Project Title: Research into the Safety of London Bus Passengers

Introduction

There were an estimated 5.04 billion bus passenger journeys in Great Britain (2015-2016), and a high proportion of these were made in the city of London (Department for Transport accessed 24/04/2017 https://www.gov.uk/government/collections/bus-statistics). In total, over 300 million vehicle miles are travelled by the London buses per annum equating to some 6 billion passenger miles per year. Over half the bus passengers in the UK are passengers of London buses with 1594 bus and coach occupant casualties reported by the Metropolitan Police Service (MPS) in 2015. These were categorised as one fatality, 70 seriously injured and 1523 slight injuries as defined within the STATS19 reporting system of 'Slight', 'Serious' and 'Fatal' casualties[1]. Other incidents with injuries not requiring police intervention are reported by London's Bus Operators to Transport for London (TfL) and published[2] on the TfL's website. In 2016, 6096 injuries were reported on London's contracted bus services ranging from those described as 'injuries treated on scene' to 'fatalities'. These figures suggest that many more injury incidents occur beyond the officially reported STATS19 data.

1. Project Objectives

The aims of the project are to (1) derive a better understanding of the nature and circumstances of injuries and how they can be prevented and/or mitigated; and (2) to provide an in-depth understanding of the safety issues which confront bus passengers in London and consider countermeasures to such safety challenges.

2. Project Deliverables

The outcomes from this project would be as follows;

- A quantitative analysis of bus passenger incidents in the Greater London area using the STATS19 and TfL databases to explore the nature and circumstances of injuries that afflict bus passengers in London
- A qualitative analysis of a representative sample of Bus Operator incident reports and interview data from passengers involved in incidents.
- Identify key causation factors in bus incidents and identify countermeasures to mitigate injury
- Dissemination of the results of the study to stakeholders of the transport system through seminars/ workshops and a bilateral one to one meeting with industry and TfL.

3. Road safety benefits to the road user community

Travelling by bus is relatively safe, as a proportion of the number of journeys that are taken in London. Nevertheless there are several thousands of incidents that result in reported injuries. It is thought that in addition to reported injuries, there may well be other incidents that go unreported. A better understanding of the causes of these injuries would allow the development of countermeasures to potentially benefit service providers, transport planners, design engineers, local authorities and policy makers to ensure confidence in the safety of public transport ultimately benefitting and enhancing the quality of life of bus passengers.

[1] http://content.tfl.gov.uk/casualties-in-greater-london-2015.pdf
[2] https://tfl.gov.uk/corporate/publications-and-reports/bus-safety-data

4. Research Methodology including ethical and privacy issues

The project will use a mixed methods approach to the problem that will include analysis of 'STATS19' data, TfL data, a sample of bus incident reports (collected by London bus operators) and interview data from bus passengers. It is hoped that CCTV footage of the sampled incidents will also be available to analyse. Data sources are presented in table 1 together with the associated partner responsible for sourcing the data and analysis.

The methodology steps that will be taken are as follows;

4.1 Quantitative methods

In the first part of this study, a study design is proposed which uses quantitative methods to analyse bus passenger injury causation. The study will analyse STATS19 and TfL data covering the most recent 5-year period for the London geographical area.

4.1.2 Analysis of STATS19

- To analyse casualty trends amongst occupants of bus and coaches within the London area.
  Key variables that will be analysed include (but not exclusively), collision partner (if any), accident severity, casualty type and injury severity, weather, time of day, road type, speed limit, driver age, passenger location / movement, age, gender
- To analyse a linked dataset of STATS19 and Health Episodes Statistics (HES) data (if permissions are granted to explore injury severity further for bus/coach passengers and 3rd party casualties)

4.1.3 Analysis of TfL data

- To analyse casualty trends in occupants of bus and coaches within the London area.

4.2 Qualitative methods

In the second qualitative phase of the study the data to be analysed include incident reports of bus accidents, on board CCTV and narrative data from interviews conducted with bus passengers involved in incidents. Content analysis will be used to determine key factors that were relevant during bus incidents as identified in the Bus operator reports and interview transcripts.

