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5 **BOOSTING RESPONSE RATES:**
6 **EVIDENCE FROM THE FLEMISH TRAVEL BEHAVIOR SURVEY (OVG)**
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1 ABSTRACT

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3 This paper investigates the transition of the Flemish travel survey (OVG) from a household-
4 based travel survey to a person-based travel survey. The paper examines the design features of
5 the different OVGs, with particular attention to the resulting response rates. In addition to the
6 sample unit, the contact and survey procedure has switched from telephone/postal to face-to-
7 face. The most striking effect of the changed methodology is the spectacular increase in the
8 response rates: overall response rates of the most recent OVGs were more than double that of the
9 previous OVGs, resulting in overall response rates of 75%. In addition, the likelihood that some
10 questionnaires were missing (e.g. diaries were retrieved, but household questionnaires were not)
11 decreased from 7% to 3%. Furthermore, the paper shows that a person-based travel survey still
12 can be used for travel demand modeling frameworks that incorporate (some) household
13 interactions. Notwithstanding, some issues have been raised, such as the decreased comparability
14 of travel figures due to the changes in the survey design. In conclusion, the inclusion of a “with
15 whom” dimension in the trip diary is recommended, and it is advocated that policy makers
16 should clearly outline the primary objectives for the OVG for the coming years.

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1. INTRODUCTION

In the past decades, the percentage of potential respondents participating in surveys has decreased considerably (1-6). The scientific community attributes this trend to a variety of factors (7-9). First, the mounting number of both commercial and non-commercial survey efforts has caused a general feeling of antipathy towards surveys. If previous survey experiences were unpleasant for the respondent, the likelihood that the respondent will participate in other surveys, regardless of the subject matter or the survey sponsor, is negatively affected. Second, potential respondents are also overwhelmed by the results of media polls. Some of these results are contrary to the preconceived notions of potential respondents or turn out to be invalid. Consequently, many respondents conclude that these inconsistencies are the fault of the survey, undermining the respondents' social motivation to participate in surveys. A third reason is the fact that marketers use survey techniques to sell products and services. Sales efforts are disguised as surveys, and as a consequence, surveys are often considered as "junk mail".

In addition to the declining participation rates, it is also important to note that household travel surveys are usually complex surveys (10-11). Deliberate choices need to be made concerning the unit of analysis: households versus individuals, and trips versus activities. In general, it is assumed that, when households are selected as the decision-making unit, it is necessary to collect survey data about entire households. On the other hand, analyses that are based on individuals' travel behavior require data collection on only a representative sample of persons, so data about only one household member are needed. The distinction between these two types of analyses is of critical importance in survey design. Household travel surveys used to obtain information on entire households are usually longer, more complicated, and more burdensome for respondents than surveys that obtain similar information for only a single household member (12). Additional issues that need to be addressed in household travel surveys when compared to person-based travel surveys include: (i) procedures for identifying individuals within the household, (ii) procedures for communicating with each household member, and (iii) the potential need for proxies. The key issue for person-based surveys is selecting the proper household member of the survey.

Having shaped the complex nature of travel surveys, this paper investigates the transition of the Flemish national – Flanders is the northern and Dutch speaking region of Belgium representing about 60% of the total population – travel survey (OVG: acronym for "Onderzoek VerplaatsingsGedrag", which could be translated as "Travel Behavior Survey") from a household-based travel survey towards a person-based travel survey. The paper examines the design features of the different OVGs, with particular attention to the resulting response rates. Moreover, the applicability of the person-based travel surveys for travel demand modeling purposes is discussed in detail. Finally, some recommendations for future data collection efforts are provided.

2. FIFTEEN YEARS OF FLEMISH TRAVEL SURVEYS

2.1 History

The foundation of the Flemish travel behavior survey lies in the feasibility study by Hajnal and Miermans (13), and in the Dutch national travel survey (14), on which the first version (OVG 1) was primarily based on. The main motivation for carrying out a national travel survey was the

1 premise that “knowledge is power”; collecting travel information was perceived as crucial for
 2 pursuing a goal-oriented and scientifically supported policy. The areas of application for the
 3 travel information include: (i) input for policy plans (e.g. mobility plan Flanders), (ii) input for
 4 simulation studies (e.g. network infrastructure design), (iii) goal-oriented research (e.g. urban
 5 dwelling versus car use), and (iv) derived application areas such as environment policy (e.g.
 6 exposure to pollutants), safety science (e.g. traffic safety), etc., which are in line with the
 7 commonly defined goals cited in literature (see e.g. 15-17)

8 Table 1 provides an overview of the different travel surveys that have been carried out in
 9 the past, are currently being, or will be carried out in the near future. The main travel surveys,
 10 which are indicated by a number, collect(ed) travel information from respondents residing in
 11 Flanders. In addition to these Flemish travel behavior surveys (OVGs), several OVGs were
 12 carried out that queried information from respondents residing in specific large urban areas.
 13 Although a large similarity between these urban travel surveys and the Flemish travel surveys
 14 can be found, this paper will focus on the evolution of the different Flemish travel surveys.

15 From Table 1, one could note that a shift was made from cross-sectional point data
 16 collections to a cross-sectional continuous survey: from OVG3 on, the survey is carried out on a
 17 yearly basis, whereas a 6 to 7-year gap between the previous surveys existed. Battellino and
 18 Peachman (18) comment that the main advantage of a continuous survey is the provision of data
 19 on trends in travel behavior patterns that reflect a changing socio-economic environment (e.g.
 20 different phases of the economic cycle) and meet the requirements for monitoring travel demand
 21 policies that face increasingly complex travel patterns. In particular, analysis of this data could
 22 lead to an increased understanding of the environmental and transport-related issues of today’s
 23 society, as well as the sensitivity to economic effects such as fuel price volatility (19).

