Re-use of mobility survey microdata to produce the harmonized set of short distance Passenger Mobility indicators as defined in the Eurostat Guidelines

Methodological report and results

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Abstract

Italy has a long tradition in passenger mobility statistics at national level. Official sources are, for example, socio-demographic statistics such as population census and the Multiscope/Aspects of daily life, both managed by the Italian NSI Istat and focused on mobility only for work/education purposes, or the survey Audimob (focused on mobility for all purposes) that has been included in the national official statistical production since 2020 and is conducted by Isfort, a private research institute in the field of transport and mobility. Althought the general structure of Audimob survey is very similar to that conveyed by the passenger mobility statistics task force and disposed in the guidelines, not all the methodological issues complied with it. Moreover, the set of indicators currently supplied by Isfort and based on Audimob microdata, differs from the Guidelines set, being designed to satisfy data needs at national level. Anyway, as the interest on PM indicators at international level is increasing more and more over time, considering the general budget restrictions to launch new surveys and the opportunity to optimize the existing statistical production, therefore a post harmonization exercise was conducted, to re-use Audimob microdata by applying the definitions, coding, classifications of the guidelines to a maximum extent, in order to produce the harmonized set of PM indicators. The project focused on 2019 and 2020 reference years and it was pursued by joint activities: in particular, Istat researchers provided methodological support and analysis of results, while Isfort implemented and managed all the operative actions and elaborations on microdata. The methodological issues of the project, the main results and the lesson learnt, are presented in this report. At the same time, Audimob survey methodology has been adapted at its best to the harmonized issues contained in the guidelines, starting from 2021 reference year. This means that more exercises may be feasible in the forthcoming years, to produce a harmonized set of indicators of improved quality.

Contents

1. Audimob survey methodology

In this section the main methodological aspects of the Audimob survey, up to 2020 reference year, are reported. For more details and the survey results at national level, the link to Isfort website dedicated section (only Italian) is provided in the references.

1.1. Reference population

Audimob survey reference population, up to reference year 2020, are the Italian residents of age 14-80. Starting 2021 the reference population has been enlarged to residents of age 14-84 to comply with the Guidelines.

1.2. Collection methods

The collection method is a CATI/CAWI mix-mode, where about 70% interviews are made by telephone and about 30% are made by the web.

1.3. Sample design

The survey is based on a yearly sample of about 16.000 individuals, stratified by: age, gender, territory of residence (NUTS2 level). The response rate is 100%, as refusals are replaced in order to complete response in all sample strata.

The land-line telephone register is used as a proxy of the reference population to contact the sampled units of the CATI subset. Telephone numbers are selected at random to contact the individuals. Refusals are replaced in order to complete all the sample strata. For the CAWI interviews individuals are selected from a marketing panel. CAWI and CATI are used in a concurrent approach in order to cover all the interviews needed to complete the sample.

The sample structure is displayed in the following table (percentage of sample units per stratum).

