Residential through traffic: quantitative evidence from participant observation

Abstract

Concerns about the effects of traffic levels on the life of neighbourhoods are very common. This paper uses participant observation to show how one community was able to organise and administer traffic surveys to obtain quantitative evidence of their impact, discussing the advantages and limitations of this “do-it-yourself” approach. The role of through traffic and in particular its presence in residential one-way streets merits further research.

Aims and Background

This study uses participant observation to examine a community-designed approach to quantifying the nature of through traffic in a neighbourhood within the city of Bristol, UK.

Following a brief overview of the socio-political context, this paper first seeks to understand the symbolism of through traffic for place-based communities, then describes how in a specific context a need arose to substantiate and quantify its assumed effects. Thirdly, some of the advantages and limitations of the DIY cordon survey method are discussed in assessing the impact on the suburban neighbourhood. In this context, potential solutions to through traffic through the use of “filter points” is discussed.

In 2016 a group of residents of the neighbourhood formed a campaign in response to perceived “rat running” on a specific street in north Bristol, i.e. traffic taking shortcuts through the residential area instead of using a longer route on main roads:

As Dongola Road is used as a “rat-run” there are many instances of vehicles meeting partway down the road and unable to pass due to its narrowness and a shortage of available passing spaces (SAFER Roads, 2016a).

Initially the group advocated this street be converted to one-way traffic in order to avoid these “face-off” confrontations; however following publicity through local newsletters, the campaign soon attracted interest from residents in neighbouring streets. It became clear to the group that a simple solution focused on one street would not be sufficient:

The Bishopston and Ashley Down Traffic Campaign has developed out of the original Dongola Road "One-Way" campaign to put pressure on Bristol City Council (BCC) to conduct a survey and residents' consultation to address traffic issues in the matrix of roads between encompassed by the junctions of Ashley Down and Gloucester Road (SAFER Roads, 2016b).

The community perspectives

Socio-political context

This study focuses on a small neighbourhood of streets within the suburb of Bishopston, an area in the city of Bristol in the South-west of England. Bristol’s population is approaching 450,000 residents with a relatively prosperous economy including in advanced and low carbon technologies, aerospace, creative and media and higher education (Invest Bristol and Bath, 2016).
The study location within Bristol is shown in Figure 2 (starred). This is also shown in more detail with the boundary of the area of interest shown in black and an area corresponding to two relevant sets of data from the 2011 census is shown shaded (Figure 1).

The study area is within the local government ward of Bishopston, a suburb of 12,431 people in north Bristol. The area is above the UK and Bristol means for proportions of working age people, educational and health indicators, car availability and household size (ONS, 2011); large mean household size is thought to be due to a large student population.

The two shaded areas in Figure 1 correspond to Lower Super Output Areas from the national census and offer a reasonable fit with the study area. In the 2011 census there were 1,183 households and 1,462 vehicles in this area, a ratio of 1.24 vehicles per household (Bristol mean=1.04; England mean=1.16). Population density was comparable with inner London suburbs (106 persons/ha²; Bristol=39.1; England=4.1).

Politically, the area elected local representatives from the Labour and Green parties in 2016. The area can be said to have an active community, with a large number of community groups and activities. Various issues have energised community engagement, such as local advocacy groups against supermarket expansion and other forms of perceived over-development (TRASH, 2015; HOWZATGCC, 2016). Nearby Gloucester Road is well known for its concentration of independent shops (Independent, 2004).