24 Besides the transition to a continuous survey, different survey design features have been
 25 altered to combat non-response. Given the fact that many of the best-practice principles
 26 discussed in literature (see e.g. 20-23) were incorporated into the survey, a more radical change
 27 was needed to combat non-response. This is especially the case when non-respondents behave
 28 differently (with respect to travel) from respondents (24-26).

30 **TABLE 1 History of Flemish Travel Surveys**

Year(s)	Flemish Reference Name	Study Area
1994-1995	OVG (Vlaanderen) 1	Flemish Region (Flanders)
1997	OVG Kust	Flemish seaboard
1999	OVG Antwerpen	City area of Antwerp
1999	OVG Hasselt-Genk	City area of Hasselt-Genk
2000	OVG (Vlaanderen) 2	Flemish Region (Flanders)
2000	OVG Gent	City area of Ghent
2001	OVG Vlaams Brabant	City area of Louvain, Mechelen and Aalst
2007-2008	OVG (Vlaanderen) 3	Flemish Region (Flanders)
2008-2013	OVG (Vlaanderen) 4	Flemish Region (Flanders)
2008-2009	OVG (Vlaanderen) 4.1	Flemish Region (Flanders)
2009-2010	OVG (Vlaanderen) 4.2	Flemish Region (Flanders)
2010-2011	OVG (Vlaanderen) 4.3	Flemish Region (Flanders)
2011-2012*	OVG (Vlaanderen) 4.4	Flemish Region (Flanders)
2011-2013*	OVG (Vlaanderen) 4.5	Flemish Region (Flanders)

31 * Surveys are (going to be/being) carried out at the moment or in the near future.

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2.2 Design Features

During the past 15 years, the Flemish travel behavior survey has undergone several changes in survey design. In this paper, the design features of the OVG 2 (27), OVG 3 (28) and OVG 4.1 (29) are discussed in detail. Abstraction of OVG 1 (30) and OVG 4.2 (31) is made, as these surveys show a very high similarity to OVG 2 and OVG 4.1, respectively. The most important survey design features, which are commonly used in travel survey comparisons (see e.g. 10, 15, 32) are displayed in Table 2, and an elaboration on the contact procedure is provided in Figure 1. Note that Figure 1 also displays the contact procedure of the New Kontiv Design (NKD), which is often regarded as the best practice for achieving a reliable survey which has a high response rate..

Before elaborating on the distinction between the different OVGs, it is important to stress that all considered OVGs have the Flemish residents aged 6 and older as their study population, and all samples are drawn from the national register (a governmental list of all persons that are officially residing in Belgium). Moreover, the surveys make use of a household questionnaire, at least one personal questionnaire, and at least one trip diary. Although subtle differences can be found in the questions' verbal formulation, the vast majority of the questions are defined in exactly the same way. The choice for a trip-based survey rather than an activity-based or time-use based survey is grounded on the fact that trip-based surveys are usually more efficient in terms of survey time and respondent burden (9). Notwithstanding, activity-based and time-use based surveys reduce the risk of trip underreporting. Consequently, it was decided that the problem of non-response outweighed the underreporting issues. Finally, it is important to note that none of the discussed travel surveys provided incentives to participate in the survey. Although incentives could increase the response rates (33-34), the risk of biasing the survey outcomes, such as trip generation estimates, outweighed the potential improvement in response (9).