A representative sample of bus incidents investigated by the Bus operator will be analysed using a systematic case review exploring common cause patterns and identifying potential solutions to reducing incidents and injuries(n=600 ~10% of TfL reported cases). Where CCTV is available 10% of the 600 cases (n=60) incidents will be reviewed in detail to explore injury causation additional to the written reports. It is expected that the Bus operator will be willing to provide incident cases and CCTV to researchers at Loughborough University. Confidentiality will be essential and if necessary the cases can be anonymised before being analysed.

Bus passengers previously involved in an incident will be approached via the Bus operator to invite them to take part in an interview about their experiences of the incident on the London bus network. Those potential participants will be screened and a representative sample selected to undertake a semi-structured interview. The sample will be selected to ensure a distribution of age / gender / injury severity and road user type. It is expected that 60 interviews will be conducted (10% of the 600 case reports). Interviews will be conducted over the telephone by an experienced researcher from Loughborough University. All

participants will provide informed consent and interviews recorded, transcribed and qualitatively analysed using NVivo software. It is expected that these interviews will provide rich additional information about the incident from the perspective of the passenger beyond that which can be analysed in the standard reports within the STATS19 or TfL reporting systems.

5. Ethical and privacy issues

The study does have ethical considerations with regarding privacy and anonymity of data given that incident records will be accessed. Loughborough University is familiar with guidelines and procedures that govern ethical issues and these will be strictly followed. If required data sharing agreements will be drawn up between Loughborough University and the bus operators, DfT (STATS19) and TfL (TfL data) to use and analyse the data. Loughborough University researchers have extensive experience working with Police Forces and coroners on confidential crash data and have signed a number of data sharing and confidentiality agreements to access and analyse the data. They also have experience working with STATS19 and HES data and the associated agreements that enabled them to use the data.

6. Proposed Methods and timetable for evaluation of the achievement of the project's objectives and impact

The project plan is presented in figure 1 and will span 10 months. It is expected that recommendations to mitigate injuries and incidents will be proposed in discussion with the Bus operators / Industry and TfL based on the presentation of the results at the seminars organised by London TravelWatch.

7. Knowledge of the relevant literature or practice

The Loughborough University project team has recently conducted a Medical research Council (MRC) funded study to explore injuries of older bus passengers and the exploration of design solutions to mitigate injuries whilst using the bus (Barnes et al 2014 & 2015; Fildes et al 2012). A systematic review was also conducted and identified that most injuries to passengers on buses are a result of non-collision incidents with older passengers' particularly vulnerable (Kendrick et al 2015).The team have experience in analysing STATS19 data and have recently completed an in-depth case study exploring TfL cycling fatalities which proved to be a valuable method to understand all aspects of the fatal incidents beyond root cause analysis (Talbot et al, 2016).

8. Project structure and management

The study will be managed by Dr Jo Barnes at the Loughborough Design School at Loughborough University; she has experience in managing research projects including the MRC older public transport user study, EU funded Belarussian Road Safety Project and a recently completed CLHARC funded Impact of Injury Study.

LondonTravelWatch will facilitate meetings with bus operators and negotiate access to data for analysis. London TravelWatch will facilitate two seminars to disseminate the findings to a wide cross section of the bus industry.

The distribution of activities can be seen in table 1.

9. Experience of the Research Team

Loughborough University has the experience in accident investigation and analysis, injury biomechanics, and human factors. The team at Loughborough University will include the expertise of Professor Andrew Morris and Ms Ruth Welsh Senior Researcher who have the skills and experience to conduct the study. The team are part of the Transport Safety Research Group and have 35 years' experience in transport ergonomics and human factors, product design evaluations, accident investigation and Field Operational Tests. The TSRG has undertaken several studies in the area of passenger safety in Public Service Vehicles (PSV's) in which it has been found that many injuries are caused during non-collision incidents. Such studies have raised the awareness of the need to change bus design for injury prevention.

10. Innovation

To date as a road user group bus passengers are under studied despite presenting as a large casualty population for TfL. Recently TfL have undertaken a study looking at past fatality files, but the incidents of passenger fatalities are very small and so the data will not be representative of the numerous incidents resulting in less severe injury. The benefit of this study will be accessing bus operator data which is more detailed and will provide an excellent source for understanding injury incidents on buses leading to potential countermeasure solutions. We know of no current independent research investigating bus passengers.

11. Partnership working

London TravelWatch is an independent statutory body that works on behalf of, and represents transport users in London, with a particular remit with respect to the operations of Transport for London (TfL). London TravelWatch has many years of experience working with the strategic transport providers: TfL, the rail industry, bus operators; local and regional government and the Department for Transport.