	Males					Females				
NUTS2	14 - 29 years	30 - 45 years	46 - 64 years	65 - 80 years	Total	14 - 29 years	30 - 45 years	46 - 64 years	65 - 80 years	Total
ITC1	9,0	12,6	16,3	9,7	47,6	8,9	12,5	17,4	13,6	52,4
ITC2	9,8	9,8	15,1	10,8	45,4	9,1	10,6	18,5	16,4	54,6
ITC4	9,7	13,8	16,1	9,1	48,7	9,0	13,8	16,4	12,1	51,3
ITH1+ITH2	10,9	11,5	16,1	10,1	48,5	10,5	13,1	16,1	11,9	51,5
ITH3	9,7	12,9	16,4	9,5	48,5	9,7	13,1	17,0	11,7	51,5
ITH4	8,6	12,5	16,2	10,7	48,0	8,3	12,8	16,8	14,1	52,0
ITC3	8,0	11,3	16,3	11,5	47,2	7,8	11,5	18,1	15,4	52,8
ITH5	8,8	13,5	16,2	9,9	48,3	8,9	14,1	17,1	11,7	51,7
ITI1	8,7	13,0	15,9	10,1	47,7	8,5	13,4	17,2	13,1	52,3
ITI2	8,8	12,5	15,5	10,6	47,4	8,7	13,0	17,0	13,9	52,6
ITI3	9,0	12,7	15,9	10,3	47,8	8,7	13,3	17,6	12,7	52,2
ITI4	9,2	14,4	15,5	9,0	48,0	9,0	14,1	17,8	11,1	52,0
ITF1	9,8	12,8	15,7	9,6	47,9	9,9	12,8	17,5	11,9	52,1
ITF2	10,3	12,5	16,2	10,1	49,0	9,1	12,2	16,3	13,3	51,0
ITF3	12,2	13,7	15,0	7,7	48,7	11,8	13,7	16,2	9,5	51,3
ITF4	11,2	13,4	15,1	8,4	48,2	10,7	13,5	17,1	10,5	51,8
ITF5	10,9	12,7	15,9	9,5	48,9	10,3	12,7	17,1	11,1	51,1
ITF6	11,5	13,0	15,3	9,0	48,8	11,2	13,3	16,7	10,0	51,2
ITG1	11,8	13,0	15,2	8,1	48,1	11,1	13,9	16,9	10,0	51,9
ITG2	9,1	13,3	16,7	9,3	48,4	9,0	13,5	17,3	11,9	51,6

1.4. Reference period

The interviews are conducted during the whole calendar year. The observed period is the day of the week. All the days of the week are included in the observation period. Each individual is asked to describe all the trips made on the day previous to the interview (only one day per individual). The reference period for the output data is the calendar year.

1.5. Classifications used

In the Audimob survey, the purpose of the trip is coded according to the following ad-hoc classification:

Purpose
Work (usual job place)
Work (other sites)
Work at restaurant/cafe
Study (usual place)
Study (place different from usual)
Shopping (household items)
Shopping
Escorting to school or other places (no medical care)
Visit to friends or relatives
Sport and physical activities
Cultural activities (museums, exibitions, volunteering, etc.)
Take a walk
Going to a hotel
Sleeping at friends'
Other
Tourism/vacation
Going to restaurant/cafe to eat
Going to Bank/Postal office/Insurance office/municipality/counter services
Personal care (hairdresser, beautician, etc)
Medical care (personal or escorting)

The mode of transport is coded as follows:

Mode of transport
Car as driver (alone)
Car as driver (+ 1 passenger)
Car as driver (+ 2 passengers)
Car as driver (+ over 2 passengers)
Leased car
Car sharing
Car as passenger
Car pooling
Taxi
Agriculture vehicle
Motorcycle/moped
Motorcycle sharing
City bus
Bus/coach
Company bus/coach
Tram
Metro
High speed train
High speed train (Freccia Rossa)
High speed train (Freccia Argento)
High speed train (Freccia Bianca)

Intercity Train
Night train/express (national)
International train/night train
Regional train
Other high speed train
Other companies train
Aviation
Ship/Ferry
Walking
Cycling/roller skates/scooter/other not mothorized mean
Other
Other public mean
Other private mean

Since 2021:

- the modes 'car as driver – alone', 'car as driver +1 passenger', 'car as driver + 2 passengers', 'car as driver + over 2 passengers', are replaced by 'car as driver', and the number of passengers is collected as separate for each stage.
- 'cycling' mode stands alone, and 'bike sharing' was added as separate. Moreover 'scooter/Segway/monowheel/hoverboard' is added, and the same 'in sharing' as separate.