Bristol has historically leaned towards centre-left politics, with the Labour party’s post-war majority in local politics punctuated by occasional successes for smaller parties such as the centrist Liberal Democrats and more recently the Green Party, plus the election of an independent, progressive and liberal mayor in 2011.
Beyond party politics, there has been considerable discussion regarding the functions and fitness of the city’s transport systems (Bristol Post, 2016 a; Key, 2015). This is in the context of long-standing debates regarding the perceived lack of ability to move goods and people quickly and effectively (Bristol Post, 2015a), and whilst debates between the “rights” of the motorist versus the need for a liveable environment are hardly unusual, some of the policy responses have been more innovative in a UK context; for example, the former Mayor’s initiatives to “Make Sundays Special” by “freeing city centre streets of traffic once a month, allowing people to enjoy street markets, entertainment, games and sporting activities and attracting many more visitors” (Bristol City Council, 2012). Such instruments are well established in other European cities (Ville de Bordeaux, 2016; Stadt Hannover, 2016), however recent interventions such as residents parking schemes, reduced urban speed limits and pro-cycling policies can be seen as partial successes only. The “shocks” experienced following introduction of such policies within a short timeframe, in comparison with the years spent gradually constructing a progressive consensus on transport policies in other European cities, may have contributed to the independent Mayor’s failure to secure a second term in the 2016 election.

Parking issues have been a theme of many of these campaigns, and there is some evidence that parking issues have been exacerbated by the introduction of Residents’ Parking Zones, restricting parking in neighbouring areas (Bristol Post, 2016 b). In an economy sustained by rising house prices, the affect heuristic of the buyer may be the bellweather judgement on the desirability of high levels of traffic, a perspective supported by the observed effect on property values following its removal (Ossokina & Verweij, 2015).

**Issues underpinning the advocacy group**

Rat-running, vehicle speeds and volumes and narrowness or otherwise unsuitability of roads for general traffic were all identified by the group as issues requiring action. Whilst several studies relating to through traffic have focused on the economic and quality of life metrics of city centres (Fisch, 1975; Blunt, 2004), there is little in the academic literature pertaining to its effects on suburban residential areas. A policy differential frequently exists between local and regional government priorities in balancing quality of life with mobility (De Borger & Proost, 2013) but such conflicts may be less important for city centres, assuming that their residents have not opted for the quiet life. Therefore, it seems important to consider these negative effects on communities which are more strongly grounded in place.

A variety of factors could be encouraging “rat runs”, from the ubiquity of Satnav systems encouraging drivers to take shortcuts (De Baets, et al., 2014) to increasing congestion levels on neighbouring arterial routes and junctions. Significant housing “intensification” has occurred within and adjacent to the study area and Melia (2016, p. 107) has argued that while urban intensification is linked to reduced propensity to drive, it can also result in increased traffic density due to there being a higher density of car owners in an area.

The group’s original suggestion of converting streets in the area to one-way traffic was related to the experiences and frustrations, anecdotal or vicarious, of “face-offs” – where vehicles meet each other on a road which is narrow (or narrowed due to parked cars). There was some debate within the group about the merits of this however, raising fears that this would encourage greater traffic speeds and volumes. While Riggs and Gilderbloom (2015) found evidence of increased traffic flow following conversion to two-way, several other ancillary benefits were noted, although this related to wide boulevards. Meng and Thu (2004) also noted improved traffic flow for one-way streets, but hypothesised that effects on pedestrians wishing to cross the road would be negative. Wazana et al (2000) found a statistically significant higher child injury rates on one-way compared with two-way streets.
The group also expressed interest in physical measures that could restrict the movement of through vehicular traffic, i.e. filtered permeability. Filtered permeability (Melia, 2012) can be considered a progressive development of Buchanan’s concept of traffic cells (or sometimes, “environmental cells”); which have been accused of “breaking the city into cells…surrounded by central ‘arteries’ like islands in an fragment urban sea…residents’ direct contract and involvement with one another, which in the past came about through movements on foot, will be severely disturbed” (Holzapfel, 2015, p. 54). In contrast, filtered permeability seeks to filter out through traffic using calming measures or closing roads to motorised traffic, together with securing a fine grain walking and cycling network. However, neither approach seeks explicitly to remove car access for non-through traffic, which as we shall see is likely to constitute the majority of vehicle movements in residential areas.