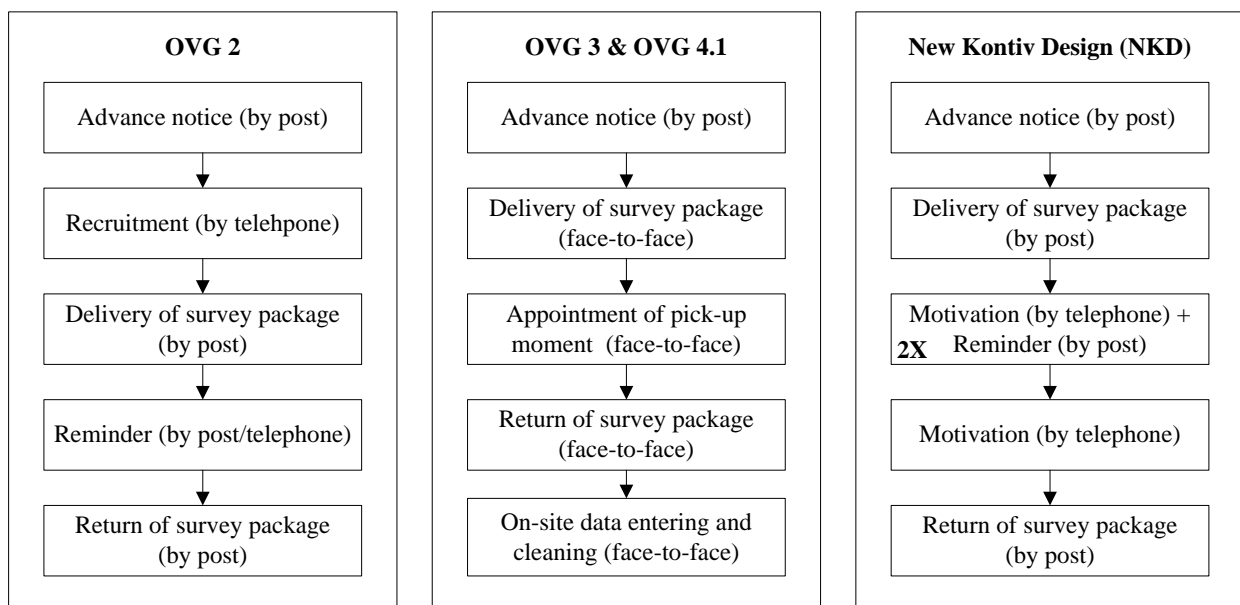
TABLE 2 Survey Design Characteristics

Design Feature	OVG 2	OVG 3	OVG 4.1
Study population	Flemish residents (age 6+)		
Sample frame	National Register		
Sample unit	Households (HH)	Persons (PP)	Persons (PP)
Sample size (target)	2500 (HH)	8800 (PP)	1600 (PP)
Sample size (obtained)	3027 (HH)	8932 (PP)	1742 (PP)
Sample frequency (annually)	1	4	4
Sampling technique	Random	Clustered	Clustered
Stratification	Age householder	Age and gender PP	Age and gender PP
Contact procedure	By telephone and post / by post	Face-to-face	Face-to-face
Survey procedure	By telephone and post / by post	Face-to-face	Face-to-face
Data collection period	Continuous 12month data collection period		
Days surveyed per respondent	2 days	1 day	1 day
Incentives	No incentives		
Form of instrument	Trip diary		

With respect to the discrepancies between the OVGs, the first important distinction is the sample unit. OVG 2 collected information regarding all household members aged 6 or older from 2500 households. In contrast, OVG 3 and OVG 4.1 collected information about 8800 and

1 1600 persons, respectively, rather than information about households. This distinction is of
 2 crucial importance in survey design. Household-based surveys are generally longer, more
 3 complicated and more burdensome for respondents than surveys that only query information
 4 from only a single household member (9). Besides, one could note that the sample size of OVG
 5 4.1 is considerably smaller than that of OVG 3. This is due to the fact that, since OVG 4.1, the
 6 survey transitioned from a discontinuous to a continuous survey.

7 A second important difference concerns the contact and survey procedure, which are
 8 elucidated in Figure 1. While in OVG 2, households were contacted either by telephone (+/-
 9 90% of the households) or by post (+/- 10% of the households), the respondents in OVG 3 and
 10 OVG 4.1 were contacted and surveyed face-to-face. The choice to switch from telephone/postal
 11 to face-to-face was based on three aspects: (i) the overall declining response rates outlined in the
 12 introduction, (ii) the decrease in the number of people with a landline telephone, (iii) the
 13 observation that face-to-face surveys generally have a higher response, and (iv) the fact that
 14 face-to-face interviewing allows for the direct verification and cleaning of data, such as the
 15 cleaning of non-reported trips back home.



17 **FIGURE 1 Contact and survey procedure of the OVGs in comparison to the NKD.**

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 19
 20 Thirdly, concerning the sampling procedure, it is important to note that, in contrast to OVG 2,
 21 which used a complete random sample of 2500 households, the persons in OVG 3 and OVG 4.1
 22 were sampled in a geographically clustered way. The clusters consisted of 14-15 persons, and for
 23 each municipality, one or more clusters were drawn in proportion to the number of residents in
 24 that municipality. Besides, the sampling frequency increased from one to four; a different
 25 sample for each trimester (three months), reducing the likelihood that a person did not live at the
 26 available address (e.g. due to the fact that the respondent has moved to another location).

27 Remaining features that have changed over time are the stratification and weighting
 28 procedures, as well as the number of days (frequency) that the respondents should report their
 29 travel behavior. Concerning the stratification of the sample, in OVG 2 the age of the householder
 30 was selected as stratification variable, whereas in OVG 3 and OVG 4.1 the age and gender of the
 31 respondent were selected as stratification variables. In this regard, it must be stated that variables

1 such as income and vehicle ownership are not available from the national register and thus could
2 not be used as stratification variables.

3 With respect to the weighting procedures, more extreme weights were introduced since
4 OVG 3 to compensate for misrepresentation of socio-demographic classes. Nonetheless, to avoid
5 the risk that travel indices are too strongly influenced by a (small) number of selected
6 individuals, some minimum and maximum boundaries were defined as well. Finally, the
7 frequency has decreased from two to one. A side remark should be noted here: in the actual
8 analysis of OVG 2, the trips reported during the second day were discarded because of non-
9 ignorable fatigue (27).

11 3. IMPACTS OF THE CHANGED METHODOLOGY

12
13 The most important effect of the changed methodology is the spectacular increase in the
14 response rates. In OVG 2, the response rate for the households contacted by telephone, defined
15 as the fraction of the total survey sample which completed and returned the survey, amounted to
16 34% and the response rate for the households contacted by post equaled only 17%. However, in
17 OVG 3 and OVG 4.1, the overall response rates were more than double the response rate of
18 OVG 2, resulting in overall response rates of 75% for both OVG 3 and
19 OVG 4.1. In addition, the likelihood that some questionnaires were missing (e.g. diaries were
20 retrieved, but household questionnaires were not) decreased from 7% to 3%. The shrinkage of
21 non-response improved the reliability of the travel indices measured. Thus, it can be stated that
22 the more recent OVGs provide an improved measurement of reality. Moreover, the response
23 rates are even within the range of the rates reported when using the New Kontiv Design (see
24 Figure 1 for the survey procedure of this method) (35).

