School Streets and Traffic Displacement

Technical Report

14 July 2022

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Contents

Executive summary

This report sets out the findings of a Sustrans project to measure the displacement impact of restrictions to through-traffic on roads outside schools. These timed restrictions, known as "School Streets", are designed to improve safety, congestion and reduce pollution by reducing levels of traffic on roads directly outside schools. However some of the benefits experienced directly outside schools may be compensated by disbenefits of greater traffic congestion on roads outside the School Streets barrier or on adjacent streets, with the potential to impact road safety at these locations. Research on whether this is the case is sparse. We set out to collect fresh evidence using a new combination of research methods. We report our findings against the following key research question:

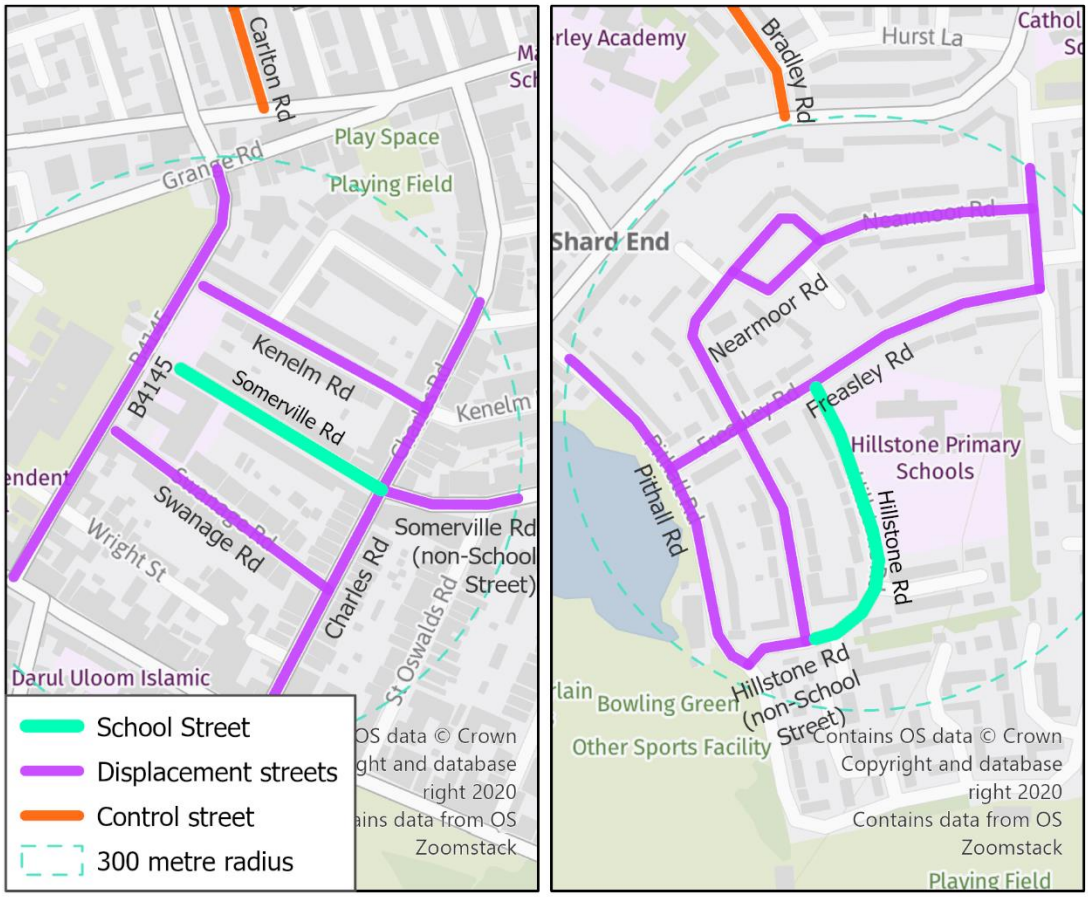
"Do School Streets cause traffic displacement that may affect road safety on surrounding roads?"

Methodology

We identified the key findings of the existing body of evidence on the impact of Schools Streets by conducting a literature review. We followed this up with a field exercise to collect fresh evidence on two Schools Streets primary schools in Birmingham. We chose the schools in question to see if road layouts would make a difference, one school being on a cul-de-sac and the other being on a road with junctions at both ends. Figure 1 show maps of the School Streets and surrounding streets.

We captured evidence on the impact of the School Streets restrictions on traffic levels and behaviour using traffic counters, video cameras and from local residents through postal surveys during three phases: at baseline before the School Streets started (September 2020), shortly after the School Streets had started (October 2020), and seven months after the School Streets had started (April/May 2021). More details on the methodology can be found in Section 3 and Appendix 6.3.

Figure 1: Maps of streets monitored at Somerville Primary School (left) and Hillstone Primary School (right): the School Street, surrounding streets with potential for displacement, and a control street



Findings

We found 16 relevant existing studies on the impact of school street restrictions as a result of our literature review. These showed in general that traffic levels usually fall during a School Street, and where there is traffic displacement, it either does not cause road safety issues or can be mitigated.