The project team has met with TfL who have offered support for the project, particularly as this work complements some that they are undertaking at present looking primarily at non-bus occupant fatalities.

The Transport Safety Research Group (TSRG) at Loughborough University has extensive experience of real-world accident research and accident investigations. It has been involved in several Department for Transport (DfT) funded projects including the Co-operative Crash Injury Study (CCIS) from 1983 until 2010 and the On The Spot (OTS) study during the years 1999 to 2010. More recently, the TSRG was a partner in the Road Accident and In-Depth Studies (RAIDS) project. Through its involvement in these projects, the TSRG has developed the experience and expertise in investigating and working with data from a wide range of crashes with a range or injury outcomes from "Non-injury" to "Fatal" crashes. The Group also has a well-established capability to identify injury and crash causation factors. The TSRG has applied in-depth crash data to policy-making or policy implementation in many projects for client or academic purposes. Topics of relevance have included the Older Public Transport Users project on behalf of the Medical research Council (2012 to 20014) which looked at the factors that prevent older people using buses. The TSRG has also undertaken several projects on behalf of the Department for Transport which used Police Fatal Accident Reports for studies including buses, coaches and minibuses and collisions involving child occupants.

12. Plans for dissemination and/or publication

The results of the research will be published as a final report and where appropriate a paper submission to a conference or journal. London TravelWatch will use the output from this work to promote change by TfL, the bus operators and the manufacturers. London TravelWatch will undertake to run two seminars/workshops involving the bus industry and manufacturers. London TravelWatch will use the findings of the research to inform its ongoing work to improve services to bus passengers in London.

13. Next steps - e.g. further development, replication of results, roll-out or the potential for sustainability.

The results from this research would be expected to ascertain clear gaps in the official statistics collated by STATS19 and those published by TfL in terms of numbers, injury severity and potential causes of incidents. Furthermore using actual incident data will hopefully provide useful data to enable a deeper understanding of bus incidents and passenger kinematics in incidents that can be used to develop countermeasures to mitigate injury. The study is only looking at the London area however the findings should be relevant to other geographical areas in the UK and other bus operators. Implementation of countermeasures is expected to reduce the incidence of passenger injuries which would need evaluating once they had been in place for a period of time.

14. Financial aspects, including a clear breakdown of costs and the proportion of total cost requested from the Trust

The research study will cost £44,946 with a breakdown presented in table 2, it is envisaged that 81% (£36,500) of the costs will be funded by the Road Safety Trust.

References

Barnes, JS, Morris, AP, Welsh, R, Summerskill, S, Marshall, R, Kendrick, D, Logan, P, Drummond, A, Conroy, S, Fildes, B, Bell, J (2015) Injuries to older users of buses in the UK, Public Transport, 8(1), pp.25-38, ISSN: 1866-749X. DOI: 10.1007/s12469-015-0113-8.

Barnes, J and Morris, A (2014) Injuries to Older Users of Public Transport - A Neglected Problem, Traffic Injury Prevention, 15(Supplement 1), pp.S245-S247, ISSN: 1538-9588

Talbot, RK, Reed, S, Barnes, J, Thomas, PD, Christie, N (2014) Pedal cyclist fatalities in London: analysis of police collision files (2007-2011), pp.1-138, Transport for London.

Fildes, B, Morris, AP, Barnes, J (2012) Analysis of injuries to young and old Victorian public transport users: 2006-2010, pp.1-33, Monash University, ISBN: 0732623898.

Kendrick, D, Drummond, A, Logan, P, Barnes, J, Worthington, E (2015) Systematic review of the epidemiology of non-collision injuries occurring to older people during use of public buses in high-income countries, Journal of Transport and Health, 2(3), pp.394-405, ISSN: 2214-1405. DOI: 10.1016/j.jth.2015.06.002.