**Ownership of spaces and places**

Filtered permeability can define the boundaries of traffic cells, thus creating attractive walk and cycle friendly enclaves; however motorised mobility modes can be displaced, or even concentrated, elsewhere, resulting in “non-places” which are “surrendered to solitary individuality, to the fleeting, the temporary and ephemeral”. With increasing mobility, non-places gradually supplant places and so residences are diminished by those in transit; travellers become drivers and passengers; and crossroads become interchanges (Augé, 1995). In non-places, the chances of place-based social interaction is diminished. Elaborating further on the concept, Freudendal Pedersen (2009) employs Shane’s (2005) description of armatures and enclaves as spaces devoted to flows and their centering devices respectively, to describe a tendency for individuals to live increasingly in enclaves, whereby the car then acts as “an enclave in the middle of armatures...a cocoon using non-spaces. It is in these cocoons that social interaction takes place”. Freedom to create one’s own social spaces within the cocoon risks “a contradictory relationship with community”. However, in responding to this threat, the non-mobile community, created in “anthropological place” (Augé, 1995) “has a number of different options in which the emergence of a strong ‘we’ can be created… if one, in addition, has a common project, a goal for the future which is dependent on the other group members’ effort to succeed, it helps tremendously. And if one furthermore can plead a common enemy… then everything is laid out for a strong and solidarity we-feeling” (Freudendal-Pedersen, 2009, p. 85).

Thus the place-based community may seek to portray those who engage in anti-social driving behaviour as outsiders; for a community whose identity is linked to a particular place, the ‘out group’ must physically belong outside the area:

“Of course, we all do it [rat-running], I know I do when I’m driving around Bristol, that’s not the point. But the problems come when people are driving through and they don’t belong to the area, they don’t feel invested in it” (SAFER Roads, 2016c).

In Bristol, with its strong undercurrent of independent thinking, “imposed” solutions such as residents parking schemes are met with scepticism if not hostility, although positive views may emerge once they are in place (Bristol Post, 2014; 2015b).

**Why participant observation?**

The origin of this study came about through contact between the author and the SAFER Roads campaign. The advocacy group had sought out individuals with knowledge of traffic issues and how to quantify them within the local community. For this group, the co-design of survey methods was an attempt to obtain objective, quantifiable evidence to submit to local authority officers. This developed into the concept of a
“study within a study”, looking not only at the outcomes of the quantitative methods but how the community helped design these processes.

Therefore from the very start, the author was engaged in the dual role of participant and observer, “reacting to and interacting with others in the events and situations that unfold” (Dewalt & Dewalt, 2002, p. 17). This involves neither pure observation (objective gaze) nor pure participation (“going native”) but a necessary blend of both.

Whilst use of participant-observation studies in the field of transport and mobility are not unknown (Rogalsky, 2010) these generally involve the informants being the subject, rather than co-creators, of the methods yielding quantitative data. For the purposes of this study the survey can be seen as insights into how a community advocacy group shapes itself around the task of obtaining such data and employing it effectively.

**The “DIY” survey method and its challenges**

One of the key issues facing the group was: how can a group of willing volunteers build evidence on the effects of through traffic with no budget and limited expertise? With contribution from the author, the group decided to design programmes of data collection from cordon surveys and parking beat surveys. The former are often designed to provide origin-destination pairs (through selective roadside interviews) or make use of Automatic Numberplate Recognition (ANPR) cameras at fixed points to determine vehicle flows.

While cordon counts are useful in obtaining objective evidence, residents’ concerns on issues such as vehicle speeds and “through traffic” in urban areas are more likely to be accurately gauged through face-to-face surveys (Hine, 1996).

Without the resources to employ expensive survey methods, the group engaged its informal membership through Facebook to survey vehicle movements at all nine key junctions forming the boundary of the study area during the summer of 2016 (2016b, Figure 3). Surveyors were to record all vehicles entering and exiting the area for a one hour period, which were a mixture of morning peak (8-9am), evening peak (5-6pm) and weekends (12-1pm Saturdays). This was done by recording the three alphabetical characters on car registrations (which are generally sufficient to uniquely identify a vehicle in the UK); whether the movement was an entry (N) or exit (X) from the area; and the time of day. Thus vehicles travelling through the area without stopping could be identified by an entry followed an exit at a different location within a short period.

