

# Wales National Travel Survey: Survey Evaluation Report

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**Prepared for:** Transport for Wales



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# Background

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## **The Wales National Travel Survey**

Transport for Wales (TfW) has commissioned the National Centre for Social Research to work as its delivery partner to design a suitable methodology for the new Wales National Travel Survey (WNTS). Scheduled for a 2024 launch, the WNTS will collect data on travel attitudes and behaviour among the population in Wales.

The primary goals of the WNTS threefold:

- 1) To monitor changes in travel behaviour and evaluate the degree to which specified targets are being achieved.
- 2) To provide data that will improve the transport evidence base and regional transport models in Wales.
- 3) To develop a robust, repeatable data collection strategy that provides more agency and control over the data generation process.

To fulfill these objectives, the WNTS will incorporate two components:

- 1) A survey that will gather data on household composition, socio-demographic characteristics, attitudes towards travel, and some travel behaviours.
- 2) A travel diary to collect detailed information on travel behaviour over a specific period.

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## The Current Report

This report is one of the outputs from the second stage of a process aimed at identifying and designing the optimal survey mode(s) for delivering the WNTS. A separate report focuses on collection tools to gather travel behaviour. The review of modes to deliver the WNTS is guided by the National Centre for Social Research's REMoDEL approach, a systematic process for designing or transforming social surveys and for gathering robust evidence around the trade-offs linked with different design options (Cornick, 2021).

### **Key Stages of NatCen's REMoDEL Approach:**

**Review** the research and information needs, including any design parameters

**Evaluate** the feasibility of various methodological designs considering different quality dimensions

**Model** a prototype design for further development

**Design** and develop the new methodological approach and questionnaire

**Experiment** by testing the design in a quantitative context

**Launch** the new survey

The review stage of the WNTS was completed in June of 2023, and a separate report was produced outlining the project's key outcomes and indicators of success, in addition to its essential and desirable requirements (Cornick, Aizpurua & Howe, 2023). The current report summarises the evaluation phase of this development, assessing the performance of multiple survey designs to meet the research needs of the project.

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# Evaluation methodology

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## Aim and scope

The aim of the evaluate stage is to identify the most suitable designs to answer the research questions and meet the design parameters outlined during the review stage. In the context of the WNTS, this includes designs for the administration of both the survey and the travel diary. This report focuses on the survey component of the project, with a separate report examining optimal tools to administer the travel diary.

## Identification of suitable designs

The evaluation stage started with members of the Centre for Social Survey Transformation team at NatCen identifying potential survey designs for evaluation. This task was completed during a meeting where the key objectives, research needs, and design parameters established during the review stage of the WNTS were thoroughly discussed.

All proposed survey designs were discussed, with five being shortlisted for further review (see Table 1).

**Table 1.** Potential survey designs to deliver the WNTS survey

Survey modes	Shortlisted	Rationale
Non-probability panels (web, CATI and F2F)	No	Excluded due to significant concerns about coverage and self-selection. They do not meet the required robustness for consideration for National Statistic status.
Non-probability bespoke F2F (random location, quota)	No	Excluded due to significant concerns about coverage and self-selection. They do not meet the required robustness for consideration for National Statistic status.
Random Digit Dial (RDD)	No	Excluded due to substantial concerns regarding representation and nonresponse. The expected response rate is extremely low (<2%) and the design is not future-proofed.



Survey modes	Shortlisted	Rationale
Random probability-based paper interview (PAPI)	No	Excluded due to significant concerns regarding representation and nonresponse. There are also concerns about the ability to gather the required volume of information in a paper-only survey.
Random probability-based panel (e.g., NatCen Panel) (CAWI-CATI)	No	Excluded due to the inability to meet bespoke sampling requirements (cross-sectional survey that is representative at the regional level), seasonality requirements, and concerns about panel conditioning and lack of control of sample for follow-up surveys.
Face-to-face only (CAPI)	Yes	Able to meet many of the design parameters and support information needs. There are some concerns about the potential sample size achievable within budget, but it is considered worthy of further assessment.
Web only (P2W)	Yes	Capable of meeting many design parameters (e.g., facilitating regional level analysis as well as urban/rural breakdown, ensuring a launch no later than December 2024, prioritising cost-effectiveness of WNTS, optimising technology to maximise participation) and support WNTS information needs. Some concerns exist with nonresponse bias and the exclusion of the offline population, considering that no other modes would be offered for those without internet access. However, this design is deemed worthy of further assessment considering the large sample size that could be achieved within the given budget (no need for sample clustering and no interviewer costs).
Web & Face-to-face (CAWI-CAPI)	Yes	Capable of meeting many of the design parameters and supporting information needs. There are minor concerns about mode measurement effects.
Web & telephone & face-to-face (CAWI-CATI-CAPI)	Yes	This assessment is similar to CAWI-CAPI, but the inclusion of telephone interviewing could reduce cost and increase the sample size achievable within budget. While more modes potentially increase inclusiveness, they also add to risk of mode measurement effects.
Telephone & face-to-face (CATI-CAPI)	Yes	The use of interviewer-administration-only modes reduces the risk of mode-effects and increases cooperation.

