Optimising Passenger Transport Information to Materialize Insights for Sustainable Mobility

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List of abbreviations

CARE – Community database on Accidents on the Roads in Europe

EC – European Commission

EU – European Union

DATELINE – Design and Application of a Travel Survey for European Long-distance Trips based on an International Network of Expertise

EUROSTAT – Statistical office of the European Union

GPS – Global Positioning System

ICT – Information and Communication Technology

LAU – Local Administrative Units

NTS – National Travel Survey

NUTS – Nomenclature of Territorial Units for Statistics

OPTIMISM – Optimising Passenger Transport Information to Materialise Insights for Sustainable Mobility

TEN-T – Trans-European transport network

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Executive Summary

The OPTIMISM project aims to *optimise passenger transport systems using co-modality ICT solutions, while keeping in mind the needs of passengers and ensuring that the impacts of any proposed measures help decrease CO_2 emissions*. In order to reach this objective, the project collects information and analyses passengers' current travel needs, mobility patterns and business models.

One of the methods to collect information on mobility patters, travel needs and business models is the use of NTS. These are surveys where respondents are asked to fill in, as completely as possible, information in relation regarding their different trips and journeys. Data collected through NTS is used for many purposes, ranging from high-level policy support over topical scientific research up to macro-economic modelling.

As a result of the data collection performed in Work Package 2 of the OPTIMISM project, it could already be concluded that NTS, often supported by specific research, are generally being used to provide governments with better awareness of travel patterns and general travel data and to help governments and authorities to make better decisions regarding planning infra-structure and implementing transport policies. These NTS form an important backbone for the continuous collection of highly detailed quantitative and qualitative rich data.

Currently, NTS are being applied in a significant number of EU Member States. However, only seldom it is the case that two NTS are similar or the same. Specific characteristics such as the questions asked, data collection method, sampling method, data collection frequency, data application, etc. differ from country to country. This can cause difficulties when comparing results of different NTS or when data continuity is key.

A possible solution is to propose a structure for a harmonised national travel survey. To do so, firstly, a theoretical framework needed to be created. This framework consists of a selection of future mobility policies that can be identified for all EU Member States. In a second step, the identified policies were then linked to a set of parameters and variables that are required to perform a sound quantitative and qualitative analysis in relation to the current and future status of the mobility network in relation to these policies. A third step was then performed to identify those parameters for which NTS is a valid instrument. In the end, a set of 48 parameters was composed. For each of

these parameters technical information (sampling frequency, data format, etc.) and a data grouping is suggested.

Based on the information available within the OPTIMISM project, a comparison is then made between the retained set of parameters and the current data collected through NTS in different countries. Focus points for this analysis are data availability (gap analysis) and comparability (grouping of data). The results of these analyses indicate that two groups of countries can be identified. A first group contains countries that already collect a fair share of the presented parameters. However, even within this group, significance differences exist in terms of the precise type of data that is collected and the way data is stored in groups. For a second group of countries, data availability is a larger issue.

As a result of this analysis, a final proposal is presented for a harmonised NTS. In it, NTS is used as a data source that can exist next to other current or future technologies. The data collected from NTS can be enhanced based on validated databases (using other information than NTS) and automatically collected data.

1. Introduction

1.1. The OPTIMISM project

The OPTIMISM project aims to *optimise passenger transport systems using co-modality ICT solutions, while keeping in mind the needs of passengers and ensuring that the impacts of any proposed measures help decrease CO_2 emissions*. In order to reach this objective, the project collects information and analyses passengers' current travel needs, mobility patterns and business models. Furthermore, the project examines potential changes in different aspects of life such as social structures, demographic changes, technical evolutions and economic influences that may help or hinder the introduction of more sustainable travel patterns.

The OPTIMISM project focusses on three areas:

1) It identifies gaps in the collection of travel data information and proposes a method to harmonise such data collection,
2) it identifies and defines demand and supply factors that shape transportation systems and mobility patterns, and
3) it defines elements that potentially lead to the decarbonisation of the passenger transport system, thus enhancing the sustainability of the transport system.

This deliverable focusses on the work that is carried out under task 2.2 of Work Package 2 of the OPTIMISM project, "Harmonisation of national travel statistics in Europe". The specific objectives of this task are:

1) To analyse gaps in travel statistics data that are collected through National Travel Surveys,
2) to analyse data formats and grouping in which travel statistics are collected, in view of a unifying methodology,
3) to analyse the comparability of the existing data, and
4) to propose a methodology for harmonising travel statistics derived from National Travel Surveys.

Task 2.2 builds strongly on the data basis delivered by Task 2.1[1]. The proposed methodology for harmonising travel statistics serves as a basis for Task 2.3 where more future developments will be discussed in detail.

[1] Ahern, A., Weyman, G., Redelbach, M., Schulz. A., Akkermans, L., & Vannacci, L. (2012). OPTIMISM Deliverable 2.1: Gather and analyze national travel statistics. European Commission FP7 project: FP7-284892-OPTIMISM

1.2. Research interest

The OPTIMISM project examines how ICT and co-modality can be used within a dual background: on one hand it can be expected that a similar or higher mobility demand for passenger transport will exist in the future[2] while on the other hand a higher level of sustainability needs to be obtained[3]. Both the application of ICT measures and improved co-modality could provide a roadway towards more sustainable travel, even with an increased transport demand. However, verification for this is still required and a number of conditions for reaching these targets can be identified.

One of the rationales within the OPTIMISM project is that a good understanding of real-life travel patterns is necessary for the understanding of how future solutions can influence travel demand and sustainable travel. This understanding of real-life travel patterns includes a wide range of information: current transport demand, travel purposes, vehicle use, modal information, current application of ICT measures and co-modality solutions, etc. One potential way of collecting this type of information, and also the focus of Work Package 2, are National Travel Surveys.

National Travel Surveys are one of the most important sources for personal mobility behaviour. Data is collected through NTS in order to provide a quantitative and qualitative overview of real-life mobility behaviour so that questions related to where, when, how and why people are mobile can be answered. The format in which NTS are used differs between countries, but by and large they are collected through pen-and-paper questionnaires (or similar formats) or phone interviews where respondents are selected on individual or household basis.

Within Task 2.1 of the OPTIMISM project the NTS of several countries have been collected and analysed both to identify and describe the travel patterns that are taking place in those countries, but also to discover what data is actually collected in different countries and how survey methodologies differ across Europe for collection of travel data. As a result it has been possible to identify some general conditions of national travel behaviour in each country and to identify some trends in travel patterns. However, comparing travel patterns across countries using data from different NTS has been limited by the variety of methods that are used to collect data and by differences in the type and format of data that is collected. Therefore, it is necessary to carry out a

[2] Akkermans L., Vanherle, K., Moizo A., Raganato P., Schade B., Leduc G., Wiesenthal T., Shepherd S., Tight, M., Guehnemann, A., Krail M., & Schade W. (2010). Ranking of measures to reduce GHG emissions of transport: reduction potentials and qualification of feasibility. Deliverable D2.1 of GHG-TransPoRD: Project co-funded by European Commission 7th RTD Programme. Transport & Mobility Leuven, Belgium.

