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Project Title: TRAVel behaviour & Edinburgh Low Emission Zone (**TRAVEL**)

Project timescale: 1 July to 31 December 2024

Chief Investigator: Dr Will Mueller

Sponsor: Institute of Occupational Medicine, Edinburgh, UK

Funder: NIHR Public Health Research Programme

Version Control Table

Date	Version number	Editor	Comments
01/08/2024	1.0	WM	Pre-ethics approval version
27/09/2024	2.0	WM	Post-ethics approval version

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KEY STUDY CONTACTS

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STUDY SUMMARY

Study Title	TRAVel behaviour & Edinburgh Low Emission Zone
Short Title	TRAVEL
Study Design	Survey. We will be asking Edinburgh residents and commuters about their travel and commuting habits in relation to the LEZ (as the intervention)
Study Participants	The target audience will be adults (≥18 years old) working or studying in Edinburgh.
Planned Size of Sample	350 individuals
Planned Study Period	1 July – 31 December 2024
Research Question/Aim(s)	Research questions: 1. How does travel behaviour differ across journeys that include and exclude the LEZ? 2. Has LEZ enforcement influenced travel decisions to travel to the city centre? Objectives: 1) Develop a survey to measure travel behaviour and assess influence of the LEZ in travel decisions. 2) Recruit a representative sample of adults working/studying in Edinburgh. 3) Undertake effective engagement with diverse stakeholders across all stages of the research.

ROLES AND RESPONSIBILITIES OF STUDY MANAGEMENT COMMITEES/GROUPS

Steering Committee

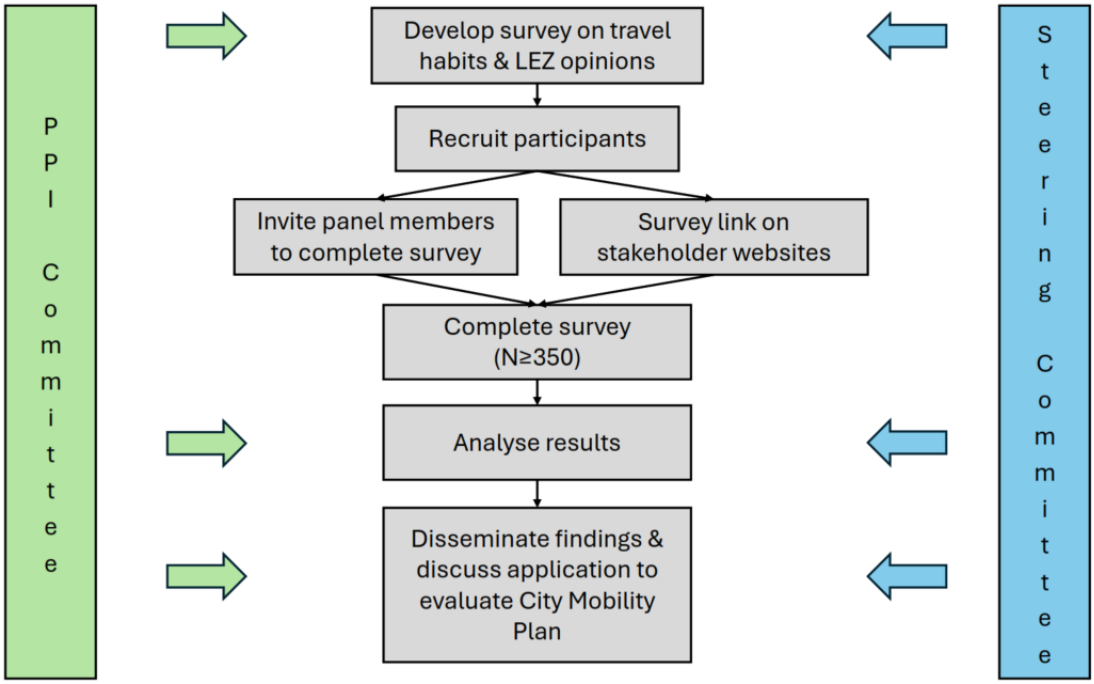
Member	Organisation	Role
Dr Paul Kelly	University of Edinburgh	Chair
Dr Audrey de Nazelle	Imperial College London	Member
Prof Peter Craig	University of Glasgow	Member
Prof Rachel Aldred	University of Westminster	Member
Dr Georgina Santos	Cardiff University	Member
Dr Tom Clemens	University of Edinburgh	Member
Dr Eric Deeson	N/A	Public member