CATI: computer-assisted telephone interviewing; F2F: face-to-face interviewing; RDD: random digit dial; PAPI: pen and paper interviewing; CAWI: computer-assisted web interviewing.

Two of the shortlisted designs were single-mode surveys employing either face-to-face interviewing or web surveys while the remaining three were mixed-mode surveys integrating a combination of web, telephone, and face-to-face modes. It was assumed in all cases that the survey would precede the travel diary, given the more demanding nature of the second task.

The specific features of the chosen survey designs will be determined during the next stage of the process (i.e., modelling), when micro-decisions are made regarding the sampling approach, the contact and incentivisation strategies, and the content of the questionnaire. At the current stage, we compare survey designs based on the following assumptions:

- 1) Initial contact will be made by post.

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- 2) In instances where multiple data collection modes are used (designs 3-5), these modes would be offered in sequence, starting with the least expensive (web/phone) and ending with the costliest (face-to-face). Each respondent will complete the survey using one mode. However, for face-to-face and telephone surveys, there might be self-completion sections to cover sensitive topics which might be susceptible to social desirability bias when administered in interviewer-led environments.
  - 3) Once a mode is offered, it will remain available with other modes (allowing data to be collected online or via telephone during face-to-face data collection) to reduce costs and expand respondent choices.
  - 4) All non-responding units will be offered each mode sequentially. However, during the modelling stage, we will consider the potential for offering specific modes only to a target sub-sample to maximise cost-effectiveness (e.g., using face-to-face interviewing on certain cases rather than offering it to all non-responding individuals/households).

### **Review of potential designs**

Each shortlisted design underwent an evaluation to identify its strengths, limitations, and to assess the potential trade-offs of each approach. To ensure a systematic approach, the NatCen Centre for Social Survey Transformation created a standardised form featuring a series of dimensions related to the quality and usability of the data which would be generated. These dimensions were drawn from a modified version of the Total Survey Quality framework (Biemer, 2010), and included project-specific parameters for the survey (e.g., the modes of administration minimise social desirability bias and allow collection of sensitive information - such as affordability of transport, or perceived safety - privately).

Table 2 outlines these dimensions and their corresponding parameters.

**Table 2.** WNTS data quality evaluative dimensions

Dimension	Description	Parameters for the survey
Accuracy	Measurement and representation error are minimised	<p>Produce a random, representative sample of adults (16 and over) in Wales</p> <p>Could produce a sample that is representative of school-aged children (5-15 years), if this was required</p> <p>The mode(s) of administration minimise social desirability bias and allow collection of sensitive information privately (affordability of transport, perceived safety, etc.)</p> <p>Survey mode(s) allow collection of data from everyone in the household</p> <p>Survey mode(s) allow collection of data from a randomly selected or a specific household member</p>
Credibility	The data will be sufficiently robust and reliable to support its intended uses	<p>Maximise participation to achieve high response</p> <p>Data collection is sufficiently robust to achieve National Statistics status</p> <p>Data can continue to be collected in unexpected events (e.g., pandemic)</p> <p>Ensure minimal reliance on third parties for critical processes, such as recruitment or data collection (e.g., postal system, public transportation)</p>
Comparability	The data will allow any comparisons required by the analysis objectives	<p>Facilitate regional-level analysis by allowing over-sampling by region</p> <p>Produce a large-enough effective sample size to facilitate analysis by region (North Wales, Mid-Wales, South-West Wales and South East Wales) as well as by urban/rural location</p> <p>Produce a large enough sample to confidently compare estimates for remote and non-remote workers</p> <p>Generate a large enough sample for disaggregated analysis based on language and protected characteristics (e.g., gender, sexual orientation, pregnancy status, race/ethnicity, religion, physical ability)</p> <p>If multiple modes are used, measurement differences are minimised</p>
Coherence	Data gathered from different modes and sources can be reliably combined	<p>The mode(s) of administration for the survey are consistent with a web-based travel diary that is administered outside of the survey environment</p> <p>Consent to participate in follow-up studies is maximised</p> <p>Expected participation in the travel diary with this survey mode is high to allow paired data in most cases</p>
Completeness	The data gathered answers the research questions while minimising the burden on respondents	<p>Missing data (unit nonresponse) is minimised</p> <p>Allows the administration of a 30–40-minute questionnaire</p> <p>Minimises the risk of dropouts during the survey</p>

In addition to these five data quality dimensions (accuracy, credibility, comparability, coherence, and completeness), for data user dimensions were considered, as displayed in Table 3.