Despite the surveyors’ enthusiasm for the task these individuals were unpaid and untrained, and consequently the survey process became a learning exercise for the group. Initial surveys were invalidated due to individuals not turning up or in one case attending to a minor road traffic accident during the survey period. Surveyors sometimes were unable to record all movements when vehicle flows were heavy. Partial losses of data through events like these were deemed to have invalidated the survey at the time of their occurrence, at least for the purposes of determining proportions of through traffic.

Learning from this, the group developed a more disciplined approach through comprehensive guidance and checklists to ensure the surveys were completed successfully. One or more “floaters” were considered necessary to act as coordinators on the day and to ensure that all survey points were covered (including in the event of any participants not turning up). Learning as a result of such issues is evident in a sample of the email communications shared by the group in Appendix 1.
To supplement this cordon data, parking beat surveys were also conducted. This involved repeated surveys of the ‘beat’ area in figure 2, recording the three registration plate characters for all parked vehicles (including those parked in driveways where possible). Surveys were conducted on subsets of the street network over a repeated period until the number of “new” vehicles seen across the area (i.e. those unseen in previous parking beats) was below $X\%$, indicating that $Y\%$ of vehicles which park in the area at some point during the day were recorded. Beats were also conducted at a variety of times, including weekends and evenings, to ensure maximum coverage. Therefore at the completion of the parking beat surveys, the probability of encountering a vehicle not previously seen was $X\%$. The existence of “churn” as a result of people moving house or purchasing a new or replacement vehicle meant that this figure would tend to some non-zero value.

Analysis of the data by the author also enabled calculation of mean vehicle speeds across the area. Whilst it was assumed that these times were accurate across different cordon points thanks to the requirement that surveyors “synchronise watches” we can expect that the time for vehicles to travel through the area is accurate only to the minute. Nonetheless it was hoped that for a large sample size, valid statistical tests could be performed to calculate mean speeds for each O-D pair surveyed.

Survey results – through traffic

Despite the initial difficulties, over 4½ hours of valid survey data were obtained, consisting of simultaneous entry/exit data recording at all nine survey locations. On several occasions one or more locations were unable to record and this imperfect data was removed for the duration of the interruption from all other survey points.

In total, 4,147 vehicle movements were recorded. Analysis of the data indicated that 783 vehicles (19%) were “through traffic”, defined as those entering and exiting the area within four minutes during the survey period.
**Vehicle speeds**

As previously discussed, a significant limitation of the method when applied to calculating speeds of through traffic is that entry and exit times were recorded in discrete one minute intervals, i.e. accurate to half a minute. Hence assuming all surveyors followed the instruction to synchronise watches (to Internet time), up to 59 seconds error could be added or subtracted to the time taken for a given vehicle to travel the link. At the extremes, for the shortest link within the survey area (138m) a vehicle travelling at a nominal speed of 2m/s taking 69 seconds could theoretically be recorded as taking 9.5s or 128.5s. The generalised formula describing the minimum and maximum speed $V$ calculated by two surveyors located distance $D$ apart over time $T$ is:

$$V_{\text{min}} = \frac{D}{T + 59}; \quad V_{\text{max}} = \frac{D}{T - 59}$$

This limitation in recording accurate times could of course be overcome through use of automated recording methods, and whilst resource limitations meant these were not readily available to this study, one possibility for future “do-it-yourself” surveys could be to use video recording at each cordon location.

Actual survey data across all survey days is plotted in Figure 4, indicating calculated mean speeds. A number of linear relationships are shown, corresponding to the discrete one minute recording intervals, clearly highlighting the errors inherent in this method.

The mean speed calculated across the area is $4.59 \pm 0.31$ m/s ($s=2.77$, $\alpha=0.05$).

It is noteworthy that the most heavily trafficked link in the area is also the only one-way street, where a priori we would expect the lack of oncoming traffic for individual vehicles could result in more consistent and possibly higher vehicle speeds. Due to the limitations of the data, no differences could be demonstrated for vehicle speeds on one-way versus two-way streets in this study.
Figure 4 - Calculated link speeds and linear relationships with discrete recorded time intervals

Community response to empirical results
Following the analysis of the survey data, the advocacy group met to discuss how it could use the data to achieve its objectives. 19% of vehicles observed in the surveys were using the area as a “rat run” and so the group was keen to look at management proposals that could reduce this traffic.