Stakeholder Group

Member	Organisation
Andy Cope	Sustrans
Jenny Munro	Royal Town Planning Institute
Vincent McInally	Transport Scotland
George King	City of Edinburgh Council
Judith Cowie	City of Edinburgh Council
Shauna Clarke	City of Edinburgh Council
Ruth White	City of Edinburgh Council
Margaret Douglas	Public Health Scotland
John Brennan	NHS
Eric Deeson	N/A
Scott Walkingshaw	N/A

STUDY FLOW CHART

TRAVel behaviour & **E**dinburgh **L**ow Emission Zone **(TRAVEL)**



STUDY GANTT CHART

Activity	Jul	Aug	Sep	Oct	Nov	Dec
Develop survey with Steering & Stakeholder feedback						
Ethics application						
Test survey						
Implement survey						
Analyse survey data						
Solicit Steering & Stakeholder feedback on survey results						
Dissemination activities						
Completion Report						
In-person final meeting						

1 BACKGROUND

We will undertake a survey of Edinburgh residents and commuters to capture attitudes and perspectives towards enforcement of the Low Emission Zone (LEZ), along with current travel behaviour, including active travel. These findings will represent important baseline data for a larger research application to evaluate and model health impacts from a suite of active travel interventions in Edinburgh. The baseline data collected can help isolate the effect on travel of the LEZ prior to these upcoming interventions.

The City of Edinburgh has implemented a LEZ in the city centre to reduce levels of harmful air pollution. The LEZ is currently in operation and enforcement formally commenced on 1st June 2024. The LEZ allows access to only those cars with minimum emission standards (e.g., Euro 4 for petrol cars and vans registered from 2006, Euro 6 for diesel cars and vans registered from 2015); non-compliant vehicles will be fined.

A primary objective of the Edinburgh LEZ is to lower nitrogen dioxide (NO_2) concentrations to legal limits. The LEZ may also result in lower particulate matter (PM) concentrations (Bernardo et al., 2021). Reducing emissions from transport is essential, as it represents nearly a third of the city's total emissions (City of Edinburgh Council [CEC], 2021). Ultimately, the LEZ is to encourage more sustainable and active journeys, as well as contribute to achieving net zero emissions by 2030. Since studies have demonstrated the larger potential health benefits of physical activity compared to air pollution, even in highly polluted environments (Giallouros et al., 2020), it will be important to include physical activity when studying the health impacts of the LEZ.

2 RATIONALE

Past LEZ research has examined the evidence for reduced car journeys and increased active and more sustainable travel. A survey found a decrease of 30% in private vehicle use following the implementation of the Madrid LEZ (Tarriño-Ortiz et al., 2021). More modest modal shifts (increases of <10%) were found for public transport use and active travel (i.e., pedestrians and cyclists) (Tarriño-Ortiz et al., 2022), the uptake of which may depend on age, sex, and other characteristics (Goel et al., 2022). Beyond the overall changes, LEZs should be evaluated for equality for who can access the LEZ and adjust travel modes appropriately (Morton et al., 2018).

As well as measuring overall changes in travel behaviour, it is useful to evaluate people's perceptions of the LEZ and, specifically, if the LEZ has acted as a barrier/facilitator for their mode of travel in relation to other factors. A 2020 survey of employers in Scotland found that the top three barriers to employees walking, cycling, or using public transport to get to work were distance (68%), inclement weather (55%), and availability/quality of public transport (45%) (McGinley et al., 2021). An important barrier for travel into the city centre and thus within the LEZ may be the capacity for individuals to adapt to the LEZ requirements. For example, the LEZ may prompt some individuals to travel less if their personal vehicle does not meet the standards, which could also lead to unintended consequences (e.g., feelings of social isolation) (De Vrij et al., 2022). Studies of other LEZs (e.g., London) have suggested an increase in bike sharing, especially for trips <30 minutes (Ding et al., 2023), so the availability of this amenity could be a potential facilitator.

3 RESEARCH QUESTION/AIM(S)

3.1 Aim
The overall aim is to study travel behaviour and attitudes related to enforcement of the Edinburgh Low Emission Zone (LEZ).