25 Since multiple design features changed simultaneously (see Figure 1 and Table 2), it is
26 difficult to unequivocally pinpoint that factor that contributed most to the sharp increase in
27 response rates. In the author's opinion, however, the reason is the combination of certain factors
28 that created a leverage effect. The first factor is the switch to face-to-face interviews. From
29 Table 3, one could notice that this shift increased the contact rate (i.e. an increase from 84% to
30 92%) and participation rates (i.e. an increase from 79% (66%/84%) to 85% (78%/92%)), and
31 especially boosted the completion rates; in OVG 2, only 51% (=34%/66%) of the participants
32 successfully completed the survey, whereas this share almost doubled to 96% (=75%/78%) for
33 OVG 3 and OVG 4.1. Note that the composition of the latter two surveys was combined as the
34 numbers only differed marginally. One of the reasons for the incredible increase in completion
35 rates is that persuasion techniques are easier to implement and more efficient in face-to-face
36 interviews. From the compliance techniques reported by Bednall et al. (36), *authority*,
37 *prosocialness* and *consistency* certainly have proven successful in the survey. *Authority*
38 compliance, which is the emphasis to the respondents that the study is financed by the
39 government, was confirmed by the face-to-face interview. Recall that the advance notice by post
40 was already signed by one of the members of the public administration. Thus, the face-to-face
41 interviewer strengthened this authority appeal. *Prosocialness* concerned the emphasis on the fact
42 that the participation would benefit the society (i.e. transport policy based on a more accurate
43 description of reality). Finally, *consistency*, an analogue to the salesperson's use of the foot-in-
44 the-door technique, was achieved by fixing a date for the completion interview a few days later.

45 Next to the transition from a telephone/postal survey to a face-to-face interview, the
46 switch from a household-based survey to a person-based survey is an essential contributing

1 factor. The ability to reach a single (pre-defined) household member is much easier than
 2 attempting to reach all the members in the household. This is especially true given the situation
 3 that the share of traditional ‘nuclear’ households is decreasing. Moreover, the switch allows the
 4 interviewer to focus on the motivation of a single predefined household member, whereas
 5 household surveys create difficulty in tailoring the motivational discussion to all household
 6 members simultaneously, especially when they might have conflicting interests and characters.

7
 8 **TABLE 3** Composition of the Response Rate (Percentage as Function of Total)

	OVG 2 (Telephone)	OVG 2 (Postal)	OVG 3 - OVG 4.1
Total	100%	100%	100%
Contact rate	84%	N/A	92%
Participation rate	66%	N/A	78%
Final response rate	34%	17%	75%

9
 10 Notwithstanding, switching the methodology also has some disadvantages. From a
 11 monitoring perspective, the most important disadvantage is the subsequent lack of comparability
 12 between two surveys. Ideally, exactly the same questionnaire and survey design are used,
 13 allowing the analysis of a continuous series of surveys. By changing the methodology, one no
 14 longer can validly identify changes in travel behavior since one cannot discriminate between the
 15 effects of the changed methodology and change in behavior. Therefore, a comparison based
 16 based on figures has to be executed with the utmost care because it is practically impossible to
 17 unequivocally determine which portion can be attributed to a change in methodology and which
 18 portion can be attributed to a real change. For this reason, comparisons can only be made if the
 19 following conditions are met: *(i)* the difference in figures is sufficiently high, *(ii)* the probability
 20 that the changed methodology has a significant effect on the figures is limited, and *(iii)* the
 21 observed difference corresponds to an actual social, international development or trend, as for
 22 example observed in the Dutch national travel survey.

23 From cost perspective, the transition towards the new methodology increased the costs
 24 significantly. From Table 4, one can see that inflation-corrected costs per household almost
 25 doubled when comparing the costs of OVG 4.1 and OVG 2. Nonetheless, these costs are still in
 26 line with the regularly reported costs in the US (37). The main reason for this increase in total
 27 costs is due to the considerably higher fieldwork costs that come with face-to-face interviews,
 28 when compared to telephone and postal interviews. The difference between the costs per
 29 household between OVG 3 and OVG 4.1 can be accounted by the set-up costs that are associated
 30 with each survey, which are relatively higher for small-case surveys in reference to surveys that
 31 employ large sample sizes. This underlines the fact that economies of scale also apply for travel
 32 survey research.

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1 **TABLE 4** Survey Costs (Expressed in Euro and American Dollars¹)

Survey	OVG 2		OVG 3		OVG 4.1	
<i>Nominal costs</i>						
Total	211,500 €	171,951 \$	1,021,400 €	830,407 \$	259,600 €	211,057 \$
- Sampling costs	7,500 €	6,098 \$	42,400 €	34,472 \$	12,000 €	9,756 \$
- Fieldwork	142,000 €	115,447 \$	921,000 €	748,780 \$	220,000 €	178,862 \$
- Supervision	26,000 €	21,138 \$	38,000 €	30,894 \$	7,600 €	6,179 \$
- Analysis	36,000 €	29,268 \$	20,000 €	16,260 \$	20,000 €	16,260 \$
Total cost per person ²	28 €	23 \$	114 €	93 \$	149 €	121 \$
Total cost per household ³	70 €	57 \$	114 €	93 \$	149 €	121 \$
<i>2012 Inflation-corrected costs</i>						
Total	275,835 €	224,256 \$	1,149,224 €	934,328 \$	286,867 €	233,225 \$
- Sampling costs	9,781 €	7,952 \$	47,706 €	38,786 \$	13,260 €	10,781 \$
- Fieldwork	185,194 €	150,564 \$	1,036,259 €	842,487 \$	243,107 €	197,648 \$
- Supervision	33,909 €	27,568 \$	42,756 €	34,761 \$	8,398 €	6,828 \$
- Analysis	46,951 €	38,171 \$	22,503 €	18,295 \$	22,101 €	17,968 \$
Total cost per person ²	36 €	29 \$	129 €	105 \$	165 €	134 \$
Total cost per household ³	91 €	74 \$	129 €	105 \$	165 €	134 \$

¹ Exchanged rate 1 € = 0.8130 \$, ² effective number of persons, ³ effective number of households.