At the time of writing, one option being considered is to introduce a series of ‘filter points’ close to the survey locations shown in Figure 3 that would restrict movement to one-way at those points (Figure 5). As an alternative to introducing one-way systems these filter points act to reduce the ability of traffic to ‘cut across’ the area between the major roads to the north-east and the west since vehicles are inhibited from entering from one major road and exiting to the other. The small red line cutting across a crossroads (highlighted by a larger arrow) prevents straight-on movements at this junction, which is on the link which experienced the highest proportion of through traffic flows (32 vehs/hr). An example of a similar arrangement on a residential street in Sheffield, UK is shown in Figure 6. Whilst this scheme restricts the number of exit points from the area to just two, analysing survey data indicates that these exit points would experience a reduction in hourly am peak flows due to the restrictions on through traffic. This does not take into account any potential demand-suppression effects on trips originating from within the area resulting from the filter restrictions.

Assuming the group does agree on a solution, many questions remain unanswered about how any neighbourhood-wide treatment could be afforded. At an informal meeting of the group in July 2016 a representative from the local “neighbourhood partnership” which includes a remit to decide priorities on local traffic issues, highlighted the local authority’s proposal for dealing with similar issues of rat-running and face-offs on a street just outside the SAFERoads study area. The local authority’s two alternative proposals were to introduce signage and markings encouraging cautious driving, or to convert the street...
to one-way. Costs to the local authority are understood to be approximately £5,000 to design the proposals and £20-30,000 to implement. Where public funds are limited, the costs of such top-down approaches contrast sharply with SAFERoads DIY methods, from survey through solution design to possible implementation.

Figure 5 - proposed filter points (arrow direction indicates mandatory direction of vehicles)
Discussion

The planning and execution of area-wide qualitative traffic surveys are challenging activities for local residents to undertake, but if managed successfully can provide motivation and overcome financial and bureaucratic obstacles often present when residents interact with traffic authorities. Whilst momentum has been building for some time for early citizen participation and engagement in sustainable transport planning, citizen engagement on the most local issues rarely reaches the top rungs of Arnstein’s “ladder” of participation (Lindenau & Böhler-Baedeker, 2014).

The cordon surveys undertaken by the citizen advocacy group in this study can be seen as successful in quantifying levels of through traffic. Lessons were learned that could prove helpful to other citizen groups in determining vehicle speeds through an area, which this study failed to quantify.

Participation in the survey process can be seen as a form of empowerment for the citizen group and to that extent may have motivated and encouraged further engagement. These shared experiences could also contribute to the socially constructed ‘we’ feeling of belonging to a place-based community, with survey participants standing at the area boundary symbolically acting as a human equivalent of gateway treatments.

The participant-observer approach enabled the co-design of these new approaches to survey methods, whilst allowing close observation of the group’s approaches to design, execution and interpretation of the surveys in contributing to the citizen group’s aims.

Figure 6 - filtering of vehicular traffic to prevent straight-on traffic movements, Sheffield. © Google Maps
Appendix 1 – briefing correspondence and guidance for cordon surveys

From: [redacted]
Sent: 07 July 2016 10:38
To: Sue; Richard; Steve Ward; Jon; Tony; Steve; Richard; Jodie; Jo; Mick; Jo
Subject: CORDON SURVEY SCHEDULE Thurs pm
Attachments: Cordon Survey Brief Jun-Jul.pdf

Hi all,

As there seemed to have been some miscommunication yesterday, so just in case, I’m re-sending this.

Please email or text me to confirm you’re OK for this afternoon.

Just a few pointers:

- text Steve in the 15m prior to start
- leave your phone on (and answer it)... inform Steve of any problems
- monitor until 4 MINUTES PAST the end time (this will trap cars 'in the system')
- record any 'face-offs' between oncoming vehicles (I just bracket the reg nos and annotate with "FO")
- do 5 bar gates of cyclists (and note any on the pavement)
- drop sheets off at 97 Dongola: Mick B will be inputting data

Further help always welcome, especially for the busy Nevil Rd, Kennington and Dongola Av junctions (Nos 1/2/3)

I’ve allocated Jo to No9 so Steve Ward can act as liaison and float to fill any gaps.