Our own fieldwork at two Birmingham primary schools with different surrounding street layouts found:

- overall traffic volumes, across the school road and surrounding roads, fell during the School Street time windows (school pick-up and drop-off times) which is likely to have had an overall positive impact on road safety

- in contrast, outside of the School Street time windows, overall traffic levels across the same roads rose compared to before the School Streets. This suggests that a degree of traffic evaporation (the disappearance of traffic when road space is reallocated away from motorised vehicles) may have occurred as a result of the School Streets

- at one of the School Street sites - Hillstone Road - the average car speed rose slightly after the School Street was brought in, posing a potential safety risk, although the speeds both before and after were relatively low[1]

- our video monitoring showed that the School Streets had an impact on parking behaviour with an increase in the number of parked cars near the entrance to the School Street, and a higher number of parking cars interacting with other road users. The severity (e.g. a road user having to stop more imminently to avoid collision) of interactions did not increase as a result of the School Streets, but the increased number of interactions indicates a potential risk of worse road safety in these locations

- our follow up residents' survey findings demonstrated strong support for the School Streets initiative as well as an overall rise in the proportion of people who believed the school road and surrounding roads were safe, compared to before the school street was implemented

- we did find some inconsistencies between the schools in the rigour with which the School Streets were stewarded by schools staff. In addition, we deliberately chose the two schools involved because of the difference in their surrounding road layouts. Nevertheless our findings at the two schools were broadly similar. It was not clear from the evidence we were able to collect what gave rise to the small differences in impact we did find between the schools

- we found some change in the direction and extent of impact of both School Streets over time, suggesting that there is a 'bedding in' period for such schemes.

We developed a methodology to collect our evidence that was more sophisticated than most of the research we came across in the literature review. We used a greater range of monitoring mechanisms and collected evidence across a wider road network surrounding the schools.

Our fieldwork provides fresh, more granular, evidence to support the findings of the literature review. That School Streets lead to overall falls in volume of traffic and although traffic may be displaced to some degree to surrounding streets, the literature review suggests that measures can be applied to successfully mitigate any associated road safety issues. Further research

[1] we had insufficient vehicle speed data to make conclusions for the other School Street on Somerville Road

could investigate which School Street contexts have required mitigation measures, what kind of measures have been applied, and to what effect.

1. Introduction

The aim of this project was to monitor traffic displacement around School Streets and evaluate any associated impact on road safety on surrounding streets.

1.1 Background

Road safety continues to be a serious issue in the UK, particularly on the walk to school. In 2019, there were 5,200 child pedestrian casualties on UK roads – 1,257 of which were serious injuries and 18 of which were deaths[2]. In 2015, 39% of incidents of children on foot being killed or seriously injured on UK roads occurred between 07:30am and 08:59am or between 15:00pm and 16:59pm on a school day[3]. One way of addressing school road safety is through the implementation of School Streets.

What are School Streets?

School Streets aim to ease the road safety, congestion and air quality concerns that many schools experience, by facilitating traffic restrictions on the road outside the school gates during drop-off and pick-up times. These are communicated beforehand and enforced by mechanisms such as signage, stewarding and traffic cones. The restriction applies to school traffic and through traffic, with exemptions for emergency vehicles, service providers, blue badge holders and residents. Schools implement a School Street via the Local Authority, using a Traffic Management Order or Traffic Regulation Order.

For definitions of key terms used throughout this report, see Appendix 6.1.

School Streets are still relatively new interventions and as they become more frequently implemented in the UK there is a need to understand whether they displace traffic and have any knock-on effects on road safety in the surrounding area.

[2] Department for Transport (2020) Reported Road Casualties Great Britain: 2019. London. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/928205/reported-road-casualties-gb-annual-report-2019.pdf.
[3] Department for Transport (2016) Reported Road Casualties Great Britain: 2015. London. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/568484/rrcgb-2015.pdf The statistic required for the calculation of this percentage value is not available for any years after 2015.

The Road Safety Trust

The Road Safety Trust (RST) awarded a grant under their 'Innovative traffic calming and provision for vulnerable road users' round of funding, to fill this research gap. The Road Safety Trust is the largest independent road safety grant-giver in the UK and funds vital research and practical interventions committed to reducing the number of people killed or injured on UK roads.

Birmingham's Car Free School Streets

To capture evidence, we monitored traffic during Birmingham City Council's ongoing scheme of School Streets, known as 'Car Free School Streets'[4]. After a successful pilot year in 2019 involving six schools, twelve schools in Birmingham have been implementing School Streets for the 2020 - 2021 academic year under Traffic Regulation Orders. Sustrans did not support the delivery of the School Streets; Birmingham City Council implemented them independently of Sustrans' research project. Both schools had School Streets in place at the start and end of the school day. Motorised vehicles driving on the school road without a permit during the restrictions could be issued with a Fixed Penalty Notice charge of £50[5].

What is road safety?

In a strict sense, road safety can be seen as freedom from the liability of exposure to harm or injury on the highway. However, it is also important to consider road safety as more than just the avoidance of harm. It must also consider the *perception* of risk of harm, at an individual and community level.

Operationalising road safety

For the purpose of this research we defined road safety using five key measures, supported by the findings from a literature review that was conducted as part of the project (see Literature Review). They were:

- **higher volumes of vehicular traffic**: on individual surrounding streets and across the area as a whole, increasing the risk of collisions
- **higher vehicular traffic speeds**: on individual surrounding streets and across the area as a whole, increasing the risk of collisions. The association between speed and safety is well established, with studies such as Rosén & Sander (2009)[6] suggesting that pedestrian fatality risk at 50 km/h vehicle impact is more than twice as high than at 40 km/h, and five times higher than at 30km/h
- **dangerous or illegal parking and driving behaviour**: drivers parking on yellow lines, zig-zags or the pavement, pulling over in the road, and parking or manoeuvring in the

[4] For more information on this scheme, see https://www.birmingham.gov.uk/info/20163/safer_greener_healthier_travel/1891/car_free_school_streets
[5] Exemptions include residents, blue badge holders and emergency services.
[6] Erik Rosén & Ulrich Sander (2009): Pedestrian fatality risk as a function of car impact speed, Accident Analysis & Prevention, Volume 41, Issue 3, Pages 536-542, https://doi.org/10.1016/j.aap.2009.02.002. [Accessed 26/11/2021]

School Street junction, increasing the risk of collisions. The literature indicates that cases of drivers parking badly on neighbouring roads during School Streets is an issue, though there are not a high number of cases

- **conflict between road users**: where driver behaviour creates situations of potential, near or actual contact between road users, requiring participants to adjust or slow in varying degrees of severity, making the road more dangerous
- **local residents' perceptions of road safety**: how safe parents and other stakeholders believe the road to be. Results of this often differ to the objective measures outlined above.