[3] European Commission (2011). White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. COM(2011) 144 final.

gap analysis followed by a proposal for a harmonised methodology of data collection by NTS.

Task 2.2 of the OPTIMISM project aims to provide an alternative for the different NTS collection methodologies that are currently being practiced by countries. To do so, four steps are followed by the current task:

1) Identify purposes for data collection through NTS and identify variables that are needed to analyse the current status of the transport system in light of these purposes,
2) identify and analyse gaps in the data collection from current NTS,
3) identify and analyse differences in the format and comparability of the data that is collected in current NTS,
4) propose a methodology for a harmonised NTS, focussing on identified data collection requirements.

1.3. The report structure

The report is divided into four sections: Introduction, Methodology, Results, Conclusions and Recommendations. The introduction explains the need for the aims and research interest. The 'methodology' section presents an outline of the approach and scope of the study, what rationale was followed for the gap analysis and what steps were taken to update the collected data from NTS. The 'results' section presents the identified data collection purposes, gap analysis and format analysis of collected NTS data. The end product, a proposed harmonised structure for NTS is also presented in the final section. It outlines the major conclusions that can be drawn from the gap analysis and a proposed harmonised methodology for data collection through NTS.

2. Methodology

2.1. Objectives

The objectives of this task are:

1) To analyse gaps in travel statistics data that are collected through NTS,
2) to analyse data formats and grouping in which travel statistics are collected, in view of a unifying methodology,
3) to analyse the comparability of the existing data, and
4) to propose a methodology for harmonising travel statistics derived from NTS.

In order to perform a gap analysis, and the associated data format and comparability analyses, it is in the first instance necessary to clearly outline the scope of the gap analysis. This scope is presented in sections 2.2 and 2.3 of the current document.

2.2. Why collect data through NTS?

As presented in Deliverable 2.1 of the OPTIMISM project, data collected through travel surveys is used for many purposes, ranging from high-level policy support over topical scientific research up to macro-economic modelling. In parallel, it can also be noted that a significant portion of the collected information from Task 2.1 of the OPTIMISM project is or will become collectable through other means than NTS: technological solutions (GPS data, automated ticketing information, etc.), validated databases (CARE[4], etc.) and other sources.

These differences make it very difficult to propose a single methodology for a unified or harmonised set of travel statistics from NTS. After all, different data usage purposes require different sets of data to be collected, with different technical qualities and different methodologies. Because of this, a first set of questions needed to be answered: How can NTS remain an asset in the future? Why collect data through NTS? How is data from NTS used?

In task 2.1, four major purposes for the execution of NTS are identified (percentages represent the share of respondents identifying the specific answering option): general data collection (100%), policy decision support (80%), planning support (74%) and research (74%). Similarly, four main user groups for NTS data are identified: policy makers (21%), government agencies (20%), researchers (20%) and communities/municipalities (14%). Table 2-1:

[4] http://ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm

Purposes and users of NTS (Number of responses out of 15 countries) presents a cross-tabulation of the different purposes and users of NTS. This reflects that NTS, often supported by specific research, are generally being used to provide governments with better awareness of travel patterns and general travel data and to help governments and authorities to make better decisions regarding planning infrastructure and implementing transport policies. Because of this, it was decided that the unified data collection methodology for NTS to be proposed should focus on policy support.

Table 2-1: Purposes and users of NTS (Number of responses out of 15 countries)[5]

Purpose of survey	General data collection	Policy decision support	Planning support	Research	Verification of existing data
Policy makers	15	12	10	10	6
Government agencies	14	12	10	9	6
Researchers	14	11	8	10	6
Communities / Municipalities	10	8	8	7	5
Consultancies / Industry	5	4	5	5	2
Transport providers	4	3	5	4	3
Media	5	4	2	4	2

'Policy support' in itself is also a relatively vague terminology. Transport policies relate to a wide range of research domains: economy, environment & sustainability, health & safety, etc. In itself, transport policies can include passenger & freight transport, all transportation modes, demographic and social differences, etc. And, in effect, the practical outcome of a transport policy can be very different indeed depending on the scope (national, regional or local), targeted outcome (optimisation for sustainability or economy), etc. In order to reduce this uncertainty, it was decided within the OPTIMISM consortium to focus on transport policies such as they were proposed in the EU White Paper on Transport[6].

Within the data collection performed in Task 2.1, also other NTS data collection methodologies than traditional 'paper' or 'phone interview' NTS were identified. The use of GPS information, smartphones or other technologies is considered to be potentially valuable for specific types of information (route information, time information, modal choice, etc.). They can enhance data reliability, reduce data

[5] Ahern, A., Weyman, G., Redelbach, M., Schulz. A., Akkermans, L., & Vannacci, L. (2012). OPTIMISM Deliverable 2.1: Gather and analyze national travel statistics. European Commission FP7 project: FP7-284892-OPTIMISM

[6] European Commission (2011). White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. COM(2011) 144 final.

collection time, simplify survey methodology, etc. However, some issues do exist with the use of these technologies: social and demographic biases (technology introduction rates potentially differ between income classes, age groups, countries, etc.), privacy issues, the sheer quantity of data that can cause problems for analysts and the simple fact that not all technologies are widely applied at the time of writing. Although for some issues solutions will be found (i.e. privacy regulation), or biases are likely to disappear (technology accessibility increases through cost reduction), NTS will remain a valuable instrument that allow analysts to obtain more depth of analysis into the transport data.

Because of the combination of these elements (policy support; passenger transport; absence of other data collection methodologies; qualitative insight), a set of well-defined policies in relation to passenger transport were identified based on the EU White Paper on Transport. They are presented below in section 3.1.1.

2.3. Data completion: required variables for policy support

After the selection of concrete policies in relation to passenger transport, a set of parameters and variables can be identified that are required to compile a sound quantitative and/or qualitative analysis. This set of parameters is firstly constructed with general data collection in mind, irrespective of the usage of NTS or other data collection methodologies. In second instance, this set is divided into parameters for which dedicated databases already exist, or for which direct technological solutions exist, are already used or are expected to be used in the near future (based on information from Work Package 4 of the OPTIMISM project). The selected parameters are presented in more detail in section 3.1.2.

2.4. Gap and format analysis

The gap analysis is based on the results of the information that was collected from NTS from Member States in Task 2.1. Information from 15 Member States was collected: Belgium, Cyprus, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, the Netherlands, Poland, Spain, Sweden, Switzerland and the United Kingdom.

Following the identification of concrete passenger related policies and required variables for analysis, a first analysis was performed to identify missing variables in the questionnaire. For these missing variables, an additional data collection round was held by consortium partners who were asked to check for

the missing variables. Where possible, general analysis documents from the NTS were used, to gather missing information on data availability.