Appendix

Table 1; Data sources to be explored in the project

Data Source	Availability	Source partner	Analysis	Data
STATS19	Available on request	Loughborough	Quantitative - Loughborough	Year 2012-2016
TfL	Available on request	London Travelwatch	Quantitative - Loughborough	Year 2012-2016 (or what is available)
STATS19+HES data	Potentially available on request (DfT) permissions required	Loughborough	Quantitative - Loughborough	Available years if permission granted
Bus operator data – incident reports	Potentially available on request	London TravelWatch	Qualitative - Loughborough	~600 cases (represents 10% of TfL reported cases in 2016)
Bus operator CCTV – video analysis	Potentially available on request	London TravelWatch	Qualitative - Loughborough	CCTV for 10% of these cases (n=60) if available
Bus passenger - Interview data	Access required via bus operators	Loughborough conduct interviews	Qualitative – Loughborough	~60 case interviews (10% of the case reviews)

Figure 1; Timetable to meet project objectives

	Month									
	1	2	3	4	5	6	7	8	9	10
Bus data sharing access										
Data analysis - STATS19; TfL;HES?										
Case studies - reports										
Case studies - video										
Interviews										
Qualitatitve data analysis										
Report writing										
Semimars										

Table 2; Financial breakdown of project costs

Description	**% time on project**	**Cost**
Requested funding from the Road Safety Trust		
Research Associate, Loughborough University	51%	£18,000
Prof Andrew Morris, Loughborough University	14%	£4,500
Dr Jo Barnes – Manager Loughborough University	35%	£12,000
Travel costs		£1,000
Dissemination costs (Two industry seminars)		£1,000
Total grant requested from RST (A)		**£36,500**
In-kind Support/additional funding		
Vincent Stops, London TravelWatch		£4,446
Grant – London TravelWatch		£4,000
Total In-kind Support/Additional Funding (B)		**£8,446**
Total Project Costs (A) + (B)		**£44,946**

CV Professor Andrew Morris

Dr Andrew Morris
Professor of Human Factors in Transport Safety

Qualifications:
PhD - University of Birmingham (1997)
MSc(Eng.) - The University of Birmingham (1989)
BSc (Hons) - University of York (1988)

Career to Date:

2013 to present	Professor of Human Factors in Transport Safety
2007-2013	Reader in Vehicle Safety, Loughborough University
2001-2007	Senior Research Fellow, Loughborough University
1999-2001	Senior Research Fellow, Monash University, Australia
1997-1999	Research Fellow, Monash University, Australia
1995-1997	Research Analyst, Loughborough University
1989-1995	Research Associate, University of Birmingham

Relevant Work Experience:

- Management of Jaguar Ltd On-Scene Pedestrian and Cyclist Accident Investigation study in city of Nottingham (March to May 1999)
- Management of On-the-Spot pilot study and OTS protocol Development (May 1999 to Sept 1999)
- Development and Management of the Australian National Crash In-depth Study (ANCIS - September 1999 to November 2001)
- Management of Holden Vehicle Design for Pedestrian protection study (including EuroNCAP testing - 2000)
- Management of PENDANT accident investigation study including collection of data on 1,100 real-world crashes within the EU (2003 to 2006)
- Management of SafetyNet WP5 which included development of two accident databases (2004 to 2008)
- Leadership of Loughborough input to TeleFOT project (EC FP7) evaluating driver performance in relation to nomadic devices (2008 to present) – leadership of Sub-project 4 (Data Analysis and Interpretation of FOT data relating to driver behaviour)
- Leadership of DaCoTA WP2, Development of Pan-European In-depth Accident Investigation infra-structure
- Leadership of Loughborough naturalistic driving and driver behaviour trials including contributions to PROLOGUE and DaCoTA WP6 projects

Professional Esteem Measures and Awards:

- International Peer Reviewer for Abu Dhabi Fatal Accident Study
- International Peer Reviewer for Australia Enhanced Crash In-depth Study (ECIS)
- International Peer Reviewer for Australian and Portuguese Research Councils
- Visiting Professor at Hasselt University, Belgium
- Awarded US Government Special Award of Appreciation in recognition of outstanding leadership and special contributions in the field of motor vehicle safety (June 2009)

Publications

Barnes, J, **Morris, A**, Welsh, R, Summerskill, S, Marshall, R, Kendrick, D, Logan, P, Drummond, A, Conroy, S, Fildes, B, Bell, J (2016) Injuries to older users of buses in the UK, *Public Transport*, 8(1), pp.25-38, ISSN: 1866-749X. DOI: 10.1007/s12469-015-0113-8.