1.2 Research aims

The aim of this project was to address the following research question:

"Do School Streets cause traffic displacement that may affect road safety on surrounding streets?"

The project's evaluation objectives were to:

- understand the extent to which traffic displacement is caused by School Streets
- assess any associated displacement of road safety issues onto adjacent streets as a result of the School Street (including high traffic volume, illegal parking, vehicle speed and unsafe road user interaction)
- measure perceptions of road safety on the School Street and adjacent streets, to assess any displacement of perceived safety issues.

While local authorities have carried out preliminary evaluations of their schemes, there is limited understanding of the wider implications for road safety of School Streets – particularly on the surrounding road network. Accordingly, this project will provide insight on common concerns about School Streets, including:

- traffic simply moving onto adjacent streets making those more dangerous
- parents driving to school and parking in the adjacent streets
- School Streets having no impact on existing levels of traffic, speeds or parking.

Another secondary objective for the project was to assess the current evidence base on the impacts of School Streets on traffic displacement and road safety. This was completed by Dr Adrian Davis and can be found in the Literature Review section.

1.3 Structure of the report

This report is set out in five sections:

- section two provides a summary of the literature review which assesses the existing evidence base surrounding displacement of traffic and safety issues onto roads surrounding a School Street
- section three describes the methodology for the research
- section four presents the findings, split by road safety measure and monitoring location, and provides discussion of the findings
- section five concludes with the value and key findings of the project.

2. Literature Review

As a key part of this study we commissioned a literature review of the existing evidence on displacement of traffic and associated road safety issues around School Streets. The review was produced by Dr Adrian Davis, professor of transport and health at Edinburgh Napier University, and published in August 2020[7]. Findings from the review contributed to the design of this research project and helped to ensure that the starting point was as fully informed as possible by previous instances of School Streets.

Dr Davis reviewed 16 previous studies of School Streets, none of which were peer reviewed and one of which was a Master's thesis. The locations covered by the studies included Camden, Edinburgh, Solihull, Perth and Kinross, East Lothian, Croydon, Southampton, and the region of Flanders, Belgium. Information from some of these studies can be found in Appendix 6.2. After it became clear that the literature on School Streets was limited, Dr Davis undertook five semi-structured interviews with local authority officers working on School Streets. These supplemented the literature with up-to-date (as of March/April 2020) perspectives and evidence.

Overall, the review found [8]:

- strong and consistent evidence that traffic displacement does not cause road safety issues of any significance and that mitigating measures, where needed, have been applied successfully
- medium strength evidence that in almost all cases the total number of motor vehicles on School Streets and neighbouring streets reduces
- medium strength evidence that perceived road safety on surrounding streets, as well as the School Streets, improves as active travel rises
- medium strength evidence that alternative parking schemes such as "Park and Stride" help reduce traffic displacement, although a small number of badly parked vehicles can remain an issue.

The literature review findings contributed to the design of the methodology for monitoring and evaluating the traffic displacement and associated road safety impacts of the School Streets by identifying monitoring tools to draw upon, and limitations in previous methodologies that could be avoided (e.g. monitoring of traffic levels on a very limited number of surrounding roads).

[7] https://www.napier.ac.uk/about-us/news/school-street-School Streets
[8] The findings are taken verbatim from the published literature review, available at: https://www.napier.ac.uk/~/media/images/news/school-street-closures/school-streets-closure-traffic-displacement-literature-review-final.pdf?la=en

3. Methodology

To assess the displacement effect of School Streets, we conducted a longitudinal study at two Birmingham schools which were participating in Birmingham City Council's 'Car Free School Streets' scheme.

3.1 Developing on historic studies

As mentioned in the previous section, the literature review contributed to the design of the methodology in the research. The key ways in which it informed this methodology were:

- highlighting of the range of tools and measures that have been applied in the monitoring of School Streets interventions. This acted as a useful starting point when considering an appropriate methodology.

- highlighting that many studies have tended to apply only one or two monitoring tools. By applying a range of monitoring tools in the methodology of this study it allows for a consideration of a wider range of 'traffic safety' concepts, such as the measurement of objective indicators (e.g. traffic levels) and subjective indicators (e.g. perceptions of traffic and safety). In addition, the variety of tools supports both generic measures (e.g. perceptions of school road vs surrounding roads) and school context specific measures (e.g. video observation of specific locations near the school) of traffic safety.

- highlighting that traffic monitoring is typically limited to the School Street and one or two other nearby roads, rather than the wider network of neighbouring roads onto which displacement may occur. By monitoring traffic over a wider area than monitored in other studies, this study will provide a more robust account of whether traffic displacement occurs following the implementation of School Streets

3.2 School locations

Selecting schools

We carried out research at two of the twelve schools taking part in Birmingham City Council's Car Free School Streets programme: Somerville Primary School in Small Heath, and Hillstone Primary School in Shard End (see Figure 2).

Somerville Primary School is located on a cul-de-sac in a mixed residential and business area, while Hillstone Primary School is situated in a residential area on a road with junctions at both ends. These different local contexts provide the opportunity to compare findings between the schools and indicate whether the road layout context is potentially a significant variable in determining the displacement impact of a School Street. It should be noted that the two schools also differ in several other respects shown in Table 1. Ward-level data is shown for Shard End ward (where Hillstone School is situated) and Small Heath ward (where Somerville School is situated) and shown in Table 1.