The data was collected in a comprehensive data matrix containing the following fields:

- Overall parameter selection (including variables suitable for NTS data collection and other variables);
- proposed data format and content;
- data availability in 15 EU Member States (similar to Task 2.1) for the proposed parameters, used for data gap analysis;
- data format match in 15 EU Member States for the proposed parameters, used for data format analysis.

In order to validate the findings of the gap analysis and data format analysis, experts from Spain, Germany and Switzerland were asked to confirm our initial findings. These experts were selected as a result of feedback received during the data collection phase performed in task 2.1 where data collection was performed swiftly and with direct personal contact with the experts.

As a result of the different steps undertaken in task 2.2 a proposal for a harmonised methodology is presented in Section 4 containing information on:

- What parameters and data to collect;
- How to collect information (data format and recommended grouping categories);
- Who to collect data from.

3. Results

3.1. Selected passenger transport policies and analysis requirements

3.1.1 Passenger transport policies

The starting point for the selection of potential passenger transport policies that are used as a reference for the collection of data through National Travel Surveys is the European Commission White Paper on Transport[7]. The document describes a set of objectives and initiatives that are put forward by the European Commission to build a competitive transport system that will increase mobility, remove major barriers in key areas and improve growth and employment. At the same time, these objectives and initiatives are strongly linked with reducing Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050.

Out of the ten goals that were identified for a competitive and resource-efficient transport system that were held as benchmarks for achieving a 60% reduction in greenhouse gas emissions, six were directly related to passenger transport:

1) Halving the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030.
2) By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail.
3) A fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high quality and capacity network by 2040 and a corresponding set of information services.
4) By 2050, establish a framework for a European multimodal transport information, management and payment system.
5) By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.
6) Move towards the full application of 'user pays' and 'polluter pays' principles and private sector engagement to eliminate distortions, including harmful

[7] European Commission (2011). White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. COM(2011) 144 final.

subsidies, generate revenues and ensure financing for future transport investment.

These objectives could be broken down and merged into seven key denominators:

1) Halving (2030) and phasing out (2050) the use of conventionally-fuelled cars in urban transport;
2) increasing (2030) and completing (2050) a high-speed rail network with the majority of medium and long distance travel to go by high-speed rail;
3) maintaining a dense railway network;
4) high capacity and quality network;
5) European multimodal transport information, management and payment system;
6) increased road safety;
7) 'user pays' and 'polluter pays' principles.

As such, they are linked with different transport related domains : general mobility, transport infrastructure, network quality, multi-modality, sustainability and environment, safety and pricing.

In addition to the ten objectives, 40 concrete initiatives were identified by the EC that should assist in reaching these goals. Out of this set of 40 initiatives, 14 initiatives are directly linked to passenger transport.

1) Towards a 'zero-vision' on road safety (initiative 16);
2) passenger's rights (initiative 21);
3) seamless door-to-door mobility (initiative 22);
4) mobility continuity plans (initiative 23);
5) a technology roadmap (initiative 24);
6) an innovation and deployment strategy (initiative 25);
7) a regulatory framework for innovative transport (initiative 26);
8) travel information (initiative 27);
9) vehicle labelling for CO_2 emissions and fuel efficiency (initiative 28);
10) eco-driving and speed limits (initiative 30);
11) urban mobility plans (initiative 31);
12) an EU framework for urban road user charging (initiative 32);
13) a core network of strategic European infrastructure (initiative 34);
14) smart pricing and taxation (initiative 39).

3.1.2 Required variables for data collection

The second step in the preparation for the data gap analysis is the identification of a set of variables and parameters, that can be collected through NTS or other means, that are required to perform a sound quantitative and qualitative

evaluation of the current and future mobility situation that can support policy decisions. In practice this means identifying and defining a minimum set of parameters from the starting point of a travel survey as data collection method.

These parameters and variables are selected on the following pages and form the basis for the gap analysis. Given the background of NTS, the following categories or domains can be identified:

1) Demographic information;
2) general mobility information;
3) transport infrastructure;
4) transport quality;
5) multi-modal transport;
6) environment;
7) cost internalisation;
8) safety;
9) vehicle usage

For each of the parameters, the following information is listed:

1) Domain/category;
2) Parameter name;
3) Description of parameter/variable;
4) Suitable for NTS data collection;
5) Data availability through other sources (new technology, databases, etc.);
6) Suitability for monitoring the progress/status of goal attainment;
7) Retained for gap analysis (based 4), 5) and 6))
    a. Retained parameter/variable is marked green;
    b. Not Retained parameter/variable is marked red;
8) Proposed type of variable;
9) Proposed unit of measurement/data;
10) Proposed grouping alternatives:
    a. For quantitative variables: distinctions between groups; including lower and upper group limits;
    b. For qualitative variables: listing;
11) Proposed frequency of collection.

Table 3-1: Initial list of parameters to be collected for policy support - Demographic information

Demographic information					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
R.Age	Respondent age	Yes	No	Yes	Yes
R.Sex	Respondent sex	Yes	No	Yes	Yes
Ax.Age	In case of additional information for family members, age information per additional member	Yes	No	Yes	Yes
Ax.Sex	In case of additional information for family members, sex information per additional member	Yes	No	Yes	Yes
R.Own	Ownership of different vehicle types by respondent	Yes	No	Yes	Yes
R.Car.Fuel	In case of car ownership, fuel type information	Yes	No	Yes	Yes
R.Edu	Level of education	Yes	No	Yes	Yes
R.Empl	Current employment	Yes	No	Yes	Yes
R.Inc	Income	Yes	No	Yes	Yes
R.Hloc	Home location	Yes	No	Yes	Yes
R.Wloc	Work location	Yes	No	Yes	Yes

Table 3-2: Initial list of parameters to be collected for policy support - Emissions and cost

Emissions and cost					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
Vkm.CO2	CO2 emissions per vehicle	No	Yes	Yes	No
Pkm.CO2	CO2 emissions per person	No	Yes	Yes	No
Fuel.CO2	CO2 emissions per fuel type (per	No	Yes	Yes	No
Ext.Cost	How is the external cost (polution, infrastructure, etc.) internalised?	No	No	Yes	No
Int.Cost	What percentage of the external costs are internalised?	No	No	Yes	No

Table 3-3: Initial list of parameters to be collected for policy support - Vehicle usage

Vehicle usage					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
Veh.Occ	Car occupancy rates (per trip)	Yes	Yes	Yes	Yes
Veh.Occ	Vehicle occupancy rates (per trip)	No	Yes	Yes	No

Table 3-4: Initial list of parameters to be collected for policy support - General mobility information