THURSDAY 7/7: 1730-1834
1 Tony C
2 Sue P
3 Jon R
4 Richard S
5 Neil W
6 Richard O
7 Steve S
8 Jo H
9 Jo S

So, let’s hope for dry weather :-(

1 personal details redacted
CORDON SURVEY BRIEFING

Surveys June/July 2016

What is the purpose of the survey?
Steve Ward (UWE Traffic Researcher) suggested that we do a cordon survey as this helps measure traffic flowing into and through the area. This is the sort of hard data that BCC are asking for (if we do it will force the issue rather than waiting for BCC to get funding).

How does it work?
Data collectors (that’s you) are stationed at main junction into the area (see 1-8 on map below). Over an agreed hour they note:
- The last 3 digits/letter of any vehicle’s registration number (if a foreign reg all of it)
- Whether the vehicle was travelling INTO or OUT OFF the area
- The time of the observation
- DON’T record motorbikes, bicycles or the now ubiquitous scooters 😊

The results are then handed in and centrally collated to identify traffic flows.

Are we monitoring speed?
No, but if anyone is clearly going well over c25mph put an * (asterisk) by it on the sheet.

Where do you position yourself?
I will let you know your designated location prior to the day (if this isn’t convenient let me know)
Once there, locate yourself anywhere that is SAFE but with a clear view of incoming and outgoing traffic. This needn’t be at the actual road junction as long as there are no side roads between you and the main road.

How do you record the information?
Steve has provided a form for us to use (see attached: I will have them on the day).
As an alternative, if you have a mobile ‘phone which records the date/time of photos, you could use this and then transfer the data onto the sheet later: this may be useful if there’s a build up of traffic and you can’t easily keep up.... BUT BEWARE that some drivers may see this as an aggressive act, so be discrete.

What happens if there is too much traffic for you to keep up?
You may be by yourself or might have another person with you. If there are two of you you may find it useful for one of you to “spot” and the other to “record”. Alternatively you may wish to have one person monitoring incoming and the other outgoing traffic.
Either way, DON’T PANIC... make full records if you can but if it’s not possible, then just note the number of vehicles entering/leaving and the time (past surveys suggest c60/70 per hour).
Otherwise, as noted above, using a ‘phone to photograph vehicles may help.

What happens if a driver asks you what you’re doing?
Simply explain what we’re doing and that the data will only be used for this survey.
- If they ask you to remove their registration number DO SO (but still record the vehicle).
- Clearly, we want to avoid any trouble, so if anyone becomes abusive or aggressive then apologise, walk away and call me.

What happens if it’s bad weather?
If it’s too bad at the start of the session, we’ll cancel and try to re-schedule. If the weather turns bad during the survey we’ll have to abandon it... BUT, please don’t do so without calling me.
 … and don’t forget to dress for a British summer (with waterproofs just in case)

**ANY OTHER QUESTION... EMAIL OR CALL ME**

**ON THE DAY**

On the day there will be a named co-ordinator
If you have any questions, need sheets etc, please contact them
Allow enough time for you to get to your position before the start of the survey
Send a SMS/call the co-ordinator 15m prior to the start to confirm you will be participating
After the survey drop your sheets in to the co-ordinator

**CHECKLIST**

Things on and for the day:

- **Recording sheets:** print off attached or collect from me
- **Pens or pencils**
- **Clipboard** (a sheet of hardboard/ply/stiff card plus a bulldog clip will do)
- **Watch/phone with correct time** (we must all start and finish “on the dot”)
- **Mobile phone to liaise** (keep it on)
- **Suitable clothing:** assume the worst!
- **Refreshments** (in case you get peckish)
- **Folding seat or stool** (an hour standing around is quite tiring)

**RECORDING SHEET**

Date: Time: Location:

**CODES:** entering use **N** or exiting use **X**

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50 per sheet
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