1.6. The questionnaire

Audimob survey questionnaire (for both CATI and CAWI mode) has a three sections structure. In the first section general information is asked about the respondent, his/her means of transport (property), and his/her general mobility activities (in particular, if he/she has moved from home on the reference day or not, which classifies the respondent as belonging to population of trip-makers or not). The second section is a trip-stage-based diary, that provides the detailed description of all the trips (and their stages) made on the reference day by the respondent. Up to year 2020, for each stage, the means of transport and the duration of each stage were collected, while the distance travelled was collected only for the trip as a whole (i.e. not for all stages). Since year 2021 the distance travelled in each stage is declared, too. The places of departure/arrival are coded at municipality level, but supplementary information about the type of zone (city center/suburbs/etc.) is supplied by the respondents. For trips made by 'car as driver', information about the passengers carried is collected, in a simplified way (see coding, section 1.5). Since 2021 the modes 'car as driver +1 passenger', 'car as driver + 2 passengers' etc. are replaced by 'car as driver', and the number of passengers carried is collected as separate. The last section of the questionnaire includes supplementary information about the individual (socio-economic condition) and questions about public transport service user's satisfaction.

1.7. Trips structure

The respondents are invited to describe the trips with a home-based approach. This means that currently, in Audimob survey the trips from the last purpose destination to home are coded as 'back-home trips'. For each trip, all the stages are observed. The trip mode of transport is determined by the prevalent mode referred to the stages. Up to 2020 only the duration of the stage was collected directly by the respondent, so the prevalent mode was stated by estimating the distances according to the transport mode of the stage. A ranking of the transport modes was determined for this scope (in particular if two or more stages have the same duration): aviation, rail, car as driver, car as passenger, taxi, motorcycle, metro/tram, bus/coach,

waterways, tractor (agriculture), other means, cycling, walking. Since 2021 the distance travelled is collected for each stage.

1.8. Other issues

Up to 2020, information about car (as driver) type of fuel was not collected. Since 2021 the new variable was added to the questionnaire for 'car as driver' trips, and since 2022 it was recorded for 'car as passenger' mode as well, according to the following classification:

Type of fuel
Petrol
Diesel
Hybrid petrol-electric
Hybrid diesel-electric
Pure electric
LPG
CNG
Hydrogen
Other (includes bi-fuel petrol/LPG, bi-fuel petrol/CNG, flex-fuel, other fuels than previously listed)/unknown

2. Post-harmonization actions on microdata 2019-2020 and methodological harmonization for survey year 2021 onwards.

The Istat-Isfort partnership project was aimed to produce – for reference years 2019 and 2020 - the harmonized set of Passenger mobility indicators as displayed in the Eurostat Guidelines, by reusing Audimob microdata. A series of actions have been implemented to align the structure and coding of survey raw data to the methodological issues of the guidelines. As data were originally collected for different purpose and the survey was tailored to satisfy a representation of short distance passenger mobility at national level, only a subset of the harmonized collection was feasible to be calculated. In particular, two groups of dominions had to be excluded because of unavailability of data: car occupancy for taxis; indicators by type of fuel. Even if the latter is of particular interest for the evaluation of the impact of mobility on the environment and for sustainability politics assessment, nevertheless the majority of the indicators of the set could be calculated, and the picture of the phenomenon was almost complete. In the following sections, the actions made are described in details.

2.1. Age cut-off

As Audimob reference population is that of 14-80 years old residents, mobility of age class 81-84 population was out of scope, so no observations were available in the sample for this group. Moreover, mobility of 14 years old population was observed, but this group is out of scope in the guidelines harmonized methodology. Therefore, a cut off was applied to data belonging to age class 14, to align at a greater extent the population as defined in the guidelines: the re-use of data regarded trips made by individuals of 15-80 in the sample. No big difference in behaviour is supposed to exist between elderly people in the group of about 80 years old and 81-84 aged population, therefore only little or no bias is supposed to affect data.