General mobility information					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
Vkm	Vehicle kilometres	Yes	Yes	Yes	Yes
Vkm.Mode	Vehicle kilometres per transport	Yes	Yes	Yes	Yes
Vkm.Veh	Vehicle kilometres per vehicle	Yes	Yes	Yes	Yes
Vkm.Fuel	Vehicle kilometres per engine	Yes	Yes	Yes	Yes
Vkm.Reg	Vehicle kilometres per region	Yes	Yes	Yes	Yes
Vkm.Purp	Vehicle kilometres per purpose	Yes	Yes	Yes	Yes
Pkm	Person kilometres	Yes	Yes	Yes	Yes
Pkm.Mode	Person kilometres per transport	Yes	Yes	Yes	Yes
Pkm.Veh	Person kilometres per vehicle	Yes	Yes	Yes	Yes
Pkm.Fuel	Person kilometres per engine type	Yes	Yes	Yes	Yes
Pkm.Reg	Person kilometres per region type	Yes	Yes	Yes	Yes
Pkm.Purp	Person kilometres per purpose	Yes	Yes	Yes	Yes
Trip	Number of trips per day	Yes	Yes	Yes	Yes
Trip.Mode	Number of trips per mode	Yes	Yes	Yes	Yes
Trip.Veh	Number of trips per vehicle type	Yes	Yes	Yes	Yes
Trip.Reg	Number of trips per region type	Yes	Yes	Yes	Yes
Trip.Purp	Number of trips per trip purpose	Yes	Yes	No	Yes
Trip.Chain	Number of trips per chain	Yes	Yes	No	Yes
Trip.M.Chain	Trip chaining information: composition of trip chain out of different individual trip legs for	No	Yes	No	No
Trip.Length	Trip length	Yes	Yes	Yes	Yes
Trip.Length.V	Trip length information per vehicle type	Yes	Yes	Yes	Yes
Chain.Length	Chain length information	Yes	Yes	Yes	Yes
OD.number	Origin-Destination information	No	Yes	Yes	No

Table 3-5: Initial list of parameters to be collected for policy support - Infrastructure, quality of mobility and multi-modality

Infrastructure, quality of mobility and multi-modality					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
Rail.Net	Rail network lenght per type	No	No	Yes	No
Rail.Use	Rail network per usage type	No	Yes	Yes	No
Trip.Dur	Duration of trips	Yes	Yes	Yes	Yes
Cong.Time	Lost time per trip (due to congestion or connection)	Yes	Yes	Yes	Yes
Cong.Bottle	Availability of list of identified	No	Yes	Yes	No
TMS.Use	Use of Travel Management	No	Yes	Yes	Yes
TMS.UseP	Use of Travel Management Systems on what percentage of	Yes	Yes	Yes	Yes
MM.Inf	Availability of transport information for multi-modal	Yes	Yes	Yes	Yes
MM.Pay	Availability of an integrated	Yes	Yes	Yes	Yes
MM.trip	Number of trips where multi-modal transport was used	Yes	Yes	Yes	Yes
MM.chain	Number of chains where multi-modal transport was used	Yes	Yes	Yes	Yes
MM.PT	Accessibility of Public Transport	Yes	Yes	Yes	Yes
MM.mode	Number of person kilometres for multi-modal trips, per vehicle type	No	Yes	Yes	No

Table 3-6: Initial list of parameters to be collected for policy support - Accidents, injuries and fatalities

Accidents, injuries and fatalities					
Parameter name	**Description**	**Suitable for NTS**	**Available through new technologies**	**Overall goal monitoring**	**Retained for Gap analysis**
Acc.Tot	Total number of accidents	Yes	Yes	Yes	Yes
Acc.Mode	Number of accidents per vehicle	Yes	Yes	Yes	Yes
Acc.Reg	Number of accidents per region	Yes	Yes	Yes	Yes
Inj.Tot	Total number of injuries	Yes	Yes	Yes	Yes
Inj.Mode	Number of injuries per vehicle	Yes	Yes	Yes	Yes
Inj.Reg	Number of injuries per region	Yes	Yes	Yes	Yes
Fatal.Tot	Total number of fatalities	No	Yes	Yes	No
Fatal.Mode	Number of fatalities per vehicle	No	Yes	Yes	No
Fatal.Reg	Number of fatalities per region	No	Yes	Yes	No

From this parameter list, a set of parameters can be identified that are recommended for inclusion in a harmonised NTS (see also Section 4.1). In the case of parameters that were not included in this list, two major reasons could be identified:

1. The parameter type in itself does not lend itself for data collection through the traditional format of an NTS (paper or phone interview). This could be because it is considered that respondents have no specific knowledge about the parameter (i.e. Rail network length), is not capable to respond (i.e. traffic fatalities), or the type of information requested is to detailed to allow for reliable data collection (i.e. trip by trip kilometre information).
2. The parameter type is not strictly required to monitor the current and future mobility situation in relation to the proposed mobility policies.
3. Other databases or data collection methodologies may provide a higher quality and increased quantity of reliable data (i.e. the CARE database, GPS tracking, etc.).

3.2. Data gap analysis

The gap analysis focusses on the availability of the proposed set of variables and parameters within the current NTS for which information was collected. At this time, it needs to be noted that data availability was only tested for those variables and parameters for which the usage of NTS was estimated to be useful. This is the case in either of the following situations:

1) Information gathered through NTS is the only likely information source for a sufficiently high quality of quantitative information;
2) Information gathered through NTS is considered a required source for background information to assist in the interpretation of a large set of quantitative data.

The findings are presented in the tables on the next pages. The legend below assists in the interpretation of these tables.

Data availability legend	
+	Available
o	Possibly availabe (micro-data)
-	Probably unavailable
?	Additional information required

In the first instance, it can be noted that demographic information is not always collected in a similar way. This is caused by the different methodologies used in countries: in some cases, only information from one respondent is collected while in other cases, information from the entire family or household is collected. This results in missing information for other family members. It does not necessarily influence information on specific vehicle ownership and vehicle information.

In relation to general mobility information, it can be noted that basic information on vehicle kilometres travelled or person kilometres performed is generally collected in all of the tested NTS. However, more detailed information allowing for distinctions for mobility patterns in terms of 'fuel type', 'region type' and 'trip purpose' is generally less readily available. This is both the case when vehicles or people are used as a base unit (vehicle kilometres and person kilometres). Furthermore, while detailed information for single trips is widely available, specific information describing trip chains is not impossible, but difficult to extract from current surveys.

When looking at factors related to the quality of transport, only trip duration is more often available. Time loss (congestion, missed connections, etc.) or the use of any type of travel management system (enhancing mobility quality) is generally not asked for in the current NTS. Car occupancy rates are more

readily collected, although still half of NTS does not ask for this type of information.

This also becomes apparent when looking at multi-modal transport. Both the effective usage of multi-modal opportunities, as well as technologies assisting multi-modal transport or accessibility of public transport in general are not commonly asked for.

Safety-related information is also poorly reported. Although safety-related databases are readily available, these are most accurate for fatalities. Within these databases, accuracy diminishes for serious and light injuries or accidents and NTS could be a valuable source of information.

Looking at different countries, it can be noted that in particular Finland, Germany, the Netherlands, Sweden, Switzerland and the United Kingdom perform relatively well for the current gap analysis. However, within these countries, detailed information on vehicle usage, personal mobility, the use of modern technologies, accidents and injuries is not always collected. Nevertheless, the NTS in these countries could be used for further guidelines.