Marshall, R, Summerskill, S, Case, K, Hussain, A, Gyi, D, Sims, R, **Morris, A**, Barnes, J (2016) Supporting a Design Driven Approach to Social Inclusion and Accessibility in Transport, *Social Inclusion*, 4(3), ISSN: 2183-2803. DOI: 10.17645/si.v4i3.521.

Barnes, J and **Morris, A** (2014) Injuries to Older Users of Public Transport - A Neglected Problem, *Traffic Injury Prevention*, 15(Supplement 1), pp.S245-S247, ISSN: 1538-9588.

Barnes, J, Lawton, C, **Morris, A**, Marshall, R, Summerskill, S, Kendrick, D, Logan, P, Drummond, A, Fildes, B, Conroy, S (2013) *Improving Safety for Older Public Transport Users (OPTU) - A Feasibility Study*, pp.1-260, Medical Research Council.

CV Dr Jo Barnes

Dr Jo Barnes

Lecturer

Qualifications:

PhD - Loughborough University (2006)
Master of Medical Science (MMedSci) - Birmingham University (1997)
BSc (Hons) Nursing Studies - University of Central England (1993)
Registered General Nurse & Diploma in Nursing Studies - Birmingham Polytechnic (1989)

Career to Date:

2016 – present	Lecturer, Loughborough University
2012-2016	Research Associate, Loughborough University
2005-2012	Medical Data Services Manager, Loughborough University
2001-2005	PhD Student, Loughborough University
1999-2001	Research Fellow, Monash University, Australia
1998-1999	Branch Manager, LPNS Ltd, Leicester
1997-1998	Project Officer, National Heart Foundation, Melbourne
1994-1996	Project Nurse, Regional Rehabilitation Centre, Birmingham
1989-1994	Staff Nurse, Accident & Emergency, Birmingham General Hospital

Relevant Work Experience:

- Management of research studies within the Design School, Impact of Injury Study (IIS), Older Public Transport Users (OPTU), TEMPUS – developing Masters Programmes in Road Safety in Belarus (BeSafe).
- Other projects include SafetyCube EU funded project WP7 conducting analyses for serious road traffic injuries at the MAIS3+ level
- Management of data collection team responsible for provision of medical data for the Transport Safety Research Centre's CCIS and OTS project groups.
- Previous experience of setting up large-scale in-depth Crash Research project in Australia (Australia National Crash In-depth Study, ANCIS), this involved deputising as management of a team of 10 comprising engineers and research nurses

Membership of Professional bodies and Awards:

Fellow of the Higher Education Academy
Member of the AAAM Injury Scaling Faculty
Reviewer for the following journals of 'Injury', 'Traffic Injury Prevention'

Relevant publications

Barnes, JS, Morris, AP, Welsh, R, Summerskill, S, Marshall, R, Kendrick, D, Logan, P, Drummond, A, Conroy, S, Fildes, B, Bell, J (2015) Injuries to older users of buses in the UK, *Public Transport*, 8(1), pp.25-38, ISSN: 1866-749X. DOI: 10.1007/s12469-015-0113-8.

Kendrick, D, Drummond, A, Logan, P, Barnes, J, Worthington, E (2015) Systematic review of the epidemiology of non-collision injuries occurring to older people during use of public buses in high-income countries, *Journal of Transport and Health*, 2(3), pp.394-405, ISSN: 2214-1405. DOI: 10.1016/j.jth.2015.06.002.

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Talbot, RK, Reed, S, Barnes, J, Thomas, PD, Christie, N (2014) *Pedal cyclist fatalities in London: analysis of police collision files (2007-2011)*, pp.1-138, Transport for London.

Full list of Publications:

http://publications.lboro.ac.uk/publications/all/collated/hujb3.html

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CV Vincent Stops

Vincent Stops

Qualifications
MSc, Manufacturing Management
BSC, Chemistry and mathematics, University of London

Career to date

2000 to date:	Policy Officer, London TravelWatch
1999 to 2000:	Temporary posts working for the Department of Transport and Department of Education at Executive Officer grade
1997 to 1999:	General Manager, Milton Keynes Recycling Facility, for Community Recycling Opportunities Programme Ltd
1983 to 1997	Manufacturing Manager, BHC Electronic Components Ltd

Relevant work Experience
Policy Officer, focussing mainly on the consumer and user issues of London's public transport and London's streets.