2.2. Recoding of trip purpose (also back-home trips)

As reported in section 1.7, Audimob trips are home-based and a specific code is used for back-home trips. In the guidelines instead, the rule is to code back-home trips with the purpose of the last trip in chronological order. Therefore, all back-home trips had to be recoded under this rule before being processed to produce the indicators. For circular home-home trips, with no break for other purpose, the 'leisure' code was chosen, to comply to the Guidelines. Recoding of purpose was applied as follows:

Purpose (Audimob)	**Purpose (Guidelines)**
Work (usual job place)	Work
Work (other sites)	Professional/Business
Work at restaurant/cafe (e.g. job lunch or dinner)	Professional/Business
Study (usual place)	Education
Study (place different from usual)	Education
Shopping (household items)	Shopping
Shopping	Shopping
Escorting to school or other places (no medical care)	Escorting
Visit to friends or relatives	Leisure
Sport and physical activities	Leisure
Cultural activities (museums, exibitions, volunteering, etc.)	Leisure
Take a walk	Leisure
Going to a hotel	Leisure
Sleeping at friends'	Leisure
Other	Other
Tourism/vacation	Leisure
Going to restaurant/cafe to eat	Leisure
Going to Bank/Postal office/Insurance office/municipality/counter services	Personal business
Personal care (hairdresser, beautician, etc)	Personal business
Medical care (personal or escorting)	Personal business

2.3. Recoding of transport mode

The majority of the codes used in Audimob to describe the mode of transport used in the trips, are easily convertible to the classification defined in the Guidelines. A slight difference may be found in the grouping of "Cycling/roller skates/scooter/other not mothorized mean", anyway in the reference years implied in the exercise (2019 and 2020), roller skates, scooter and other not mothorized mean could be considered as residuals modes, and not compromising the recoding to "Cycling". It should be noted that "Van/lorry/tractor" is a residual code as well, and that "Aviation" is not compatible with short distance mobility. The recoding follows the scheme below:

Mode of transport (Audimob)	**Mode of transport (Guidelines)**
Car as driver (alone)	Car as driver
Car as driver (+ 1 passenger)	Car as driver
Car as driver (+ 2 passengers)	Car as driver
Car as driver (+ over 2 passengers)	Car as driver
Leased car	Car as driver

Car sharing	Car as driver
Car as passenger	Car as passenger
Car pooling	Car as passenger
Taxi	Taxi (as passenger)
Agriculture vehicle	Van/lorry/tractor
Motorcycle/moped	Motorcycle/moped
Motorcycle sharing	Motorcycle/moped
City bus	Bus/coach
Bus/coach	Bus/coach
Company bus/coach	Bus/coach
Tram	Metro/Tram/light rail
Metro	Metro/Tram/light rail
High speed train	Train (split: High speed rail)
High speed train (Freccia Rossa)	Train (split: High speed rail)
High speed train (Freccia Argento)	Train (split: High speed rail)
High speed train (Freccia Bianca)	Train (split: High speed rail)
Intercity Train	Train (split: Regular/regional train)
Night train/express (national)	Train (split: Regular/regional train)
International train/night train	Train (split: Regular/regional train)
Regional train	Train (split: Regular/regional train)
Other high speed train	Train (split: High speed rail)
Other companies train	Train
Aviation	Aviation
Ship/Ferry	Waterways
Walking	Walking
Cycling/roller skates/scooter/other not mothorized mean	Cycling
Other	Other
Other public mean	Other
Other private mean	Other

2.4. Definition of urban mobility with reference to FUAs

To switch data to the dominions defined in the Guidelines, in particular as regards the territorial disaggregation referred to Total/Urban mobility, a selection of a subgroup of microdata and the recoding of the places of departure/arrival was necessary. In the Guidelines, the definition of short distance mobility is referred to the distance travelled. The threshold to define Short distance mobility is 300 km. In addition, Urban mobility is defined with reference to FUAs. Moreover, to simplify the calculation of the harmonized set of indicators when it's difficult to refer to FUAs, Urban mobility may be defined, in alternative, as the subgroup of trips equal or less than 100 Km. In the exercise, the definition of Short distance mobility is accepted as it is, so all trips over 300 Km are excluded (Aviation mode and some non-urban Train and Bus/Coach trips). As concerns Urban mobility, the definition as "mobility inside the FUA (if any) or the municipality" is used as guiding, since the identification of the geographical dimension is feasible and considered more precise than applying a common threshold of 100 Km (too large for medium and small municipalities, and not very meaningful even for larger cities, where most of the urban trips are under 10 Km). Thus, every trip has been recoded and classified as Urban/non-urban according to the scheme below:

Origin	Destination					
	MUNICIPALITY A1 in FUA A	**MUNICIPALITY A2 in FUA A**	**MUNICIPALITY B1 in FUA B**	**MUNICIPALITY B2 in FUA B**	**MUNICIPALITY C (no FUA)**	**MUNICIPALITY D (no FUA)**
MUNICIPALITY A1 in FUA A	URBAN	URBAN	NON-URBAN	NON-URBAN	NON-URBAN	NON-URBAN
MUNICIPALITY A2 in FUA A	URBAN	URBAN	NON-URBAN	NON-URBAN	NON-URBAN	NON-URBAN
MUNICIPALITY B1 in FUA B	NON-URBAN	NON-URBAN	URBAN	URBAN	NON-URBAN	NON-URBAN
MUNICIPALITY B2 in FUA B	NON-URBAN	NON-URBAN	URBAN	URBAN	NON-URBAN	NON-URBAN
MUNICIPALITY C (no FUA)	NON-URBAN	NON-URBAN	NON-URBAN	NON-URBAN	URBAN	NON-URBAN
MUNICIPALITY D (no FUA)	NON-URBAN	NON-URBAN	NON-URBAN	NON-URBAN	NON-URBAN	URBAN

3. Innovations and new indicators by type of fuel for reference year 2021

In section 2, the steps to harmonize the PM survey methodology to the Guidelines were presented. In particular, the definitions and the collected variables were aligned to the GL prescriptions. A remark is needed with reference to the variable 'fuel type' for the trips with 'private car' mode (driver or passenger). For year 2021 this information was collected only for 'car as driver' mode. The 'car as passenger' trip distance was then attributed to the different 'type of fuel' classification items using the distribution by fuel type of the 'car as driver' trips but only considering the trips with additional passengers. This solution was applied to reduce the possible bias due to differences in the behavior (the choice of a car with a different fuel type) between drivers that usually travel alone and drivers that usually drive with other passengers. Since 2022 the variable 'fuel type' was collected for all trips of 'private car' mode (driver or passenger).

4. Main results (Tables)

The results of the exercise are displayed in the linked tables. Percentage distributions on sample values and the harmonized set of indicators, including Passenger-km, have been calculated according to formulas and examples in the Guidelines. Reference year 2019 may be used as a benchmark to compare the results with the other Member States, while figures related to year 2020 show some differences in mobility behavior, and likely a turning point, due to the COVID19 pandemic. Year 2021 figures show a show a partial return to pre-pandemic mobility behaviors and patterns. In addition, indicators on distance travelled by fuel type are provided.

5. Conclusions and the way forward

The opportunity of reusing data to produce additional information on passenger mobility is undoubtedly very interesting from many points of view. First of all, the information gap is fulfilled without additional budget and avoiding survey duplications and increasing burden. This means that statistical production is optimized, in a 'sustainable statistics' perspective. Moreover, the partnership generates a synergy, by sharing the different levels of know-how of the researchers. Although the output of the project may be considered as experimental statistics, the survey used as source (Audimob) is part of the official statistical production of the Country. As reported starting from 2021 reference year, the survey methodology has been aligned to the indications of the Guidelines at a maximum extent, so it was possible to produce all the indicators using current survey microdata (an improvement for a more precise calculation of 'fuel type' indicators was implemented from 2022). Anyway, more effort is requested to enhance the quality of the results, and in particular the sample design should be revised and its dimension increased. As highlighted in the linked tables, some figures have been calculated on a limited number of trip-records (less than 10 and between 10 and 100). A more detailed analysis of the quality of the output data is foreseen in the next future.

As concerns Passenger-km estimates, figures have been calculated according to the Guidelines formulas, therefore by multiplying the means per the number of days in the year per the reference population level (age 15-84) in each breakdown dominion. The general formula may be revised to take in consideration a more precise calculation strategy (e.g. figures related to 'car as driver' should be calculated with reference to the over 18 population, allowed to have a guide license, and so on).

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