A second group of countries includes Cyprus, Hungary, Ireland, Italy, Latvia, Poland, Spain, and to a lesser extent Belgium and France. These countries already collect some information but based on the current information still have some major data gaps.

Table 3-7: Data gap analysis - Demographic information

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL *	ES	SE	CH	UK
Demographic information	R.Age	Respondent Age	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	R.Sex	Respondent Sex	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Ax.Age	Additional Age	+	+	-	-	+	-	-	-	+	-	-	o	-	+	+
	Ax.Sex	Additional Sex	+	-	-	-	+	-	-	-	+	-	-	o	-	+	+
	R.Own	Vehicle ownership	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+
	R.Car.Fuel	Car fuel	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+
	R.Edu	Level of education	+	+	+	+	+	+	+	+	?	+	-	+	+	+	+
	R.Empl	Current employment	+	+	+	+	+	+	+	+	?	+	-	+	+	+	+
	R.Inc	Income	-	-	-	+	+	-	o	o	?	+	-	+	+	+	+
	R.Hloc	Home location	+	+	+	+	-	+	+	+	?	+	-	+	+	+	+
	R.Wloc	Work location	+	+	+	+	-	+	+	+	?	+	-	+	+	+	+

Table 3-8: Data gap analysis - Transport quality

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Transport quality	Trip.Dur	Duration of trips	-	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Cong.Time	Lost time per trip	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
	TMS.Use	Use of Travel Management Systems	+	-	-	-	-	-	-	-	?	-	-	-	-	-	-
	TMS.UseP	Use of TMS on % of trips	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-

Table 3-9: Data gap analysis - Multi-modal transport

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Multi-modal transport	MM.Inf	Availability T.I. for M.M. assistance	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
	MM.Pay	Availability of int. ticketing system	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	MM.trip	Number of M.M. trips	-	+	+	+	+	+	-	+	?	+	-	-	-	-	+
	MM.chain	Number of M.M. Chains	+	-	-	-	+	-	-	-	?	-	-	-	-	-	+
	MM.PT	Accessibility of Public Transport	+	-	-	-	+	-	-	-	-	-	-	+	-	+	+

Table 3-10: Data gap analysis - Accidents and injuries

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Safety (Accidents)	Acc.Tot	Total number of accidents	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Acc.Mode	Number of accidents per vehicle type	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Acc.Reg	Number of accidents per region	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
Safety (injuries)	Inj.Tot	Total number of injuries	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Inj.Mode	Number of injuries per vehicle type	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Inj.Reg	Number of injuries per region	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-

Table 3-11: Data gap analysis - Car occupancy rate

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Vehicle usage	Veh.Car.Occ	Car occupancy rate	-	-	+	+	-	-	+	-	?	+	-	-	+	+	+

Table 3-12: Data gap analysis - General mobility information

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
General mobility information	Vkm	Vkm per trip	+	-	o	+	+	+	-	-	-	o	-	-	+	+	+
	Vkm.Mode	Vkm per transport mode	+	-	o	+	+	+	-	-	-	o	-	-	+	o	o
	Vkm.Veh	Vkm per vehicle type	+	-	o	+	+	+	-	-	-	o	-	-	+	o	o
	Vkm.Fuel	Vkm per fuel type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Vkm.Reg	Vkm per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Vkm.Purp	Vkm per trip motive	+	-	o	o	o	-	-	-	-	o	-	-	+	o	o
	Pkm	Pkm per trip	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Pkm.Mode	Pkm per transport mode	o	o	+	+	+	o	+	+	o	+	-	+	+	+	+
	Pkm.Veh	Pkm per vehicle type	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Pkm.Fuel	Pkm per fuel type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Pkm.Reg	Pkm per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Pkm.Purp	Pkm per trip motive	-	-	o	o	o	-	-	-	-	o	-	-	+	o	o
	Trip	Number of trips per day	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Mode	Number of trips per transport mode	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Veh	Number of trips per vehicle type	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Reg	Number of trips per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Trip.Purp	Number of trips per trip motive	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Chain	Number of trips per chain	-	-	o	-	+	-	-	-	-	o	-	-	o	o	o
	Trip.Length	Trip length	+	+	+	-	+	+	+	+	+	+	-	+	+	+	+
	Trip.Length.V	Trip length per vehicle type	+	o	o	-	+	-	+	-	-	o	-	-	o	o	o
	Chain.Length	Chain length	-	-	o	-	+	-	-	-	-	o	-	-	o	o	o

3.3. Data format analysis

The data format analysis focusses on the matching of the proposed set of variables and parameters with the data collected from the NTS for which information was collected. At this time, it needs to be noted that data format matching was only tested for those variables and parameters for which the usage of NTS was estimated to be useful. This is the case in either of the following situations:

1) Information gathered through NTS is the only likely information source for a sufficiently high quality of quantitative information;
2) Information gathered through NTS is considered a required source for background information to assist in the interpretation of a large set of quantitative data available from other sources.

The findings are presented in the tables on the next pages. The legend below assists in the interpretation of these tables.

Data format legend	
+	Match
o	No match (unavailable or no approximative formatting match)
-	Partial match (approximative formatting match or microdata)
?	Additional information required

In the first instance, it can be noted that demographic information is not always collected in a similar way. In particular for the recording of age information, different age categories are used. Also, in some cases, information is only partially gathered: for a limited set of household members of only for individuals of a certain age (i.e. age 14 and over).

In relation to general mobility information, it can be noted that basic information on vehicle kilometres travelled or person kilometres performed is generally collected in all of the tested NTS. However, for some of the more detailed information items, different groupings are used. This is in particular the case when looking at trip purposes (with levels of detail ranging from very high to very low) and regional distributions (differing between distinctions roughly representing NUTS levels 3 and LAU 1). In the case of higher levels of details than suggested, this does not necessarily need to be problematic since a reduction to the suggested level of detail should in theory be possible. Information in relation to trips and chains, however, is less easy to merge. In some cases, definitions for trips and chains can differ and a unified definition may be required.

For the other categories of information for which data availability and data format was checked, little can be said due to the initial unavailability of data.

This means that a detailed analysis on the quality of mobility, multi-modal mobility, injuries and accidents and vehicle usage cannot be made.

Looking at different countries, it can be noted that although Finland, Germany, the Netherlands, Sweden, Switzerland and the United Kingdom perform relatively well for the current gap analysis, this does not necessarily mean that similar data formats are used. In particular groupings differ in Finland, the Netherlands, Switzerland and the United Kingdom. Mostly these differences tend towards a higher level of detail of information that is gathered than strictly necessary. It should be noted that this can be caused by different underlying research questions or policy support purposes for these countries than the more general purposes that are suggested in this Deliverable.

For the second group of countries, consisting of Cyprus, Hungary, Ireland, Italy, Latvia, Poland, Spain, and to a lesser extent Belgium and France, it is more difficult to look at specific data formats. In the case of Belgium and France, a relative high level of detail is available and some data reductions for the available parameters are possible. However, for the other countries this is only scarcely the case.