3.2 Research questions
The specific research questions are:

1. How does travel behaviour differ across journeys that include and exclude the LEZ?
2. Has LEZ enforcement influenced travel decisions to travel to the city centre?

3.3 Objectives
The specific objectives are to:

1) Develop a survey to measure travel behaviour and assess influence of the LEZ in travel decisions.

2) Recruit a representative sample of adults working/studying in Edinburgh.

3) Undertake effective engagement with diverse stakeholders across all stages of the research.

3.4 Outcome
The primary outcome for our survey will be weekly minutes of active travel, including active commuting, as reported by respondents. The secondary outcome will be the modelled carbon emissions based on reported travel modes and distances.

4 STUDY DESIGN and METHODS of DATA COLLECTION AND DATA ANALYIS

We will employ an online survey to collect data about respondents' travel behaviour. To identify potential respondents, we will make use of an existing large panel of individuals who have previously agreed to be contacted to complete surveys.

The survey will collect data on demographics (age, sex, income, car ownership, employment [including remote work habits]), travel habits (origin & destination, frequency, purpose, mode), and motivation/consideration of travel (cost, time, convenience, physical activity). We will develop the questionnaire with a professional survey company (Civica). The survey will be pilot-tested for clarity and ease of completion using IOM staff who are not part of the project team.

We will compare travel modes and reported influence of the LEZ based on workplace postcode and whether this is situated within, near (e.g., <1 km), or far (e.g., ≥1 km) from the LEZ boundary (Ogilvie et al., 2017). As secondary comparisons, we will examine travel modes based on home address postcode in relation to the LEZ boundary, as well as across subgroups where data permit.

The main analysis will involve producing summary statistics of each survey question and comparing travel behaviour responses by the above LEZ comparators. Statistical analysis (e.g., t-tests of means, difference in proportions) will be completed for: 1) Differences in commuting patterns and mode share for travel by LEZ comparator group and 2) Awareness of the LEZ and identification of barriers/facilitators by LEZ comparator group. Further subgroup analysis will be performed as described below where data permit. We will also have data on how the survey was accessed (i.e., panel or stakeholder website) and may wish to further examine any such differences in respondent characteristics or responses.

Individuals will be identified, screened, and recruited through an existing panel of potential survey respondents based on directories of employers with offices in Edinburgh. Individuals will access the survey through a weblink, which will open to a webpage describing the study's purpose, content, and use of data. The survey also will be made available on websites of any stakeholders who are keen to support recruitment, including those organisations represented on the stakeholder group. No additional payments or incentives will be provided for completion of the survey; however, panel respondents already receive point incentives based on surveys completed. Participants will need to provide consent before progressing to the survey questions.

The survey will be designed to be completed within 15-20 minutes. To explore modal change, questions will address travel behaviour prior to the LEZ enforcement (i.e., pre-June 2024), as well as at the time of the survey (September-October 2024). We will include as a measure of self-reported health the ONS personal wellbeing questions (ONS, 2016). In addition to the LEZ, the survey will ask about cycle lanes and any other infrastructure/policies as perceived barriers or facilitators for travel decisions. The questionnaire will include closed questions with opportunities for participants to add free text if desired. The survey will close with an acknowledgement page thanking the participant for their time and input.

We will also compare survey results and travel behaviour by individual socioeconomic indicators (employment, car ownership) and also area-level (postcode deprivation). Deprivation can be used to assess representativeness of respondents across Edinburgh. We will examine any evidence of inequality in compliance with the LEZ requirements by demographic and geographic characteristics. Depending on the amount of data submitted, we may also include data in the analysis from individuals who only partially completed the survey.

The data will be analysed using statistical programmes, such as R and Stata.

5 SAMPLE AND RECRUITMENT

5.1 Study setting

The study will consist of an online survey, but will target those living in and around Edinburgh, UK.

5.2 Eligibility Criteria

The target audience will be adults (≥18 years old) working or studying in Edinburgh. We are interested in those travelling to (and also within) the LEZ, representing the city centre. This population represents over 80% of adults in Edinburgh (CEC, 2022) and is thus an important demographic for whom to promote active travel via commuting. It will also be useful to include those working remotely to understand motivations for choosing not to commute, such as the presence of the LEZ.

To assess any differential associations in active travel or adherence to the LEZ, we will collect data on age, sex, and disability. We will aim to achieve a representative sample of all working age adults residing in or commuting to Edinburgh and will apply quotas to ensure representative numbers by age and sex.