2
3 To further elucidate the difficulty in addressing changes in travel indices, the following
4 real life examples will be addressed using data from OVG 2, OVG 3, and OVG 4.1: the
5 distribution of people according to car ownership and driving license ownership, and the
6 distribution of the average number of trips per person per day (ANTPD) according the main
7 transport mode and motive. Note that these distributions result from the weighted analysis using
8 the weights as reported in the official tabular reports (27-29).

9 Concerning the ratio of non-car owners displayed in Table 5, one can observe that this
10 portion is higher in OVG 3 and OVG 4.1. A first reason is the fact that certain subgroups in the
11 population are better represented in OVG 3 and OVG 4.1 because of the face-to-face survey
12 procedure. Secondly, the share in OVG 2 is most likely underestimated since the census, which
13 was carried out in the same year as OVG 2, reported a share amounting to 19.4%. Consequently,
14 one could infer that OVG 3 probably provides a more accurate depiction of reality. In addition, it
15 is important to stress that many travel indices depend directly or indirectly on car ownership
16 obfuscating comparisons between the different surveys. The decrease in carless households
17 reported by OVG 4.1 in reference to OVG 3 is in line with the number of registered vehicles (an
18 external data source).
19

20 **TABLE 5** Distribution of Car Ownership

Number of cars	OVG 2 (%)	OVG 3 (%)	OVG 4.1 (%)
0	14.27	18.21	17.00
1	58.66	53.64	53.01
2	24.23	24.75	26.68
3+	2.84	3.39	3.31

21
22 With regard to the comparison of driving license ownership shown in Table 6, one can
23 ascertain that the impact of face-to-face recruiting is most likely negligible. The differences
24 between driving license ownership, especially for women, are attributable to changes in society.
25 The increasing share of driving license ownership for women can be accounted for by the more
26 extensive participation of women in socio-economic activities. The differences are especially
27 striking in age categories 55-64 and 65+. Moreover, similar findings are reported in the
28 Netherlands.

1 **TABLE 6 Distribution of Driving License Ownership by Gender and Age**

Driving license ownership	OVG 2 (%)	OVG 3 (%)	OVG 4.1 (%)
<i>Men (all 18+)</i>	91.33	89.93	91.53
18-24	N/A	55.00	63.55
25-34	94.57	90.30	95.36
35-44	96.42	96.20	97.45
45-54	97.41	96.06	96.77
55-64	92.76	95.14	93.39
65+	89.47	89.21	90.01
<i>Women (all 18+)</i>	71.60	73.84	76.18
18-24	N/A	51.93	56.55
25-34	91.33	87.03	88.06
35-44	90.58	90.86	90.68
45-54	83.44	84.67	85.73
55-64	72.12	78.52	82.41
65+	36.81	50.02	54.51

2
3 With respect to the average number of trips per person per day (ANTPD) presented in
4 Table 7, one can notice a rather high variability in both the average number of trips and the share
5 of immobile respondents. Note that these trip rates are the average trip rates of all respondents,
6 including the immobile ones. Concerning trip motives, the share of work trips is particularly
7 different between OVG 2 and its successors. Regarding mode choice, the variability appears to
8 be smaller, although one could note a decrease in bicycle share. It is expected that the influence
9 of the changed methodology is rather limited here, as bicycle ownership is quite stable. A
10 comparison with the Netherlands is difficult because of the significantly different biking culture.

11

12 **TABLE 7 Comparison of Trip Rates and Trip Rate Distributions**

<i>Distribution</i>	<i>OVG2</i>	<i>OVG3</i>	<i>OVG4.1</i>
Immobiles	20.00%	17.83%	21.60%
ANTPD	2.76	3.14	2.84
<i>Motive</i>			
ANTPD Work	0.53	0.47	0.45
ANTPD Education	0.23	0.21	0.19
ANTPD Shopping	0.58	0.68	0.65
ANTPD Leisure	0.41	0.42	0.36
% Work	19.09%	14.88%	15.71%
% Education	8.30%	6.65%	6.77%
% Shopping	20.89%	21.60%	22.89%
% Leisure	14.91%	13.26%	12.72%
<i>Main travel mode</i>			
ANTPD Car driver	1.30	1.48	1.43
ANTPD Car passenger	0.52	0.56	0.49
ANTPD Cycling	0.43	0.44	0.38
ANTPD Walking	0.33	0.42	0.34
% Car driver	47.17%	47.00%	50.42%
% Car passenger	18.79%	17.82%	17.36%
% Cycling	15.61%	14.15%	13.51%
% Walking	11.84%	13.37%	11.81%

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1 **4. HOUSEHOLD INTERACTIONS**

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3 An important question that should be raised when shifting from a household-based travel survey
4 to a person-based travel survey is whether the applicability of the information from the person-
5 based survey for travel demand frameworks that incorporate (some) household interactions is
6 assured. After all, from the perspective of travel demand modeling, there is a concern that, by
7 surveying only one individual from a household, essential information is lost within the
8 household as a whole. For analyses that treat households as the main travel-decision-making
9 unit, it is necessary to survey the entire households. Take as an example trip-generation models.
10 Typically, these models are developed at the household level and thus require information of all
11 trips made by the different household members.

12 Within the context of activity-based travel demand models, it should be acknowledged
13 that information is indeed lost, but to date, only a small number of activity-based models have
14 attempted to include interaction between family members (38). None of them have attempted to
15 account for activity patterns based on interactions between households or individuals in
16 organizations (39). Notwithstanding, Srinivasan and Bhat (40) have demonstrated that a
17 significant number of trips are made with both household and non-household (friends, co-
18 workers) members. Consequently, current research efforts focus on the inclusion of wider
19 interactions such as social networks (41-42).