Table 3-13: Data format analysis - Demographic information

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Demographic information	R.Age	Respondent Age	o	o	o	+	+	o	o	o	o	o	-	o	+	+	o
	R.Sex	Respondent Sex	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Ax.Age	Additional Age	o	o	-	-	+	-	-	-	o	-	-	o	-	+	o
	Ax.Sex	Additional Sex	+	-	-	-	+	-	-	-	+	-	-	o	-	+	+
	R.Own	Vehicle ownership	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+
	R.Car.Fuel	Car fuel	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+
	R.Edu	Level of education	+	+	+	+	+	+	+	+	?	+	-	+	+	+	+
	R.Empl	Current employment	+	+	+	+	+	+	+	+	?	+	-	+	+	+	+
	R.Inc	Income	-	-	-	+	+	-	o	o	?	+	-	+	+	+	+
	R.Hloc	Home location	+	+	+	+	-	+	+	+	?	+	-	+	+	+	+
	R.Wloc	Work location	+	+	+	+	-	+	+	+	?	+	-	+	+	+	+

Table 3-14: Data format analysis - Transport quality

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Transport quality	Trip.Dur	Duration of trips	-	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Cong.Time	Lost time per trip	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
	TMS.Use	Use of Travel Management Systems	o	-	-	-	-	-	-	-	?	-	-	-	-	-	-
	TMS.UseP	Use of TMS on % of trips	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-

Table 3-15: : Data format analysis - Multi-modal transport

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Multi-modal transport	MM.Inf	Availability T.I. for M.M. assistance	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
	MM.Pay	Availability of int. ticketing system	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	MM.trip	Number of M.M. trips	-	+	+	+	+	+	-	+	?	+	-	-	-	-	+
	MM.chain	Number of M.M. Chains	+	-	-	-	+	-	-	-	?	-	-	-	-	-	+
	MM.PT	Accessibility of Public Transport	+	-	-	-	+	-	-	-	-	-	-	+	-	+	+

Table 3-16: Data format analysis - Accidents and injuries

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Safety (Accidents)	Acc.Tot	Total number of accidents	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Acc.Mode	Number of accidents per vehicle type	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Acc.Reg	Number of accidents per region	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
Safety (injuries)	Inj.Tot	Total number of injuries	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Inj.Mode	Number of injuries per vehicle type	-	-	-	-	-	-	-	-	?	-	-	-	-	-	+
	Inj.Reg	Number of injuries per region	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-

Table 3-17: Data format analysis - Car occupancy rate

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
Vehicle usage	Veh.Car.Occ	Car occupancy rate	-	-	+	+	-	-	+	-	?	+	-	-	+	+	+

Table 3-18: Data format analysis - General mobility information

			BE	CY	FI	FR	DE	HU	IE	IT	LV	NL	PL	ES	SE	CH	UK
General mobility information	Vkm	Vkm per trip	+	-	o	+	+	+	-	-	-	o	-	-	+	+	+
	Vkm.Mode	Vkm per transport mode	o	-	o	+	+	o	-	-	-	o	-	-	+	o	o
	Vkm.Veh	Vkm per vehicle type	o	-	o	+	+	o	-	-	-	o	-	-	+	o	o
	Vkm.Fuel	Vkm per fuel/propulsion type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Vkm.Reg	Vkm per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Vkm.Purp	Vkm per trip motive	+	-	o	o	o	-	-	-	-	o	-	-	+	o	o
	Pkm	Pkm per trip	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Pkm.Mode	Pkm per transport mode	o	o	+	+	+	o	+	+	o	+	-	+	+	+	+
	Pkm.Veh	Pkm per vehicle type	o	o	o	+	+	o	+	+	o	+	-	+	+	+	+
	Pkm.Fuel	Pkm per fuel type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Pkm.Reg	Pkm per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Pkm.Purp	Pkm per trip purpose	-	-	o	o	o	-	-	-	-	o	-	-	+	o	o
	Trip	Number of trips per day	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Mode	Number of trips per transport mode	o	o	o	+	+	o	-	+	+	+	-	+	+	+	+
	Trip.Veh	Number of trips per vehicle type	o	o	o	+	+	o	-	+	+	+	-	+	+	+	+
	Trip.Reg	Number of trips per region type	-	-	o	-	o	-	-	-	-	o	-	-	o	o	o
	Trip.Purp	Number of trips per trip motive	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+
	Trip.Chain	Number of trips per chain	-	-	o	-	+	-	-	-	-	o	-	-	o	o	o
	Trip.Length	Trip length	+	+	+	-	+	+	+	+	+	+	-	+	+	+	+
	Trip.Length.V	Trip length per vehicle type	o	o	o	-	+	-	+	-	-	o	-	-	o	o	o
	Chain.Length	Chain length	-	-	o	-	+	-	-	-	-	o	-	-	o	o	o

4. Proposition for harmonised national travel surveys

In the previous sections, a set-up for the proposal for harmonised NTS was presented. In section 3.1, a set of parameters and variables was identified that could be considered as a base requirement to provide data for a sound scientific analysis of the current mobility status and future evolutions towards selected mobility goals. In section 3.2, an analysis was made on the current availability of such data in the existing NTS that were collected from a selection of countries. In section 3.3, the current format and comparability of the existing data is discussed in comparison to an ideal data structure.

The current section merges these findings and aims to propose a structure for a harmonised national travel survey. An important background here for is the specific setting for which an NTS can be considered as a good instrument: the comparison of information gathered through NTS in different countries. A harmonised NTS can assist in the collection of (household or individual) mobility related information that is required to gain insight in the current and future mobility status, in relation to a well-defined set of policy targets.

A proposition for the content of a harmonised NTS is made in Section 4.1. This includes a listing of the set of parameters and variables, for which data should be collected, but also the variables' type and suggested grouping. However, in itself, this information is not enough to provide data that is comparable between different countries. For that, also information on sampling frequency and sample composition needs to be taken into account. A suggestion for these elements is presented in Section 4.2.

4.1. Data format and categories

Currently, a number of countries do provide a good guideline for harmonised NTS: Germany, Sweden, Switzerland and the UK already collect a fair share of the required data, even though the current data categorisation does not always match. Experience from these countries can provide a good starting point for a more harmonised data collection that may be maintained by a single entity such as EUROSTAT.

Before going into the list of parameters and related technical issues, a number of remarks need to be made:

1) The existence of, or the proposal of, a harmonised NTS does not discard the need for other specialised mobility-related surveys. The current proposal starts from a standard set of objectives and initiatives, but national

objectives and initiatives can differ. Such differences may warrant additional, more detailed surveys. An example hereof is the introduction of electric vehicles and charging infrastructure: although a clear link with European policies can be found and a harmonised NTS can provide background information, such an NTS should not be used to pinpoint the actual locations where charging stations should be placed. For this, other information sources are more relevant.