5.3 Sampling

We will obtain responses from 350 individuals during September-October 2024. We will use quotas to ensure representativeness in age and sex, as well as to cap respondents who do not commute (i.e., remote work/study only). The sample size was estimated using figures from the 2011 census as the most recent data available: a population size of 300,000 for the number of workers in Edinburgh, proportion of commute mode ranging from 5% (cycle) to 33% (car), margin of error of 5%, and a 95% confidence interval.

We aim to recruit a sample representative of the working/student (mainly working age) population of Edinburgh and will identify eligible respondents (commuters) through the screening of potential respondents (not excluding those over 64 who are still in the workforce and commuting). Given the current working age population and previous commuter proportions we estimate that a sample of 350

individuals will yield a representative sample of the working/student population. Sample representativeness will be determined within 95% confidence limits, and a 5% margin of error.

To identify potential respondents, we will use a company (Dynata) that manages a large panel of individuals who have previously agreed to be contacted to complete surveys. Individuals living and/or working within the Edinburgh LEZ area will be targeted for the survey.

Dynata recruits individuals via both "open enrolment" and "by-invitation-only" modes using direct email and through online marketing channels, using hundreds of diverse, online affiliate partners and targeted websites. Panel recruitment methods are non-probabilistic (although they do provide broad general population coverage) and include 'panels' and 'intercepts'.

- **PANELS:** These are databases of potential participants who declare that they will cooperate for future data collection if selected, generally in exchange for a reward/incentive. This includes traditional access panels, co-branded panels, or opt-in databases of individuals who agreed to complete research projects and also undertake other non- market research activities (e.g., watch ads, download an app, complete marketing offers, etc, also known as loyalty programmes, or rewards communities within GPT (Get paid to) sites.) Loyalty card and subscription databases are included here if there is a continuous relationship with members who understand the commitment asked of them.
- **INTERCEPTS:** This includes intercepts from offer walls, affiliate networks, social media or other platforms to drive traffic to a survey. Intercept is an approach where potential participants are asked to take a survey for a reward while they are engaged in another activity such as playing an online game, reading news, or some other online activity. Intercepted participants may be previously unknown to the sample provider or may have been pre-identified and profiled through a prior survey experience.

To ensure the collection of true respondents, Dynata uses an array of fraud control, increasingly leveraging AI and Machine Learning.

In addition to using for recruitment the panel managed by Dynata, we will encourage members of the stakeholder group to share the survey link on their organisational websites.

5.4 Consent

The introductory webpage that potential respondents will be directed to will be used as the participant information sheet. It will provide sufficient information for participants to make an informed choice as to whether to complete the questionnaire and the duration of time it will take (within 15-20 minutes). In addition to providing the background information and purpose of the study to understand LEZ enforcement and travel behaviour of Edinburgh residents and commuters, the introductory webpage will provide the following details (See Annex for full section text):

> *The IOM has asked Civica to design and run the survey. The survey results will be shared with IOM who will analyse the data and prepare a written report. Your responses will be combined so that no individual can be identified.*
>
> *For the purposes of this survey, Civica is the data processor. All data is collected and stored following GDPR regulations. IOM's privacy policy can be found here: https://www.iom-world.org/privacy-policy/*
>
> **The survey has been designed to be completed within 15-20 minutes.**

All current members have already agreed to the terms and conditions when signing up for the panel: https://www.opinionoutpost.co.uk/terms

6 ETHICAL AND REGULATORY CONSIDERATIONS

6.1 Research Ethics Committee (REC) review

Ethical approval will be sought from the Reading Independent Ethics Committee prior to inviting participants to complete the online survey.

Since the study consists of a single survey, which will be submitted to the ethics board, we do not foresee the need for any amendments subsequent to study approval; however, if any such circumstances arise, we will seek advice from the ethics board, as well as notify the funder (NIHR).

6.2 Public Involvement

The TRAVEL study involves a stakeholder group to facilitate coproduction of the research, as well as capturing priorities and concerns from different perspectives.