Table 1: Data collection methods with relevant road safety characteristics

School context	Hillstone School	Somerville School
Historic share of pupils being driven to school	47% of pupils driven to school in 2013/24 academic year	23% of pupils driven to school in 2012/13 academic year
School catchment area size	1.3 miles from school	0.5 miles from school
Demographic characteristic[9][10]	**Shard End**	**Small Heath**
Employment rate	59.1%	36.9%
% Under 18 years of age	25.6%	36.9%
Index of Deprivation 2015 national rank of ward (out of 7,511 wards, lower rank is more deprived)	139	175

[9] Shard End ward factsheet (Census 2011)
https://www.birmingham.gov.uk/download/downloads/id/15497/shard_end_profile.pdf
[10] Small Heath ward factsheet (Census 2011)
https://www.birmingham.gov.uk/download/downloads/id/15498/small_heath_profile.pdf

Figure 2: Map of monitored schools and other schools in Birmingham

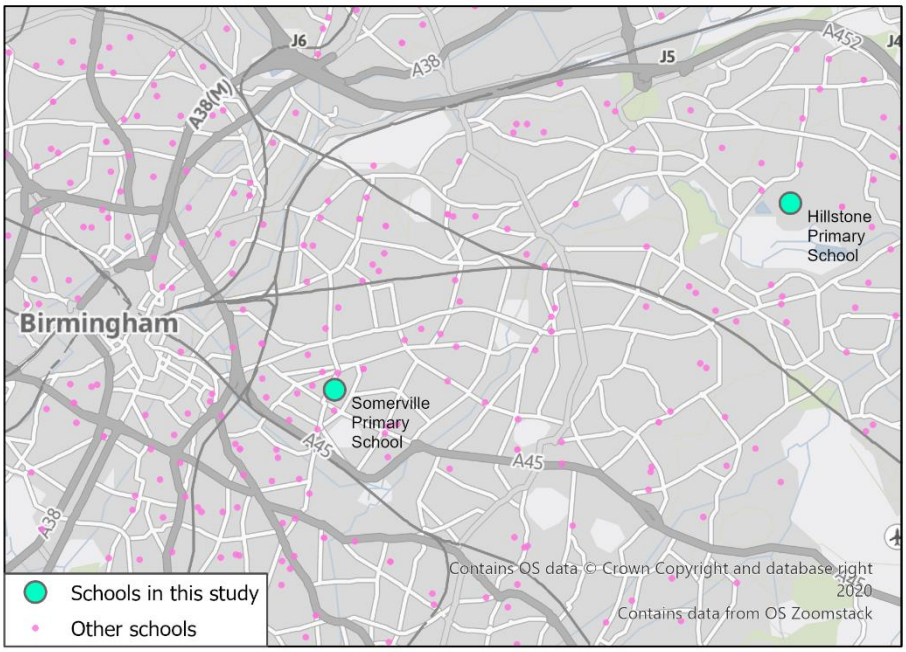


Figure 3 and Figure 4 show maps of each school location. When planning our monitoring, we took into account the entrances being used for pupil access, including any special Covid-19 measures.

Figure 3: Map of Hillstone Primary School with School Street and entrances

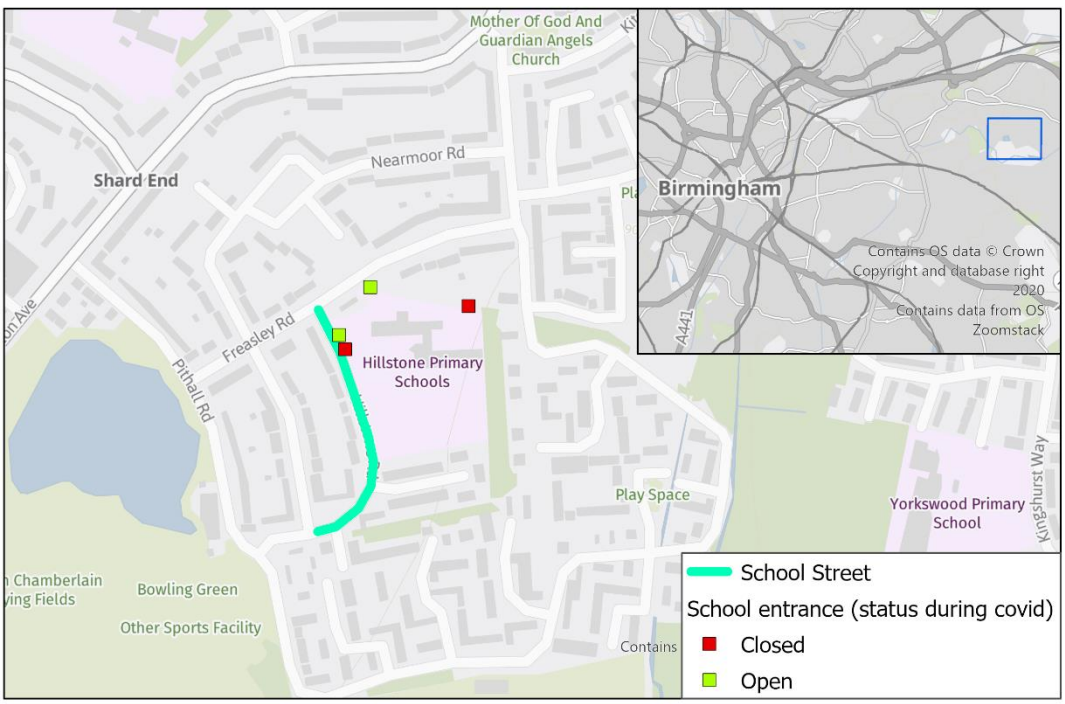


Figure 4: **Map of Somerville Primary School with School Street and entrances**

Implementation and stewarding of School Streets

The School Streets timed restrictions were implemented through signage, stewarding and cones at both schools.