2) NTS should not be overloaded with too many questions. Asking respondents to provide answers to a large set of questions causes the risk of low-quality data to increase. Respondents may experience extensive surveys as a burden, resulting in general displeasure and unwillingness to participate. It is preferential to focus on the most important items to provide a continuous stream of high quality information and to get 'secondary' information via other means.
3) The use of NTS needs to be seen in light of the availability of other data collection techniques and more validated databases. Over the past years, alternative data collection techniques and databases have become more readily available. In order to optimise the use of NTS as a data collection method, this implies that a frequent analysis of existing NTS needs to be considered. As a result, NTS may undergo continuous evolutions. Special care should be taken to guarantee that these evolutions do not jeopardise comparability over time.

The following parameters are suggested for inclusion into a harmonised NTS:

Table 4-1: Parameter listing for harmonised NTS – Demographic information

Demographic information				
Parameter name	**Description**	**Format: quantitative / qualitative**	**Unit**	**Recommended grouping categories**
R.Age	Respondent age	Quantitative	Number	Age 6 and older
R.Sex	Respondent sex	Qualitative	Listing	Male / Female
Ax.Age	In case of additional information for family members, age information per additional member	Quantitative	Number	Age 6 and older
Ax.Sex	In case of additional information for family members, sex information per additional member	Qualitative	Listing	Male / Female
R.Own	Ownership of different vehicle types by respondent	Quantitative	Number	Per vehicle type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
R.Car.Fuel	In case of car ownership, fuel type information	Quantitative	Number	Per fuel type: diesel, gasoline, electric, phev, hev, range extender, LPG, CNG, Ethanol, other
R.Edu	Level of education	Qualitative	Listing	Vocational training / Elementary school / Secondary school / Bachelor / Master / PhD / Other
R.Empl	Current employment	Qualitative	Listing	Yes/no
R.Inc	Income	Quantitative	Number	Monthly household net income
R.Hloc	Home location	Quantitative	Number	Communicty Identification Number
R.Wloc	Work location	Quantitative	Number	Communicty Identification Number

Table 4-2: Parameter listing for harmonised NTS – General mobility information

General mobility information				
Parameter name	**Description**	**Format: quantitative / qualitative**	**Unit**	**Recommended grouping categories**
Vkm	Vehicle kilometres	Quantitative	Vkm	No grouping
Vkm.Mode	Vehicle kilometres per transport mode	Quantitative		Per mode: air, road, rail, water
Vkm.Veh	Vehicle kilometres per vehicle type	Quantitative		Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Vkm.Fuel	Vehicle kilometres per engine type / fuel type	Quantitative		Per fuel type: diesel, gasoline, EV, PHEV, HEV, range extender, LPG, CNG, Ethanol, other
Vkm.Reg	Vehicle kilometres per region type	Quantitative		Per region: urban, suburban, rural
Vkm.Purp	Vehicle kilometres per purpose	Quantitative		Per purpose: home, work, business, education, shopping, leisure, other
Pkm	Person kilometres	Quantitative	Pkm	No grouping
Pkm.Mode	Person kilometres per transport mode	Quantitative		Per mode: air, road, rail, water
Pkm.Veh	Person kilometres per vehicle type	Quantitative		Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Pkm.Fuel	Person kilometres per engine type / fuel type	Quantitative		Per fuel type: diesel, gasoline, electric, EV, PHEV, HEV, range extender, LPG, CNG, Ethanol, other
Pkm.Reg	Person kilometres per region type	Quantitative		Per region: urban, suburban, rural
Pkm.Purp	Person kilometres per purpose	Quantitative		Per purpose: home, work, business, education, shopping, leisure, other
Trip	Number of trips per day	Quantitative	Number of trips	No grouping
Trip.Mode	Number of trips per mode	Quantitative		Per mode: air, road, rail, water
Trip.Veh	Number of trips per vehicle type	Quantitative		Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Trip.Reg	Number of trips per region type	Quantitative		Per region: urban, suburban, rural
Trip.Purp	Number of trips per trip purpose	Quantitative		Per purpose: home, work, business, education, shopping, leisure, other
Trip.Chain	Number of trips per chain	Quantitative	Trips / Chain	No grouping
Trip.Length	Trip length	Quantitative	Pkm	No grouping
Trip.Length.	Trip length information per vehicle type	Quantitative	Pkm/trip	Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Chain.Lengt	Chain length information	Quantitative	Pkm/Chain	No grouping

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[8] Data on vehicle kilometres or person kilometres travelled is preferentially on a as small as possible unit of time. In the case of automated data collection, this can happen on a trip basis. In the case of traditional NTS, it can be considered on a daily or weekly basis. Raw data should allow for a distinction between weekdays and weekends.

Table 4-3: Parameter listing for harmonised NTS – Transport quality and multi-modal transport

Transport quality and multi-modal transport				
Parameter name	**Description**	**Format: quantitative / qualitative**	**Unit**	**Recommended grouping categories**
Trip.Dur	Duration of trips	Quantitative	Minutes	No grouping
Cong.Time	Lost time per trip (due to congestion or connection)	Quantitative	Minutes	Per time group: 0-5 minutes; 5-10 minutes; 10-15 minutes; etc. until 60 minutes
TMS.Use	Use of Travel Management Systems	Qualitative	Listing	Yes / No
TMS.UseP	Use of Travel Management Systems on what percentage of trips	Quantitative	Percentage of trips	No grouping
MM.Inf	Availability of transport information for multi-modal assistance for the trip	Qualitative	Listing	Yes / No
MM.Pay	Availability of an integrated ticketing system for the trip	Qualitative	Listing	Yes / No
MM.trip	multi-modal transport was used	Quantitative	Number of trips	No grouping
MM.chain	Number of chains where multi-modal transport was used	Quantitative	Number of chains	No grouping
MM.PT	Accessibility of Public Transport	Qualitative	Listing	Yes / No

Table 4-4: : Parameter listing for harmonised NTS – Accidents and injuries

Safety (accidents and injuries)				
Parameter name	**Description**	**Format: quantitative / qualitative**	**Unit**	**Recommended grouping categories**
Acc.Tot	Total number of accidents	Quantitative	Number of accidents	No grouping
Acc.Mode	Number of accidents per vehicle type	Quantitative		Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Acc.Reg	Number of accidents per region	Quantitative		per region: urban, suburban, rural
Inj.Tot	Total number of injuries	Quantitative	Number of injuries	No grouping
Inj.Mode	Number of injuries per vehicle type	Quantitative		Per mobility type: pedestrian, bicycle, motorised two-wheeler or similar, motorcycle, car, bus/coach, taxi, tram, metro, train, high-speed train, aircraft, boat/ferry
Inj.Reg	Number of injuries per region	Quantitative		per region: urban, suburban, rural

Table 4-5: Parameter listing for harmonised NTS – Car occupancy rates

Vehicle usage				
Parameter name	**Description**	**Format: quantitative / qualitative**	**Unit**	**Recommended grouping categories**
Veh.Occ	Car occupancy rates (per trip)	Quantitative	Number of car occupants	No grouping

4.2. Sampling

In this section, a proposal is made on two elements related to sampling: surveying frequency and sample composition. Both are relevant in order to obtain a certain level of comparability between NTS. Often, data from successive NTS within one country are compared in order to analyse changes over time. As long as there is a simple quantitative comparison, a large time gap between NTS does not have to pose problems. However, when causal relations are introduced, this does become a problem. A multitude of factors influence mobility behaviour and change can happen rapidly. A frequency for repeating surveys is proposed in the following paragraphs.