**Table 3.** WNTS user quality evaluative dimensions

<b>Dimension</b>	<b>Description</b>	<b>Parameters for the survey</b>
Relevance	Data satisfy users' needs	The mode(s) of administration are expected to remain relevant in 5 to 10 years  Optimise technology use to meet social expectations
Timeliness	The data is available in sufficient time to meet information needs	Survey is launched by no later than December 2024  Weighted data sets are provided within three months of the end of the survey year
Cost-effectiveness	Approach offers value for money	Data is collected in a cost-effective way  Sample size can easily and cost-effectively be increased if needed  Data is collected in a way that is environmentally sustainable
Usability	Ease of use and efficiency with which respondents can complete the tasks when interacting with the survey (user friendly and accessible design)	Allows data collection in both Welsh and English languages  Data collection minimises respondent burden  Potential respondents can choose how (mode) and when (time, number of sittings) they participate  Maximises inclusivity

These standardised forms were used to assess each of the shortlisted designs. The goal was to evaluate how likely each proposed survey design would be to fulfill the survey requirements. The review process began with a qualitative assessment of the design's likelihood of satisfying each specific parameter. Following this, we assigned a score based on the following rating scale:

#### **Rating scale for each design parameter**

- 1) Very likely
- 2) Fairly likely
- 3) Fairly unlikely
- 4) Very unlikely
- 5) Unknown/More information required

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# Evaluation outcomes: Survey modes

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In this section, the shortlisted survey designs are evaluated against the design parameters. As described in the previous section, three of the five approaches (Designs 3, 4 and 5) incorporated two or three modes of data collection. All three included a face-to-face component, which was preceded by a more cost-effective mode such as web (Design 3), telephone (Design 5) or both (Design 4).<sup>1</sup> The two single-mode surveys were web only and face-to-face only.

## Accuracy

Accuracy is a key consideration that refers to the ability of a survey to minimise sources of measurement and representation error. Designs 1 (face-to-face) and 3 (web + face-to-face) scored best on this dimension. The other two mixed-mode designs followed.

All the designs, except for web only approach, were deemed “very likely” to produce a representative sample of adults in Wales. Although coverage bias in online surveys has been declining over time (Sterret et al., 2017) and estimates from online and offline populations have been found to be comparable for most topics (Kocar & Biddle, 2023), web-only surveys tend to overrepresent certain segments of the population such as individuals with higher education and income levels, and those who own their home (Hamlyn, Fitzpatrick, & Williams, 2015). If producing a representative sample of school-aged children is required, the face-to-face and mixed-mode designs were also considered “very” or “somewhat” likely to provide it.

When it comes to reducing social desirability bias and offering privacy to gather sensitive information<sup>2</sup> (e.g., affordability of transportation modes, perceived safety), the face-to-face only (Design 1) and telephone + face-to-

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<sup>1</sup> Note that a sequential mixed-mode design is assumed, although this would be determined during the model stage.

<sup>2</sup> Questions are considered sensitive when:

1) They are intrusive and cross boundaries found in typical conversations, such as questions about sexual behaviour or income.  
2) They are subject to social desirability bias, influenced by social norms and expectations about what is socially desirable (e.g., volunteering) or undesirable (e.g., drug use).

3) They require the disclosure of information to the survey organisation or a third party, which could potentially result in consequences for the respondent (e.g., citizenship status) (Yan, 2021).

face (Design 5) were the least successful. This is because both designs rely on interviewers, which reduces perceived privacy. Even if more sensitive sections of the questionnaire are self-administered, interviewers are still present, which may impact on how people respond to the question.

The ability of each design to accommodate either an individual level or a household level survey design was also assessed. The web-first, mixed mode designs (Designs 3 and 4) were considered “somewhat likely” to accommodate both approaches. The web-only design, however, was seen as “somewhat unlikely” to obtain responses from everyone in the household, or to achieve responses from a randomly selected individual. Obtaining responses from every household member without an interviewer is considered challenging, and randomly selecting household members in self-administered environments has proven difficult (Smyth, Olson, & Stange, 2019), although verification questions have shown improvements over general instructions (Olson & Smyth, 2017). Should a web-only, or a web-first design be chosen for delivering the WNTS with an individual-level approach, further selection options would be assessed during the model stage (e.g., any adults, up to two adults, all adults in the household).

**Table 4.** Accuracy scores by survey design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Accuracy	Produce a random, representative sample of adults (16 and over) in Wales	1	3	1	1	1
	Could produce a sample that is representative of school-aged children (5-15 years), if this was required	1	5	2	2	2
	The mode(s) of administration minimise social desirability bias and allow collection of sensitive information privately (affordability of transport, perceived safety, etc.)	3	1	2	3	3
	Survey mode(s) allow collection of data from everyone in the household	2	3	2	2	3
	Survey mode(s) allow collection of data from a randomly selected or a specific household member	1	3	2	2	2

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

### Credibility

Credibility assesses the robustness and reliability of each design to support its intended uses. In this context, the web-first mixed-mode designs scored best. They were considered best positioned to maximise participation and maintain fieldwork in unexpected events, such as a pandemic. The web-only design scored poorly, due to anticipated lower response rates (Daikeler, Bosnjak, & Manfreda, 2020), and its reliance on the postal system to deliver invitations. The face-to-face design received mixed scores, with notable concerns around its ability to continue data collection in unexpected events that might prevent interviewers from contacting potential respondents.