20 Moreover, many household interactions can be captured through either the household
21 questionnaire or the trip diary. In the example of the activity scheduler from the ALBATROSS
22 model (43-44), the most important household interaction is car availability. The applicability of
23 the person-based OVG for modeling this interaction is underlined by the fact that the OVG
24 captures both the number of cars and the number of adults and children in the household
25 questionnaire. Furthermore, the OVG is used as the main dataset in the synthetic population
26 generator and activity scheduler within the FEATHERS framework (45-46).

27 28 **5. CONCLUSIONS AND RECOMMENDATIONS**

29
30 The most striking effect of the changed methodology of the survey design of OVG is the
31 spectacular increase in the response rates. This alone supports the decision to change the
32 methodology. Moreover, the costs are still within commonly reported ranges. As previously
33 discussed in detail, the two main contributing factors are the shift from telephone/postal surveys
34 to face-to-face interviews, and the switch from household-based to person-based questionnaires,
35 the latter opposing the common recommendation of including all persons in the households (see
36 e.g. 4). Nonetheless, some issues have been raised, such as the decreased comparability of
37 figures due to the changes.

38 Although the changes in the survey design of OVG have proven extremely valuable,
39 some important recommendations can still be formulated for future data collection efforts. The
40 first feasible improvement is the inclusion of the “with whom”-dimension in the trip diary. In its
41 present form, the Flemish travel survey only queries the number of people traveling in the car,
42 which is especially interesting from a carpool perspective. The explicit inclusion of the “with
43 whom” dimension would enable the incorporation of additional categories to the household
44 members, such as friends, colleagues, etc. The latter is particularly important given the above
45 noted importance of social networks on travel behavior.

1 Finally, policy-makers should clearly outline the primary objectives for the OVG for the
2 coming years, such that the decision of whether or not to shift to a fully-fledged longitudinal
3 study can be tailored on these key objectives. The evolution of the OVG from a single-point
4 survey towards a continuous survey could be seen as a first step in the transition to a continuous
5 survey with a rotating panel. If the key objective continues to be the monitoring of changes in
6 travel behavior, a step towards the latter type of longitudinal design would make unambiguous
7 pronouncements about changes in travel behavior possible. Nonetheless, an elaborate discussion
8 between the different stakeholders is needed (*11, 47-48*), especially given the fact that this raises
9 new challenges such as the treatment of fatigue and selectivity (*49*). A key challenge to attain
10 similar response rates in the future will be the motivation of the interviewers and the rigorous
11 adherence to survey standards (*19*).
12

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14

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7. REFERENCES

- (1) Korimilli, M.S., R.M. Pendyala, and E. Murakami. Metaanalysis of Travel Survey Methods. In *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 1625, Transportation Research Board of the National Academies, Washington, D.C., 1998, pp. 72-78.
- (2) Tourangeau, R. Survey Research and Societal Change. *Annual Review of Psychology*, Vol. 5, 2004, pp. 775-801.
- (3) Contrino, H., and S. Liss. Sources and Impacts of Nonresponse in Household Travel Surveys: Three Case Studies. *Proceedings of the 7th International Conference on Travel Survey Methods*. International Steering Committee for Travel Survey Conferences, Playa Herradura, Costa Rica, 2004.
- (4) van Evert, H., W. Brog, and E. Erl. Survey Design: The Past, the Present and the Future. In P. Stopher and C.C. Stecher (eds.), *Travel Survey Methods. Quality and Future Directions*. Elsevier, Kidlington, 2006, pp. 75-93.
- (5) Melnyk, S.A., T.J. Page, S.J. Wu, and L.A. Burns. Would you mind completing this survey: Assessing the state of survey research in supply chain management. *Journal of Purchasing and Supply Management*, Vol. 18, No. 1, 2012, pp. 35-45.
- (6) Curtin, R., S. Presser, and E. Singer. Changes in telephone survey nonresponse over the past quarter century. *Public Opinion Quarterly*, Vol. 69, No. 1, 2005, pp. 87-98.
- (7) Grooves, R.M., and M.P. Couper. *Nonresponse in Household Surveys*. Wiley, New York, 1998.
- (8) Grooves, R.M., D.A. Dillman, J.L. Eltinge, and R.J.A. Little. *Survey nonresponse*. Wiley, New York, 2002.
- (9) TRB Committee on Travel Survey Methods. *The On-Line Travel Survey Manual: A Dynamic Document for Transportation Professionals*. Provided by the Members and Friends of the Transportation Research Board's Travel Survey Methods Committee (ABJ40), Washington, D.C., 2009. <http://www.travelsurveymethods.org/>. Accessed July 31, 2011.
- (10) Kunert, U., J. Kloas, and H. Kuhfeld. Design Characteristics of National Travel Surveys: International Comparison for 10 Countries. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1804, Transportation Research Board of the National Academies, Washington, D.C., 2002, pp. 107-116.
- (11) Schulz, A., C. Nobis, R. Follmer, B. Jesske, and D. Gruschwitz. Improving Usability of a Complex Household Travel Survey: An Evaluation of User Requirements. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 2105, Transportation Research Board of the National Academies, Washington, D.C., 2009, pp. 11-17.
- (12) Cambridge Systematics. *Travel Survey Manual*. U.S. Department of Transportation Washington, D.C., 1996.
- (13) Hajnal, I, and W. Miermans. *Onderzoek Verplaatsingsgedrag Vlaanderen, Haalbaarheidsstudie: Eindverslag (Travel Behavior Research Flanders, Feasibility Study: Final report)*. Provinciale Hogeschool Limburg, Diepenbeek, Belgium, 1993.
- (14) CBS. *De mobiliteit van de Nederlandse bevolking (The mobility of the Dutch population)*. Centraal bureau voor de statistiek, Heerlen, The Netherlands, 1990.