The extent to which a School Street is stewarded is likely to influence compliance with the restrictions and therefore the impact of the School Street. At Hillstone Primary School we observed that the stewarding started and stopped at roughly the same time (i.e. within a couple of minutes) as the times indicated on the signage.

However, due to staff shortages and the Covid-19 pandemic, the stewarding at Somerville Primary School varied slightly from the intended times (see Appendix 6.3.1 for the stated monitoring times). During the week of monitoring shortly after the implementation of the School Streets, the stewarding generally started at the same time as indicated on the signage, but always stopped between 15 to 30 minutes early. On the Friday afternoon there was no stewarding. During the follow-up data collection phase, the hours of stewarding were shorter (between 15 to 20 minutes) and there was no stewarding observed during the afternoon hours.

More detail about each school and their School Streets implementation can be found in Appendices 6.3.1 and 6.3.2.

3.3 Data collection

Table 2 lists the data collection methods used to monitor the relevant road safety characteristics. All three data collection tools were delivered by external contractors.

Table 2: Data collection methods with relevant road safety characteristics

Data collection method	Safety characteristics assessed
Automatic traffic counters (ATCs)	Traffic volumes Traffic speeds
Video monitoring	Illegal or unsafe parking Road user interactions including pedestrian crossings
Postal surveys	Perceptions of road safety (traffic volume, traffic speed, traffic behaviour, crossing the road, safety for the person and for children)

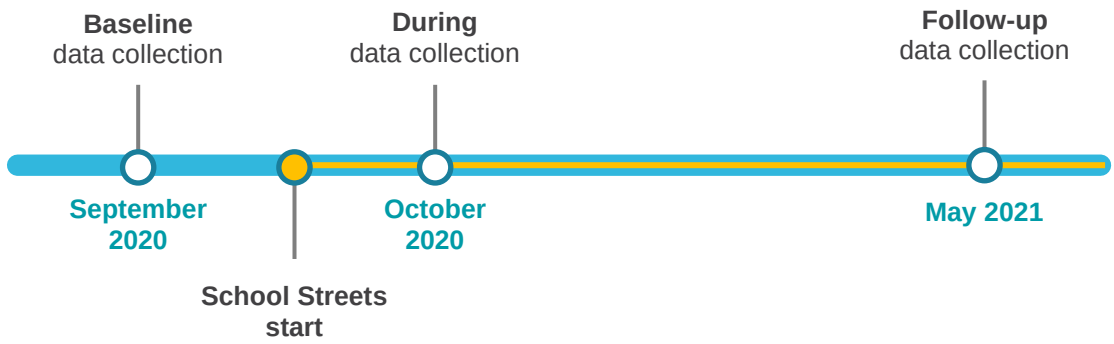
3.3.1 Data collection phases

Data collection took place over three phases: baseline (before any School Streets were implemented), during intervention (within the first few weeks of the School Streets) and follow-up (six to seven months into the School Streets, while it is still running). Exact dates are shown in Table 3. By comparing the data at each phase, we identified any changes in traffic displacement or road safety around the School Street interventions.

Table 3: Dates of baseline, during and follow-up monitoring, by method and location

Data collection method	Baseline (2020)		During intervention (2020)		Follow-up (2021)	
	Somerville	**Hillstone**	**Somerville**	**Hillstone**	**Somerville**	**Hillstone**
Automatic Traffic Counters	21st – 25th Sep 2020	14th – 20th Sep 2020	12th – 18th Oct 2020	12th – 18th Oct 2020	10th – 16th May 2021	10th – 16th May 2021
Video monitoring	21st – 25th Sep 2020	16th – 23rd Sep 2020	12th – 16th Oct 2020	12th – 16th Oct 2020	10th – 14th May 2021	10th – 14th May 2021
Perception surveys	13th – 28th Sep 2020	13th – 28th Sep 2020	N/A	N/A	4th – 21st Apr 2021	4th – 21st Apr 2021

Figure 5: Timeline of data collection phases before and during School Streets



3.3.2 Automatic traffic counters

Automatic traffic counters (ATCs) were temporarily installed on roadsides to count vehicles and record their speeds for seven days of 24-hour data recording at each data collection phase. A general explanation of the ATC locations, how the data was analysed and information on missing data is given in Appendix 6.3.3. The specific ATC locations for each of the two schools are shown below.