National Statistical status was an important consideration reflected in the Review report (Cornick, Aizpurua, & Howe, 2023). The face-to-face design was considered “very likely” to achieve it. Meanwhile, all mixed-mode designs were deemed “somewhat likely”, due to the lack of precedent. However, considering the ongoing shift from face-to-face interviewing to mixed-mode approaches in many surveys in the UK and elsewhere, we believe that meeting this criterion will be achievable.

**Table 5.** Credibility scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Credibility	Maximise participation to achieve high response	2	3	1	1	2
	Data collection is sufficiently robust to achieve National Statistics status	1	3	2	2	2
	Data can continue to be collected in unexpected events (e.g., pandemic)	4	1	1	1	2
	Ensure minimal reliance on third parties for critical processes, such as recruitment or data collection (e.g., postal system, public transportation)	2	4	2	2	2

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

### Comparability

Comparability refers to the ability of the resulting data to allow the comparisons required by the analysis objectives. On this dimension, the web-only and the web-first, mixed-mode designs, performed best. This was due to the scalability of the web component and the ability to issue more cases within budget constraints.

Both the face-to-face and the telephone + face-to-face designs were deemed less likely to produce a large-enough effective sample size. This would hinder disaggregated analysis by region and protected characteristics.

Mode measurement effects were considered in the evaluation of mixed-mode designs. The most pronounced effects were expected by the design combining web, telephone, and face-to-face modes. This is because this approach merges both aural and visual communication channels, as well as self-administered and interviewer-administered modes. While differences in travel estimates are expected to vary little across modes, attitudinal assessments and sensitive questions are likely to result in larger measurement effects (Gruschwitz, Eggs, Nobis, & Schulz, 2018).

**Table 6.** Comparability scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Comparability	Facilitate regional-level analysis by allowing over-sampling by region	2	1	1	1	2
	Produce a large-enough effective sample size to facilitate analysis by region (North Wales, Mid-Wales, South-West Wales and South East Wales) as well as by urban/rural location	3	1	1	1	3
	Produce a large enough sample to confidently compare estimates for remote and non-remote workers	2	1	1	1	2
	Generate a large enough sample for disaggregated analysis based on language and protected characteristics (e.g., gender, sexual orientation, pregnancy status, race/ethnicity, religion, physical ability)	4	2	2	2	4
	If multiple modes are used, measurement differences are minimised	NA	NA	3	4	2

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Coherence

In the coherence dimension, we evaluate the extent to which data gathered from different modes and sources can be reliably combined. The web-only and the web-first, mixed-mode designs outperformed the other approaches in this area.

Given our experience with other online and face-to-face surveys, we anticipate a high level of consent to participate in follow-up studies. However, the web only design scored slightly lower due to the absence of an interviewer who could provide additional context about the study and the scope of the consent, if necessary.

We expect a relatively high level of participation in the subsequent travel diary because survey respondents have already agreed to take part in the study. The web-only design's performance in this parameter is uncertain, although other countries (e.g., the Netherlands) successfully use a web-only approach for their National Travel Survey. However, it is important to note that other countries (e.g., the Netherlands) have access to person-named samples, enabling them to tailor their contact strategy by targeting specific individuals. While the evidence is mixed (Dykema et al., 2018), it has been suggested that personalising letters, rather than using a generic salutation, may foster a sense of social obligation in the recipient. This feeling may prompt them to reciprocate by opening the letter and responding to the survey. If this were the case, we could expect lower response rates to web surveys that draw their samples from frames where names are unavailable, such as the Postal Address File in the UK. This lower response rate at stage one (i.e., survey) would reduce the available sample for the second stage (i.e., trip data collection). However, maintaining consistency in the mode of administration for the survey and the diary (web) is expected to reduce dropouts.

Given that all the shortlisted data collection tools for collecting travel data are administered online, and the risk of attrition can increase if the modes of administration change, this factor was evaluated. The two fully interviewer-administered modes scored worst, and the two web-first, mixed-mode designs were considered somewhat inconsistent with this web-based travel diary. Design 2 was rated as "somewhat likely", as it would still imply a different survey environment.

**Table 7.** Coherence scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Coherence	The mode(s) of administration for the survey are consistent with a web-based travel diary that is administered outside of the survey environment	4	2	3	3	4
	Consent to participate in follow-up studies is maximised	1	2	1	1	1
	Expected participation in the travel diary with this survey mode is high to allow paired data in most cases	2	5	2	2	2

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Completeness

Completeness refers to the ability of the data gathered to answer the research questions comprehensively and to be useful for various audiences. All designs performed well on this dimension.

When it comes to minimising item non-response, all designs were considered "very likely" to meet this criterion. Despite the absence of interviewers, web surveys have been shown to produce similar rates of missing data (refusals, don't knows) compared to other modes (Cehovin, Bosnjak & Manfreda, 2023). For sensitive questions, web surveys could actually increase response due to its increased sense of privacy. Given the salience of the topic (travel), the rate of missing data at the item level is expected to be low.