- 1 (15) Hartgen, D.T. Coming in the 1990s: The agency-friendly travel survey. *Transportation*,
2 Vol. 19, No. 2, 1992, pp. 79-95.
- 3 (16) Ampt, E., and P. Bonsall. Current issues in travel and transport demand surveys.
4 *Proceedings of the 25th European Transport Conference*. Association for European
5 Transport, Cambridge, 1997.
- 6 (17) Bonsall, P. So What Is All This Data For? *Proceedings of the 9th International Conference*
7 *on Transport Survey Methods: Scoping the Future While Staying on Track*. International
8 Steering Committee for Travel Survey Conferences, Thermas de Puyehue, Chile, 2011.
- 9 (18) Battellino, H. and J. Peachman. The joys and tribulations of a continuous survey. In P.R.
10 Stopher and P.M. Jones (eds.), *Transport Survey Quality and Innovation*. Pergamon,
11 Amsterdam, 2003, pp. 49-68.
- 12 (19) Ortúzar, J., J. Armoogum, J.-L. Madre, and F. Potier. Continuous Mobility Surveys: The
13 State of Practice. *Transport Reviews*, Vol. 31, No. 3, 2011, pp. 293-312.
- 14 (20) Griffiths, R., A. J. Richardson, and M. Lee-Gosselin. Millennium Paper on Travel Surveys.
15 Paper prepared for the Committee on Travel Survey Methods, Transportation Research
16 Board, 2000.
- 17 (21) Zmud, J. Designing Instruments to Improve Response. In P.R. Stopher and P.M. Jones
18 (eds.), *Transport Survey Quality and Innovation*. Pergamon, Amsterdam, 2003, pp. 89-108.
- 19 (22) Stopher, P.R., R. Alsnih, C.G. Wilmot, C. Stecher, J. Pratt, J. Zmud, W. Mix, M.
20 Freedman, K. Axhausen, M. Lee-Gosselin, A.E. Pisarski, W. Brög. *Standardized*
21 *Procedures for Personal Travel Surveys*. NCHRP REPORT 571. Transportation Research
22 Board of the National Academies, Washington, D.C., 2008.
- 23 (23) Clifton, K., C.D. Muhs. Capturing and representing multimodal trips in travel surveys: A
24 review of the practice. Forthcoming in *Transportation Research Record: Journal of the*
25 *Transportation Research Board*, Transportation Research Board of the National
26 Academies, Washington, D.C., 2012.
- 27 (24) Kurth, D.L., J.L. Coil, and M.J. Brown. Assessment of Quick-Refusal and No-Contact
28 Nonresponse in Household Travel Surveys. In *Transportation Research Record: Journal*
29 *of the Transportation Research Board*, Vol. 1768, Transportation Research Board of the
30 National Academies, Washington, D.C., 2001, pp. 114-124
- 31 (25) Forsman, Å., S. Gustafsson, and A. Vadeby. Impact of Nonresponse and Weighting in
32 Swedish Travel Survey. In *Transportation Research Record: Journal of the Transportation*
33 *Research Board*, No. 1993, Transportation Research Board of the National Academies,
34 Washington, D.C., 2007, pp. 80-88.
- 35 (26) Roux, S., and J. Armoogum. Calibration Strategies to Correct Nonresponse in a National
36 Travel Survey. In *Transportation Research Record: Journal of the Transportation Research*
37 *Board*, No. 2246, Transportation Research Board of the National Academies, Washington,
38 D.C., 2011, pp. 1-7.
- 39 (27) Zwerts, E., and E. Nuyts. *Onderzoek Verplaatsingsgedrag Vlaanderen 2 (januari 2000 –*
40 *januari 2001), Deel 1: Methodologische Analyse (Travel Behavior Research Flanders 2*
41 *(January 2000 – January 2001), Part 1: Methodological Analysis)*. Provinciale
42 Hogeschool Limburg, Diepenbeek, Belgium, 2004.
- 43 (28) Moons, E. *Onderzoek Verplaatsingsgedrag Vlaanderen 3 (2007-2008): Tabellenrapport*
44 *(Travel Behavior Research Flanders 3 (2007-2008): Table report)*. Hasselt University,
45 Diepenbeek, Belgium, 2009.