Objectives

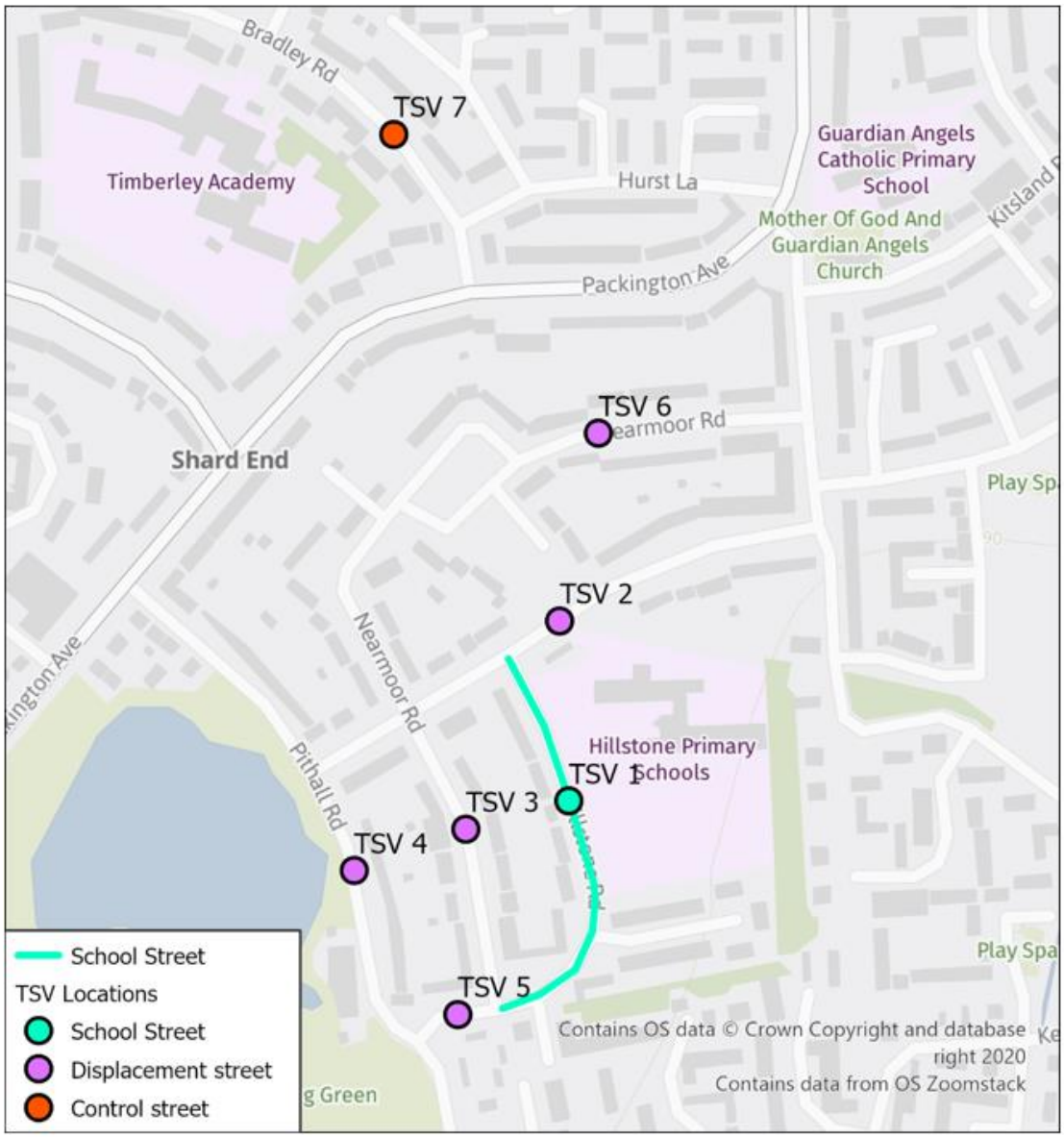
The traffic speed and volume (TSV) data generated by the ATCs supports the following objectives:

- understand the extent to which traffic displacement is caused by School Streets
- assess any associated displacement of road safety issues onto adjacent streets as a result of the intervention (for this objective, the relevant road safety issue is vehicle speed)
- understand if there has been any evaporation of traffic from the school area, and implications on road safety issues.

Hillstone

As shown in Figure 6, one TSV location was on the School Street itself, Hillstone Road (TSV 1). Five were then located on potential displacement routes. Two of these were on Freasley Road (TSV 2) and Hillstone Road (TSV 5) near to the School Street entrance, to capture the most likely locations of new pick-up/drop-off points. Two more were located on Nearmoor Road (TSV 3 and TSV 6), as a parallel road which might be used by displaced traffic. One was located on Pithall Road (TSV 4) to capture traffic potentially circling back after drop-off/pick-up. Finally, Bradley Road (TSV 7) was used as a control location.