The feasibility of administering a 30-40-minute questionnaire was viewed as very viable in the two single-modes and the web + face-to-face design. Face-to-face surveys can accommodate such length, and the web has demonstrated its ability to deliver long questionnaires (Hanson, Fitzgerald, Aizpurua & Vokovic, forthcoming). The inclusion of telephone in Designs 3 and 4 slightly reduced the score on this area, given the challenges of administering lengthy surveys over the phone.

**Table 8.** Completeness scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Completeness	Missing data (item nonresponse) is minimised	1	1	1	1	1
	Allows the administration of a 30–40-minute questionnaire	1	1	1	2	2
	Minimise the risk of dropouts during the survey	1	2	2	2	1

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Relevance

Relevance assesses the extent to which each survey designs meets social expectations and its future-proofed nature. In this context, the designs that included a web component outperformed those based solely on face-to-face and/or telephone interviewing.

With the rise in digitisation and a significant increase in online surveys over recent decades, we expect web-based designs to remain relevant in the years to come. Face-to-face interviewing scored worst, given changes in social expectations about unannounced visits. Moreover, there has been a shift toward respondent-centered designs, which provide individuals with options regarding when and how to complete surveys (e.g., time of the day, number of sittings, device of choice). Design 5, which supplemented face-to-face with telephone interviewing, was rated slightly better. While response rates in telephone surveys are low, particularly in designs where respondents must call in to schedule an interview, smartphone ownership in the UK is very high and expected to increase (Hiley, 2023). Furthermore, telephone surveys have been integrating new technologies such as Interactive Voice Response.

Designs 1 and 5, which rely solely on interviewers, were considered less capable of optimising technology use. Although both face-to-face and telephone interviewing have been computerised for decades now, they do not allow for the same level of technology optimisation as web-based designs, where information is recorded in real time using respondents' own devices.

**Table 9.** Relevance scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Relevance	The mode(s) of administration are expected to remain relevant in 5 to 10 years	4	1	1	1	3
	Optimise technology use to meet social expectations	3	1	2	2	3

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Timeliness

Timeliness is a critical consideration for WNTS and refers to ensuring that the data is available in time to meet information needs. Two indicators from the Review stage were considered: (1) the ability to launch the survey by December 2024, and (2) to provide weighted data within three months of the end of the survey year.

All designs performed well regarding their ability to provide weighted data sets within the requested timeframe. While it was assumed that weighting might be more intensive for mixed-mode designs, the timeline was considered viable in all cases.

The single-mode designs performed best in terms of launching the survey before the end of 2024. This is due to their reduced complexity, especially the web survey which does not require clustering, nor does it need interviewer training and assignment management. Designs 3 (web + face-to-face) and 5 (telephone + face-to-face) were considered “somewhat likely” to launch the survey by the end of 2024, due to the additional time needed to adapt, program, and test the questionnaire in two modes. Design 4, which combines web, telephone, and face-to-face, scored worst because of the increased logistic challenges associated with an additional mode.

**Table 10.** Timeliness scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Timeliness	Survey is launched by no later than December 2024	1	1	2	3	2
	Weighted data sets are provided within three months of the end of the survey year	1	1	1	1	1

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Cost-effectiveness

Cost-effectiveness refers to the ability of the designs to provide value for money. There was substantial variation across designs on this dimension. The face-to-face single mode scored worst across indicators, followed closely by the telephone + face-to-face design.

Face-to-face interviewing is the costliest mode of data collection due to the need to hire and train interviewers and cover their time and travel expenses. In lengthy surveys, the cost of mixed-mode surveys using web and paper has been estimated to be less than half of face-to-face interviews (Wolf, Christmann, Gummer, Schnaudt, & Vehoven, 2021). Telephone interviewing is less costly than face-to-face, primarily because it removes travel costs and improves time efficiency. However, telephone interviews remain substantially more expensive than web surveys, which do not require interviewers.

Scalability is another advantage of web surveys. The marginal cost of adding additional respondents to a web survey is minimal once the survey is set up, leading to Design 2 (web only) scoring best in this category. The web-first, mixed-mode designs were seen as “somewhat likely” to cost-effectively increase the sample size due to the scalability of the web component. Both face-to-face and telephone interviewing are the least scalable modes, as increasing the sample size requires more interviewer time.

Regarding environmental impact, web surveys were viewed as the most sustainable, requiring no travel or use of physical materials other than the invite. All other interactions and data exchange occur digitally, which minimises the carbon footprint. The web-first, mixed-mode designs are more sustainable than face-to-face or telephone

interviewing due to the web component, but they still have an environmental impact due to travel for face-to-face interviews, and energy use for telephone interviews.

**Table 11.** Cost-effectiveness scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Cost-effectiveness	Data is collected in a cost-effective way	4	1	2	2	3
	Sample size can easily and cost-effectively be increased if needed	4	1	2	2	4
	Data is collected in a way that is environmentally sustainable	4	1	3	3	4

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Usability

Usability, a measure of the ease and efficiency with which respondents can interact with the survey, has become an increasingly important factor in recent years, due to declining response rates and a need to develop strategies to improve participation. Factors such as offering respondents choices, reducing their burden, and maximising inclusivity to improve representation are key considerations. The two web-first, mixed-mode designs performed best on this dimension.