The stakeholder group members:

- Public Health Scotland (PHS) – Margaret Douglas, Consultant in Public Health
- Sustrans - Andy Cope, Director of Evidence and Insight
- NHS Lothian – John Brennan, Population Public Health Project Manager
- Royal Town Planning Institute (RTPI)– Jenny Munro, Policy, Practice and Research Officer
- Transport Scotland – Vincent McInally, Air Quality and Environment Manager
- City of Edinburgh Council – George King, Ruth White, Shauna Clarke, Judith Cowie
- Public representative - Eric Deeson, Full-time volunteer in lay involvement in health/care research
- Local community member – Scott Walkingshaw, University of Edinburgh graduate student

Early drafts of the research plan were circulated to all members of the stakeholder group, and two members also gave input on the plain English summary.

The stakeholder group will meet three times (twice virtual and once in-person) coinciding with key project milestones. There will also be regular feedback on iterations of the survey, facilitated digitally by the PPI lead (Ms Helena Copsey). Further, IOM will host an in-person workshop at the end of the project to discuss findings, dissemination, and a larger application to evaluate upcoming active travel initiatives in Edinburgh.

6.3 Study steering committee

The study steering committee (SSC) of the TRAVEL study includes experts in the fields of active travel, air pollution, and intervention evaluation, including as Chair Dr Paul Kelly (University of Edinburgh), Dr Audrey de Nazelle (Imperial College London), Prof Rachel Aldred (University of Westminster), Dr Tom Clemens (University of Edinburgh), Peter Craig (University of Glasgow), Dr Georgina Santos (Cardiff University), and Dr Eric Deeson (member of the public).

The SSC will guide and provide oversight on project governance, timelines, and adherence to the protocol. The SSC will also ensure the research complies with data protection and confidentiality.

The SSC will meet twice virtually, and will also be invited to the final in-person meeting with the stakeholder group. A virtual option will be made available for those unable to attend in-person.

6.4 Data protection and confidentiality

The survey will be hosted on Civica's external survey platform, Alchemer. Alchemer provides an integrated feedback management platform for businesses of all sizes that enables them to collect and

operationalise feed. Alchemer has safeguards established to protect against physical access to customer data (see Privacy Policy of Alchemer).

The survey link will direct potential respondents to a webpage providing details on the survey and how their data will be used (i.e., the participant information sheet). As noted above, participants will need to provide explicit consent prior to entering the questionnaire.

The questionnaire data will predominantly be in the form of categorical data. None of the questions will collect personal, identifiable data. We will include a question about willingness to be contacted again for further research related to the LEZ, but will not be collecting email addresses or other contact information. Future contact of participants would be facilitated via the survey company who at present have their details. We will also include an optional, free text question for any additional comments/perspectives on the LEZ.

Civica will perform data cleaning and processing and will provide the survey dataset to IOM as a csv file. The data will be stored on IOM's secure server using OneDrive. Only IOM members of the project team will have direct access to the dataset. The Chief Investigator (Dr Mueller) will be the data custodian.

Civica will retain the dataset for a period of 6 months following project completion (i.e., until June 2025). These data may be used as comparator/reference data for a future study of the Edinburgh LEZ. As such, IOM will retain the data for 5 years following completion of the project (i.e., until December 2029).

We have already completed an internal data protection risk assessment and will ensure all aspects of data management, analysis, and storage are fully compliant with GDPR standards.

7 DISSEMINIATION POLICY

7.1 Dissemination policy

There will be three main research outputs from the survey: 1) infographic, 2) two-page simplified report brief and 3) presentation to the stakeholder committee (via an in-person meeting).

The infographic will provide a visual representation of the findings, which can be easily consumed by all parties interested and used to engage the public, as well as government, employers, and other researchers. These outputs will be shared across social media (e.g., Facebook) with a paid media campaign to target the niche audiences of those interested in green policy in Scotland. Previous campaigns have indicated this would generate 15,000-20,000 impressions. Aimed at other potential collaborators, the 2-page simplified report brief will summarise the findings, methodology, and audience targeted. This will support an understanding of baseline behaviour and opinions around the LEZ within the relevant groups. Presentations to stakeholder and study steering committees (SSC) will help refine and communicate dissemination material.

Since we will not be collecting personal or identifiable data from survey respondents, we will not be able to share directly with them the study findings.

A final report documenting all aspects of the study will be submitted to NIHR in January 2025, which will be publicly available.

8 REFERENCES

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9 APPENDICES

9.1 Appendix 1 – Amendment History

Amendment No.	Protocol version no.	Date issued	Author(s) of changes	Details of changes made
1	2.0	27/09/2024	Will Mueller	Minor edits made according to ethics committee feedback