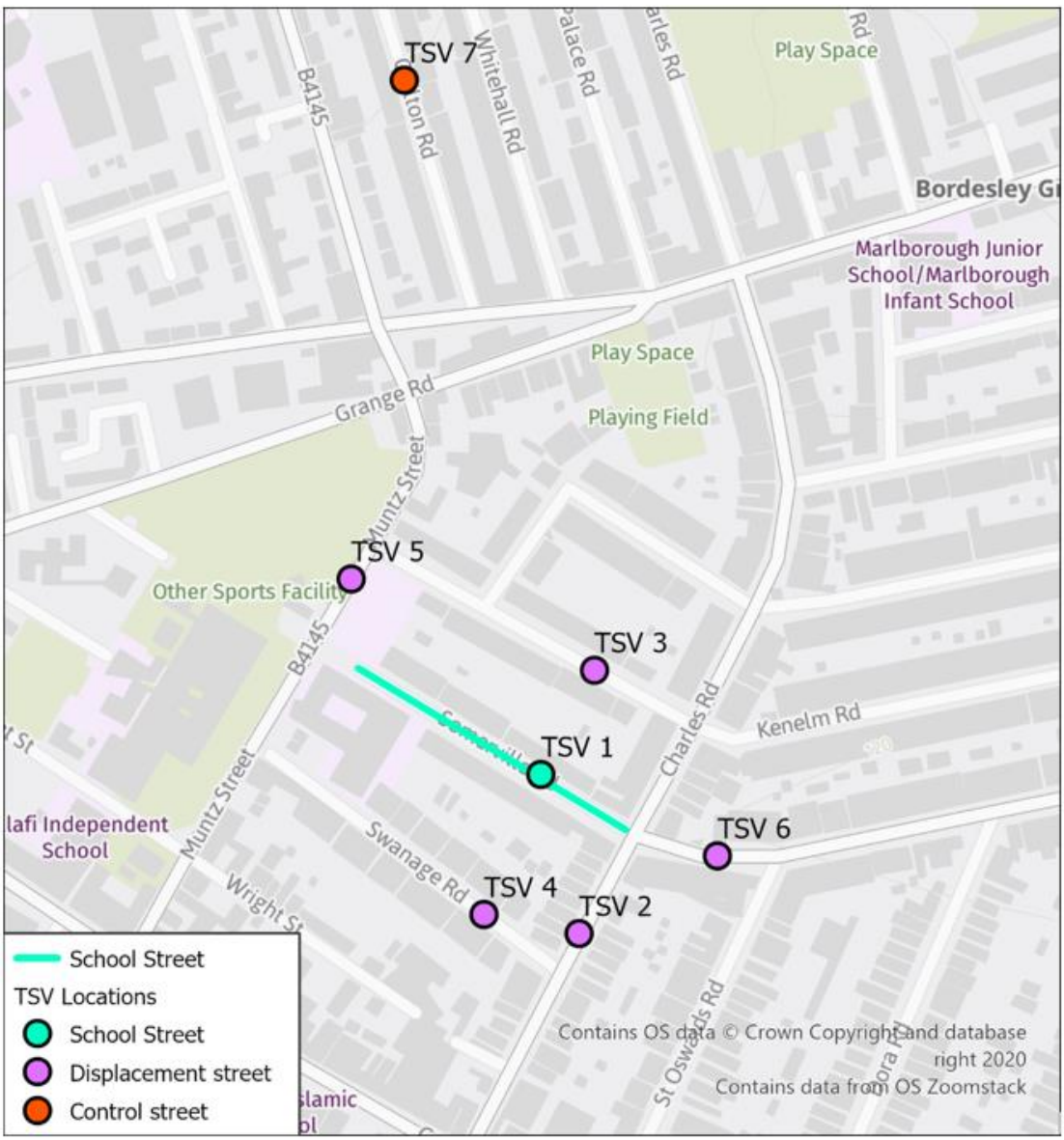
Figure 6: Traffic Speed & Volume (TSV) locations for Hillstone Primary School



Somerville

As shown in Figure 7, one TSV location was on the School Street itself, Somerville Road (TSV 1). Five were then located on potential displacement routes. Two of these were on Charles Road (TSV 2) and Somerville Road, near to the school street entrance (TSV 6). Two more were located on parallel roads Kenelm Road (TSV 3) and Swanage Road (TSV 4). One was also located on the B4145 (TSV 5) to capture traffic potentially using the B145 instead of Somerville Road to drop-off/pick-up. Finally, the control location was on Carlton Road (TSV 7).

Figure 7: Traffic Speed & Volume locations for Somerville Primary School



Analysing traffic volumes and speeds

We compared volumes of traffic during the School Street hours at the different monitoring phases (baseline versus during intervention, and baseline versus follow-up) and locations. The analysis examined if there had been:

- **displacement from one road to another**
- **evaporation of traffic from the school area.**

We compared the average weekday speed[11] of traffic during the School Streets hours between the baseline and during intervention phases, and between the baseline and follow-up phases. For Somerville Primary School, speed data is only available for one location across all three phases of monitoring, due to issues with the installation of the ATC equipment.

For more information on the methodology and analysis approach, see Appendix 6.3.3.

3.3.3 Video monitoring

Video monitoring involved temporarily installing cameras on street furniture (such as lamp posts) to record footage. We then analysed the footage ex-situ to provide objective evidence on the behaviour of road users, including drivers, around the School Streets.

Objective

The video monitoring supports the objective:

- assess any associated displacement of road safety issues onto adjacent streets as a result of the intervention (including illegal parking, vehicle speed and unsafe road user interaction).

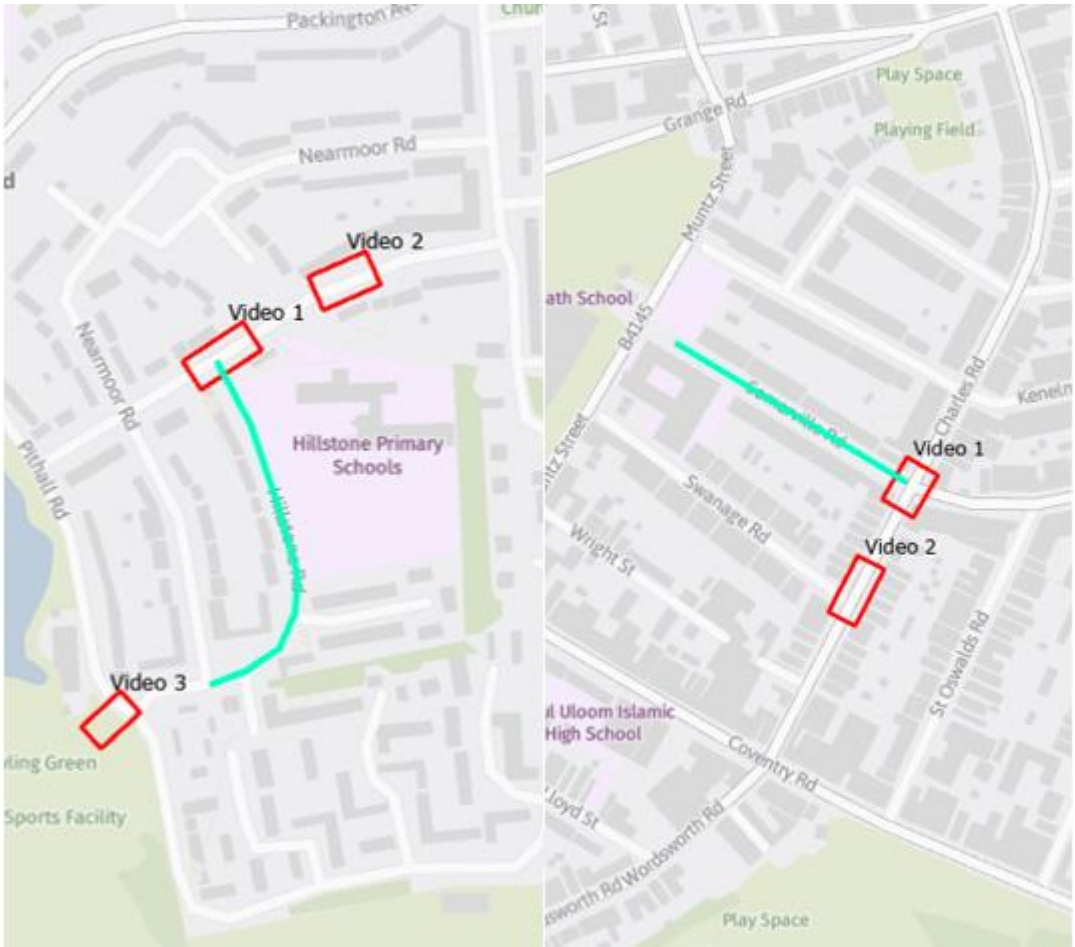
Footage was recorded for five days at each monitoring phase. Of this, we sampled the hours of the School Streets (08:00-09:00 and 14:45-15:45 at Hillstone Primary School and 08:00-09:30 and 14:30-16:00 at Somerville Primary School) on two of the five days (Tuesday and Thursday) at each of the three data collection phases[12].