For data collection in both Welsh and English, the web design scored best, given the ease with which online surveys can be adapted to multiple languages. All other designs scored slightly lower, as they require bilingual interviewers who can administer the survey in both languages.

In terms of reducing respondent burden, the web design also scored best due to its flexibility and convenience. Respondents can complete the survey at their own pace, which is expected to reduce their perceived burden. Unlike face-to-face and telephone surveys - where interviewers read the questions and response options, dictating the pace of the interview - web surveys allow respondents to proceed at a pace comfortable to them. However, it is important to note that the impact of survey mode on respondent burden can vary, depending on their characteristics, motivation to participate, and cognitive ability (Yan & Williams, 2022). In the case of telephone surveys, they can be more burdensome, as they rely on respondents' memory (i.e., ability to recall all response options).

In terms of flexibility regarding how and when respondents participate, the web-first, mixed-mode designs ranked best. These designs provide two different modes for participation, and web surveys allow for more flexibility in terms of completion (e.g., number of sittings, time of the day, choice of device). The web-only and telephone + face-to-face designs were deemed as somewhat limited in this respect, while face-to-face was considered most restrictive due to the need to accommodate interviewers' visits.

Finally, to maximise inclusivity, the web-first, mixed-mode designs outperformed other approaches. They provide a blend of self-completion and interviewer-based approaches, accommodating a wider range of respondent preferences. Conversely, the web-only design ranked worst due to its exclusion of those with no or limited access to the internet (in 2022, about 3% of adults 16+ in the UK were estimated to access the internet less than once a week, Tech tracker, 2022). Similarly, the face-to-face and telephone + face-to-face designs might exclude those who are uncomfortable with in-person/telephone interactions or have auditory impairments.

**Table 12.** Usability scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Usability	Allows data collection in both Welsh and English languages	2	1	2	2	2
	Data collection minimises respondent burden	2	1	2	2	2
	Potential respondents can choose how (mode) and when (time, number of sittings) they participate	4	3	2	2	3
	Maximises inclusivity	2	3	1	1	2

Design 1: Face-to-face only; Design 2: Web only; Design 3: Web + Face-to-face; Design 4: Web + Telephone + Face-to-face; Design 5: Telephone + Face-to-face. Rating: 1 = Very likely; 2 = Somewhat likely; 3 = Somewhat unlikely; 4 = Very unlikely; 5 = Unknown.

## Summary

Overall, Design 3 (web + face-to-face) showed the strongest performance across data quality and user dimensions. It consistently ranked either first or second in all areas and was the only design that did not score “very unlikely” on any of the 31 design parameters.

Design 2 (web only) performed well overall, and outperformed other designs in terms of comparability, cost-effectiveness, and relevance. This is due to its scalability, minimal environmental impact, and optimisation of technology to reduce respondent burden. However, this design ranked last for accuracy and credibility, given limitations to cover the offline population and expected lower response rates.

Design 4 (web + telephone + face-to-face) ranked third overall, demonstrating strong performance across a number of quality dimensions, including coherence, cost-effectiveness, credibility, relevance, and usability. However, this design raised concerns regarding mode-measurement effects, social desirability bias for sensitive questions, its ability to be launched on schedule, and its environmental impact.

Designs 1 (face-to-face) and 5 (telephone + face-to-face), which are entirely reliant on interviewers, scored the worst overall, despite their strengths in some dimensions (e.g., accuracy and completeness for face-to-face). Their lower rankings primarily result from their low performance in areas like cost-effectiveness and relevance. They also scored comparatively worse than other designs in usability, coherence, and comparability. In both cases, the increased costs of data collection limit the achievable sample size and place a larger burden on the environment due to travel costs and energy use. For further details on how the shortlisted designs performed across dimensions, see Table 13.

**Table 13.** Average score by quality dimension and design

Dimension	Design 1	Design 2	Design 3	Design 4	Design 5
Accuracy	1.60	2.50	1.80	2.00	2.20
Coherence	2.33	2.00	2.00	2.00	2.33
Comparability	2.75	1.25	1.60	1.80	2.60
Completeness	1.00	1.33	1.33	1.67	1.33
Cost-effectiveness	4.00	1.00	2.33	2.33	3.67
Credibility	2.25	2.75	1.50	1.50	2.00
Relevance	3.50	1.00	1.50	1.50	3.00
Timeliness	1.00	1.00	1.50	2.00	1.50
Usability	2.50	2.00	1.75	1.75	2.25
<b>Overall</b>	<b>2.30</b>	<b>1.75</b>	<b>1.71</b>	<b>1.84</b>	<b>2.32</b>

Note: Average scores are computed based on the original scale (1 'Very likely' – 4 'Very unlikely'), excluding 5 ('Unknown'). Therefore, lower scores represent better performance.