At the same time, comparisons between countries are also often made. In these cases the following elements are of importance: parameter definitions (does a figure in country A mean the same in country B? A solution is presented in Section 4.1.) and sample composition (is data collected from similar types of people? A sample selection is proposed in the section below). Both of these factors are required in order to consider the data collected from different NTS to be comparable.

A guideline is presented based on the information collected in the survey collected for Task 2.1 of the current project and literature on applied sampling.

Sampling frequency

Identifying a good frequency for repeating NTS depends on a number of elements related to practical feasibility on one hand and minimum requirements to guarantee data continuity and comparability over and across samples on the other hand.

Within the context of policy support, a clear separation between an original situation and a situation after the implementation of a policy or technology is achieved resulting in clear "before implementation" and "after implementation" comparison. However, in practice such a situation is only seldom achieved.

Projects leading to policy introductions in real life seldom include clear pre- and post-measurements of the mobility status. Furthermore, even if such a measurement is included, the influence of other factors that also influence mobility behaviour are only seldom measured and excluded from such an impact analysis. It could be argued that such a situation can be avoided by collecting data on a continuous basis. However, this often is impossible due to limited funding, limited project time or other reasons.

In practice, and recognisable from the different NTS for which information was collected in the Member States, a repeat frequency of 1 year is suggested. This means that data is collected regularly on a yearly basis. Within the context of mobility policies, and the associated comparison of policy introduction effects, it is not recommended a time period of more than 5 years for comparison of data.

Sample composition

The second issue influencing the comparability of NTS is that the samples are composed in such a way that they are representative for the population they are meant to reflect upon. For example: it makes little sense to compare the mobility patterns of two countries when no information is available on the type

of population they represent (population composition, demographic information, economic situation, etc.). At the same time, an indication of the representativeness of each sample for the populations they represent needs to be foreseen.

As a starting point, it is suggested that population registries are used to compose population samples. They are, as such, less influenced by social differences that are introduced as a result of technology based sample bases (for example the use of telephone directories or email listings as sample base). Within the DATELINE project, other possible strategies are provided in case of unavailability of such registries[9].

Often related to sample composition are issues in relation to sample size. For this, we refer to the working paper of Freedman and the usage of Cochran's formula. In essence, it is impossible to set a specific percentage (of persons included in the sample, compared to the population size) that is representative for every population. Furthermore, response rates can be very different for different countries. This makes the net sample (the number of usable/valid returns at a unit level) important. Choosing a correct net sample depends on the following elements:

- Desired precision of results (error of margin): the difference between the real and the sampled population.
- Confidence level: the amount of risk that you are willing to take that the sample taken contains the populations' true values within the precision of results defined. A higher confidence interval requires a larger sample size.
- Degree of variability: the distribution of attributes or concepts that are measured in the questions in the total population. A homogenous population is easier to measure than a heterogeneous population. The degree of variability is often estimated based on prior information or expert information.
- Response rate: the amount of valid responses compared to the number of respondents that are tested, if possible over NUTS regions.

An example:

- A 5% error of margin means that the true value of a population is within 5% of the value that is found in the sample. If the value of a survey indicates that 20% of the people in the survey sample use public

[9] Socialdata (2000). DATELINE Deliverable 3: Sampling Methodology. FP5 DG TREN project DATELINE: Design and application of a travel survey for European long-distance trips based on an international network of expertise.

transport, and the error of margin is 5%, this means that the real population value lies between 15 and 25%.
- A confidence level of 95%, given a 5% error or margin then means the following: if 100 samples were taken, 95 of these samples would have effectively had the real population value within the error of margin presented.
- A population with a 50%-50% division on an attribute is considered very heterogeneous. A population with an 80%-20% division homogenous.

In the case of NTS, it is suggested to aim at an error of margin that is not bigger than 5% and a confidence level of 95% or better.

4.3. The value of national travel surveys, including future developments

Although different technologies are becoming more available, they also come with specific problems. The use of GPS information, smartphones or other technologies is considered to be potentially valuable for specific types of information (route information, time information, modal choice, etc.). They can enhance data reliability; reduce data collection time, etc. However, some issues do exist with the use of these technologies: social and demographic biases, privacy issues but also the sheer quantity of data that can cause problems for analysts.

In the face of this, it can be considered that NTS remain valuable instruments that allow analysts to obtain more depth of analysis into the transport data. As well-known and accepted data sources, they allow for a degree of continuity in data collection, and as a result comparability over years of information. In particular cases they can even assist analysts in identifying underlying reasons for variations and changes in acquired data.

At the same time, the information carrier that is used to perform a NTS can change over time, without the content of the NTS in itself changing. The use of internet, smart phones, etc. can allow for a swifter completion of the questionnaires and a more regular flow of data from respondents to analysts. In some cases they can assist the respondent in keeping daily trip diaries (i.e. pre-filled trip information offered for verification during the final interview). However, exactly this change could also lead to the exclusion of potentially interesting groups of respondents such as the poor, the elderly, or persons with disabilities. At the same time, it is not clear at the moment whether or not the introduction of new technologies is also more or less cost-efficient than current methodologies.

Because of this, it is currently recommended to not abandon the use of traditional instruments (pen and paper, telephone interview, etc.) for the collection of data through NTS. What can be considered is the parallel usage of traditional and new technologies (smartphone, etc.) for a certain time. This would allow for mutual data validation (checking for consistency), a swifter data flow, increased data usage and, equally important, the building of a working experience with such a new information carrier for NTS.

5. Conclusion

Although different methodologies can be used to collect data on mobility patterns, travel demand, etc., NTS remain an important data collection methodology that can be used in parallel to modern data collection methodologies (GPS, smartphone information, etc.). This is in particular the case when data comparability and continuity within the context of policy support are considered.

Although significant differences exist between countries for which NTS data was collected, some groupings could be found. More importantly, a set of parameters is identified for which information needs to be collected in order to properly analyse the most important European transport policies that are linked to passenger transport.

Based on this group of parameters, a set of 48 parameters for which data could be collected through NTS is selected. This group can be considered as a starting point of the harmonisation of data collection, a key element towards ultimate data comparability and the selection of appropriate measures for a sustainable passenger transport system.

Because of on-going evolutions in the domains of data collection, position tracking, etc. some considerations need to be made. The availability and usability of other techniques than NTS to collect mobility data is increasing. The combination of traditional NTS methods and modern data collection techniques can lead to an improved data collection, allowing for a higher quality of data analysis. Similarly, the availability of validated databases allows for the mutual enrichment of mobility data. This is in particular the case when the element of sustainability is introduced in an analysis: emission data, safety related information, network information, etc. are typically not collected through NTS but are available in validated databases.

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