- 1 (29) Cools, M., K. Declercq, D. Janssens, and G. Wets. *Onderzoek Verplaatsingsgedrag*
2 *Vlaanderen 4.1 (2008-2009): Tabellenrapport (Travel Behavior Research Flanders 4.1*
3 *(2008-2009): Table report)*. Hasselt University, Diepenbeek, Belgium, 2010.
- 4 (30) Hajnal, I., and W. Miermans. *Onderzoek Verplaatsingsgedrag Vlaanderen 1, Analyse*
5 *opdracht: Eindverslag (Travel Behavior Research Flanders 1, Analytic assignment: End*
6 *report)*. Provinciale Hogeschool Limburg, Diepenbeek, Belgium, 1996.
- 7 (31) Cools, M., K. Declercq, D. Janssens, and G. Wets. *Onderzoek Verplaatsingsgedrag*
8 *Vlaanderen 4.2 (2009-2010): Tabellenrapport (Travel Behavior Research Flanders 4.1*
9 *(2009-2010): Table report)*. Hasselt University, Diepenbeek, Belgium, 2011.
- 10 (32) Bonnel, P., and J. Armoogum. National transport surveys – What can we learn from
11 international comparisons? *Proceedings of the 33th European Transport Conference*.
12 Association for European Transport, Strasbourg, 2005.
- 13 (33) Tooley, M.S. Incentives and Rates of Return for Travel Surveys. In *Transportation*
14 *Research Record: Journal of the Transportation Research Board*, No. 1551,
15 Transportation Research Board of the National Academies, Washington, D.C., 1996, pp.
16 67-73.
- 17 (34) Zimowski, M., R. Tourangeau, R. Ghadialy, and S. Pedlow. *Nonresponse in Household*
18 *Travel Surveys*. NORC, Chicago, IL, 1997.
- 19 (35) Brög, W. *The New Kontiv Design – NKD*. Socialdata, Munich, Germany, 2006.
- 20 (36) Bednall, D.H.B., S. Adam, and K. Plocinski. Ethics in practice: Using compliance
21 techniques to boost telephone response rates. *International Journal of Market Research*,
22 Vol. 52, No 2, 2010, pp. 155-168.
- 23 (37) Hartgen, D.T., and E. San Jose. *Costs and Trip Rates of Recent Household Travel Surveys*.
24 The Hartgen Group, Charlotte, NC, 2009.
25 [http://www.hartgengroup.net/Projects/National/USA/household_travel_summary/2009-11-](http://www.hartgengroup.net/Projects/National/USA/household_travel_summary/2009-11-11_Final_Report_Revised.pdf)
26 [11_Final_Report_Revised.pdf](http://www.hartgengroup.net/Projects/National/USA/household_travel_summary/2009-11-11_Final_Report_Revised.pdf). Accessed July 30, 2012.
- 27 (38) Henson, K., K. Goulias, and R. Golledge. An assessment of activity-based modeling and
28 simulation for applications in operational studies, disaster preparedness, and homeland
29 security, *Transportation Letters: The International Journal of Transportation Research*,
30 Vol. 1, No. 1, 2009, pp. 19-39.
- 31 (39) Henson, K., and K. Goulias. Preliminary Assessment of Activity Analysis and Modeling
32 for Homeland Security Applications. In *Transportation Research Record: Journal of the*
33 *Transportation Research Board*, No. 1942, Transportation Research Board of the National
34 Academies, Washington, D.C., 2006, pp. 23-30.
- 35 (40) Srinivasan, S., and C.R. Bhat. An exploratory analysis of joint-activity participation
36 characteristics using the American time use survey, *Transportation*, Vol. 35, No. 3, 2008,
37 pp. 301-327.
- 38 (41) Arentze, T., and H. Timmermans. Social networks, social interactions, and activity-travel
39 behavior: a framework for microsimulation, *Environment and Planning B: Planning and*
40 *Design*, Vol. 35, No. 6, 2008, pp. 1012-1027.
- 41 (42) Axhausen, K.W. Social networks, mobility biographies, and travel: survey challenges,
42 *Environment and Planning B: Planning and Design*, Vol. 35, No. 6, 2008, pp. 981-996.
- 43 (43) Arentze, Theo, F. Hofman, H. van Mourik, and H. Timmermans. ALBATROSS:
44 Multiagent, Rule-Based Model of Activity Pattern Decisions. In *Transportation Research*
45 *Record: Journal of the Transportation Research Board*, No. 1706, Transportation Research
46 Board of the National Academies, Washington, D.C., 2000, pp. 136-144.

- 1 (44) Arentze, Theo, F. Hofman, and H. Timmermans. Reinduction of Albatross Decision Rules
2 with Pooled Activity-Travel Diary Data and an Extended Set of Land Use and Cost-
3 Related Condition States. In *Transportation Research Record: Journal of the*
4 *Transportation Research Board*, No. 1831, Transportation Research Board of the National
5 Academies, Washington, D.C., 2003, pp. 230-239.
- 6 (45) Nakamya, J., E. Moons, S. Koelet, and G. Wets. Impact of Data Integration on Some
7 Important Travel Behavior Indicators. In *Transportation Research Record: Journal of the*
8 *Transportation Research Board*, Vol. 1993, *Transportation Research Board of the National*
9 *Academies*, Washington, D.C., 2007, pp. 89-94.
- 10 (46) Bellemans, T., B. Kochan, D. Janssens, G. Wets, T. Arentze, and H. Timmermans.
11 Implementation Framework and Development Trajectory of FEATHERS Activity-Based
12 Simulation Platform. In *Transportation Research Record: Journal of the Transportation*
13 *Research Board*, Vol. 2175, Transportation Research Board of the National Academies,
14 Washington, D.C., 2010, pp. 111-119.
- 15 (47) Chiao, K.-A., J. Argote, J. Zmud, K. Hilsenbeck, M. Zmud, and J. Wolf. Continuous
16 Improvement in Regional Household Travel Surveys: New York Metropolitan
17 Transportation Council Experience. In *Transportation Research Record: Journal of the*
18 *Transportation Research Board*, No. 2246, Transportation Research Board of the National
19 Academies, Washington, D.C., 2011, pp. 74-82.
- 20 (48) Ivey, S.S, D.A. Badoe, and S. Edwards. National Household Travel Survey Add-On
21 Program: Experience of Stakeholders and Best Practices for Maximizing Program Benefits.
22 Forthcoming in *Transportation Research Record: Journal of the Transportation Research*
23 *Board*, Transportation Research Board of the National Academies, Washington, D.C.,
24 2012.
- 25 (49) Kuhnimhof, T., B. Chlond, and D. Zumkeller. Nonresponse, Selectivity, and Data Quality
26 in Travel Surveys: Experiences from Analyzing Recruitment for the German Mobility
27 Panel. In *Transportation Research Record: Journal of the Transportation Research Board*,
28 No. 1972, Transportation Research Board of the National Academies, Washington, D.C.,
29 2006, pp. 29-37.
30