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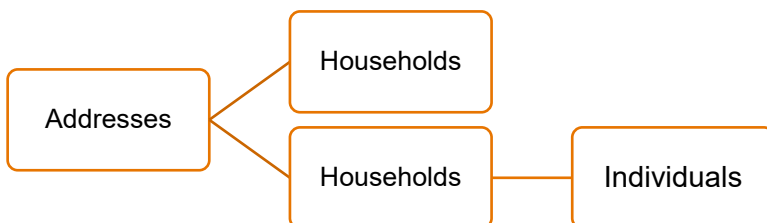
# Household- vs. individual- level design

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## Household- and individual-level surveys

This section of the report discusses the advantages and disadvantages of implementing either an individual- or a household-level design in the WNTS, where the primary unit of analysis could be either the household or the person (see Figure 1).

**Figure 1.** Household- and individual-level surveys



In household surveys, every eligible member of a selected household is invited to participate in the survey. In contrast, individual-level surveys extend invitations to specifically selected individuals. However, general information about the structure and composition of the household is collected in both approaches.

The choice between these two designs depends on several factors, including the available sampling frame. Individual-level surveys are straightforward to implement when individual registers are available, and communication can be directed to specific individuals. However, when relying on lists of addresses, an additional step is required for within household-selection.

Another factor that led to the wide use of household surveys historically was the use of face-to-face interviewing. Considering the high costs associated with this data collection mode (e.g., interviewer training, travel, interview

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time...), it proved more cost-effective to interview all members of a household once the interviewer had traveled to the address and established contact.

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## Advantages and disadvantages of household- and individual-level surveys

Both household and individual-level surveys have their unique set of advantages and disadvantages, and they impact the amount and quality of data collected, as well as the associated survey costs.

Household-level surveys come with certain advantages. Because they collect information from every eligible household member, these surveys are likely to yield a higher amount of data. They also provide a more holistic view of household travel behaviour and dynamics, which can offer valuable insights (e.g., shared use of vehicles and other forms of transportation within a household). By inviting everyone to take part, there is a lower risk of selection bias. It could also be more cost-effective, given that once a household is recruited, data for all its members are obtained at minor additional cost. However, the efficiency of the household approach versus the individual is dependent on the net response rates of the two methods.

On the downside, household-level surveys present important challenges, including obtaining cooperation from every household member which leads to partially completed surveys. This issue could be more problematic in a self-completion environment where interviewers are not present to promote participation. Household surveys also require relaxing proxy rules, reducing data quality and availability, as some questions may not be suitable for proxy responses (e.g., some questions regarding protected characteristics, perceived safety of transportation modes). Another disadvantage of this approach stems from the nested structure of the data, as the clustering at the household level requires more complex analytical techniques, such as multilevel modeling. This clustering also leads to a loss of efficiency and an increase in variance, which can overshadow gains in achieved sample size (Hubrick & Wittwer, 2014). In addition, it is important to consider that household surveys place an extra burden on households with multiple children, especially if proxy is more often common among certain groups (e.g., women, see Richardson, 2006). The logistics of a household-level survey can be particularly challenging in a self-completion environment, in terms of distributing access codes among household members and following-up with households that only partially responded to the survey. When conducting household-level surveys where multiple members answer identical questions (e.g., household composition, income, etc.), there can be inconsistencies in the responses to the survey (e.g., differing reported household incomes) and diary (e.g., shared journeys with different start or end times, etc.). Addressing and reconciling these discrepancies when no ground truth is available requires the allocation of additional resources to establish suitable protocols for verifying and reconciling these entries.

Individual-level surveys have their own unique benefits. They impose a lower burden, as only one individual needs to participate. Because of this, they are likely to yield higher response rates than household-level surveys (Hubrich, Wittwer, & Gerike, 2018). Another advantage of individual-level surveys is their alignment with the frame for travel diaries, as future-proof data collection tools for trip data, such as smartphone applications and cellular data, are intrinsically designed for individual use. In addition, if there is an interviewer-based component in the survey design (e.g., shortlisted Designs 3, 4, and 5), there is extra flexibility in survey scheduling, since only one person needs to be available.

Despite these advantages, individual-level surveys come with their own set of challenges. For instance, there is a higher risk of selection bias, especially in self-administered environments, where random selection has proven difficult. Although individual-level surveys collect information about the characteristics of the household and its members, which can function as explanatory values in statistical models, they miss household interactions and dynamics. Finally, to obtain a comparable number of responses to household-level surveys, more individuals need to be surveyed, which could lead to higher costs.

