then deleted, not sent to the centre due to their size (KB)).
The information required from the IET is:

- Stay in Spain
- Nationality of number plate
- Date/time
- Length of the vehicle (light and heavy)

The IET’s collaboration: The Institute of Tourism Studies will collaborate where possible in the implementation of this new system. The recognition of the vehicle number plates which cross the borders with France and Portugal is a substantial improvement in the information which the IET usually works with; hence it is very interested in its implementation and the necessary adjustments.

The points of implementation of the new system are similar to the places where the survey and assessment are carried out by the IET, thus there will be contrasting information available for the modifications and checks that the DGT may esteem opportune. There are only two points where the IET does not carry out surveys/assessments and where the number plate recognition system is to be installed.

The IET intends to carry out assessments at these two points when they are necessary for the modifications and checks of the system.

CONCLUSIONS

Greater detail on the study of government records. All statistical operations must periodically be submitted for revision of their estimates. With the incorporation of this system, the knowledge which would be obtained from the government record, key information for the sample group estimate, would be much more accurate. This would result in an improvement in the use that the FRONTUR operation makes of said information.

Closer collaboration between the two institutions. Up until now, collaboration between the IET and the DGT has been very vague. However where necessary, the implementation of this system will result in the IET’s participation in the modification of measurements of vehicle flows. It will enable comparison of the information from assessments with data produced by number plate recognition, not only at points where the IET carries out said assessments but also where these counts are not performed.

Obtaining more accurate information. New technology has been used to capture data by means of the implementation of the new system. This has allowed better information to be obtained for collection, analysis and presentation, on availing of data on vehicle transit across the Spanish borders.

Better information obtained by the DGT. With the information provided by the number plate recognition system, the number of visitors to Spain in vehicles by road in a certain time period can be estimated, along with the average stay of said vehicles in the country, their nationality, whether they use Spain as an access route to Portugal or Morocco, together with other information of interest. Furthermore all this information will be for public use.

Improvement in the FRONTUR/EGATUR statistical studies. On attaining all the information mentioned in the previous point, the estimates of the sample group will be improved, not only in the sense of contrasting vehicle counts (as was discussed in point 1 of this conclusion) but rather other types of contrast may be made, such as nationalities, average stay and transits to other countries, obtained through random surveys. This will allow the basic variables in the FRONTUR operation to be finetuned and consequently the EGATUR statistical study as well, given that it takes its sample group from the FRONTUR estimates.
REFERENCES


Institute of Tourism Studies (1997) FRONTUR, Methodological References. Madrid