**Table 14.** Advantages and disadvantages of individual- and household-level designs in the context of WNTS

	<b>Advantages</b>	<b>Disadvantages</b>
<b>Household level</b>	<ul style="list-style-type: none"> <li>○ The amount of data is likely to be higher, even if response rates are slightly lower compared to individual surveys</li> <li>○ Provides a more holistic view of household travel behaviour and dynamics</li> <li>○ There is a lower risk of selection bias</li> <li>○ Once a household is recruited, information for all members of the household is obtained at minor cost</li> </ul>	<ul style="list-style-type: none"> <li>○ Cooperation from every household member is challenging, leading to partial completes to some extent</li> <li>○ Requires relaxing proxy rules, which reduces data quality and availability (some questions are not suitable for proxying)</li> <li>○ The clustering at the household level requires more complex analysis to account for the nested structure of the data (e.g., mixed-level models)</li> <li>○ The clustering at the household level leads to a loss of efficiency and variance increase</li> <li>○ Places extra burden on households with multiple children</li> <li>○ The logistics can be challenging in a self-completion environment (e.g., distribute access codes, following-up with partial responding households)</li> </ul>
<b>Individual level</b>	<ul style="list-style-type: none"> <li>○ Poses lower burden on respondents</li> <li>○ Likely to yield higher response rates than household-level surveys</li> <li>○ New data collection tools for trip data such as smartphone applications, cellular data, etc. are intrinsically individual based</li> <li>○ If there is an interviewer-based component, there is extra flexibility in survey scheduling, as only one person needs to be available</li> </ul>	<ul style="list-style-type: none"> <li>○ High risk of selection bias, especially in self-administered environments</li> <li>○ Household interactions and dynamics are only partly reflected</li> <li>○ The need to survey more people to get a comparable number of responses can lead to higher costs</li> </ul>



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# Discussion topics

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This report summarises the findings from the Evaluation stage as they pertain to the mode of survey administration. After a thorough review of WNTS' research needs, five designs were shortlisted for further assessment (see Table 1).

Overall, the web + face-to-face, web only, and web + telephone + face-to-face designs performed best across both data and user quality dimensions. Of these, the web + face-to-face was viewed as particularly strong.

In addition to addressing any questions or comments that Transport for Wales and the Welsh Government may have, we recommend discussing in greater detail several points before proceeding to the Model stage:

- The inclusion and operation of telephone interviewing,
- Choosing the model(s) to carry forward into the modeling stage,
- Discussing dropout rates between the survey and the diary in a self-completion web environment, and potential experiments to understand and address this issue.
- The advantages and disadvantages of an individual- and household-level survey design, as well as preferences.
  - o If individual selection is chosen, potential experimentation ideas to test before the launch.

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# Appendices

## Appendix A. Complete Proforma by design

**Table 15.** Scores by design

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Accuracy	Produce a random, representative sample of adults (16 and over) in Wales	1	3	1	1	1
	Could produce a sample that is representative of school-aged children (5-15 years), if this was required	1	5	2	2	2
	The mode(s) of administration minimise social desirability bias and allow collection of sensitive information privately (affordability of transport, perceived safety, etc.)	3	1	2	3	3
	Survey mode(s) allow collection of data from everyone in the household	2	3	2	2	3
	Survey mode(s) allow collection of data from a randomly selected or a specific household member	1	3	2	2	2
Credibility	Maximise participation to achieve high response	2	3	1	1	2
	Data collection is sufficiently robust to achieve National Statistics status	1	3	2	2	2
	Data can continue to be collected in unexpected events (e.g., pandemic)	4	1	1	1	2
	Ensure minimal reliance on third parties for critical processes, such as recruitment or data collection (e.g., postal system, public transportation)	2	4	2	2	2
	Facilitate regional-level analysis by allowing over-sampling by region	2	1	1	1	2
Comparability	Produce a large-enough effective sample size to facilitate analysis by region (North Wales, Mid-Wales, South-West Wales and South East Wales) as well as by urban/rural location	3	1	1	1	3
	Produce a large enough sample to confidently compare estimates for remote and non-remote workers	2	1	1	1	2
	Generate a large enough sample for disaggregated analysis based on language and protected characteristics (e.g., gender, sexual orientation, pregnancy status, race/ethnicity, religion, physical ability)	4	2	2	2	4
	If multiple modes are used, measurement differences are minimised	NA	NA	3	4	2
	The mode(s) of administration for the survey are consistent with a web-based travel diary that is administered outside of the survey environment	4	2	3	3	4
Coherence	Consent to participate in follow-up studies is maximised	1	2	1	1	1
	Expected participation in the travel diary with this survey mode is high to allow paired data in most cases	2	5	2	2	2
Completeness	Missing data (item nonresponse) is minimised	1	1	1	1	1
	Allows the administration of a 30–40-minute questionnaire	1	1	1	2	2
	Minimise the risk of dropouts during the survey	1	2	2	2	1

Dimension	Design parameter	Design 1	Design 2	Design 3	Design 4	Design 5
Relevance	The mode(s) of administration are expected to remain relevant in 5 to 10 years	4	1	1	1	3
	Optimise technology use to meet social expectations	3	1	2	2	3
Timeliness	Survey is launched by no later than December 2024	1	1	2	3	2
	Weighted data sets are provided within three months of the end of the survey year	1	1	1	1	1
Cost-effectiveness	Data is collected in a cost-effective way	4	1	2	2	3
	Sample size can easily and cost-effectively be increased if needed	4	1	2	2	4
	Data is collected in a way that is environmentally sustainable	4	1	3	3	4
Usability	Allows data collection in both Welsh and English languages	2	1	2	2	2
	Data collection minimises respondent burden	2	1	2	2	2
	Potential respondents can choose how (mode) and when (time, number of sittings) they participate	4	3	2	2	3
	Maximises inclusivity	2	3	1	1	2