[11] Comparisons of the 85th percentile traffic speed (i.e. the speed at or below which 85 percent of all vehicles are observed to travel under free-flowing conditions past a monitored location) are also presented in this report, in appendix 6.6.
[12] The exception to this was the follow up around Somerville primary school, where the Wednesday video footage was analysed instead of the Thursday due to the impact of the Eid-Ul-Fitr celebrations. There was no evidence to suggest that there was any difference between the nature of the Wednesday traffic and the Thursday traffic.

Video monitoring locations

The video monitoring locations around Hillstone and Somerville Primary Schools are shown in Figure 8. There were several prospective video monitoring locations in the vicinity of the School Streets that could have provided useful insights into the impact of the intervention, such as at the southern entrance to the Hillstone School Street[13], but with the resources available Birmingham City Council agreed that the locations shown below were appropriate for monitoring. Further explanation of the site selection is given in Appendix 6.3.4.

Figure 8: Video locations for Hillstone Primary School (left) and Somerville Primary School (right), with School Streets indicated by turquoise line



Video monitoring analysis

The video monitoring data was analysed to assess:

[13] Traffic monitoring near this location, indicates that the traffic levels near the southern entrance to the School Street dropped following the intervention, which suggests that an increase in hazardous parking behaviour was unlikely to have been an issue at that location.

- **illegal or hazardous parking and driving behaviour**
- **traffic interactions.**

Further explanation of the video monitoring analysis is given in Appendix 6.3.4.

3.3.4 Postal surveys

We mailed a paper questionnaire with a cover letter and prepaid return envelope to residents of the School Street itself and of the surrounding streets. The survey was designed to obtain evidence on changes in the perception of safety on the School Street itself and neighbouring streets. Further information on the postal survey is given in Appendix 6.3.5.

Objective

The postal surveys support the objective:

- measure perceptions of safety on the street where road closure is located, and in the area adjacent to the road closure to assess any displacement of perceived safety issues.

The postal survey was used at two phases; at baseline and follow-up with questions repeated at both phases and compared in the analysis. The numbers of surveys posted and responses received are shown in Table 4.

Table 4: Numbers of surveys posted and responses received, by data collection phase and school

School	Baseline			Follow-up		
	Number of surveys sent	Number of responses received	Number of responses from residents living on School Street	Number of surveys sent	Number of responses received	Number of responses from residents living on School Street
Somerville Primary School	554	38	9	554	28	3
Hillstone Primary School	504	58	11	504	54	11

4. Findings

This section will present our findings on the impact of the School Streets on traffic displacement and road safety. Table 5 displayed in full on the following page, shows key indicators relating to changes in road safety, at Somerville and Hillstone Primary Schools.

Table 5: Key changes in driver and pedestrian behaviour, and safety perceptions at both schools from baseline to follow-up[14]

		Hillstone Primary School	Somerville Primary School
Traffic Speed and Volume (TSV)			
Overall traffic volume on, and around, School Streets road during School Streets hours		8% ↓	3% ↓
Traffic volume on School Streets road during School Streets hours		36% ↓	20% ↓
Traffic volume at control site during School Streets hours		3% ↑	10% ↑
Average traffic speed (afternoon hours)	**– on School Streets**	7 % ↑	Insufficient data*
	– on roads around School Streets	3% ↓ (Freasley Road) 5% ↓ (Pithall Road)	Insufficient data*
Video monitoring			
Parking near entrance to School Streets (On grass verge at Hillstone, on pavement area at Somerville)		25% ↑	80% ↑
Number of drivers parking along the main road near School Streets entrance (On Freasley Road at Hillstone, on Charles Road at Somerville)		42% ↓	48% ↓
Pedestrian road crossing – around School Street	**– number of pedestrians crossing**	Not applicable**	32% ↑
	– proportion of pedestrians needing to wait before crossing	Not applicable**	4 pp (percentage points) ↑
Pedestrian road crossing – road parallel to School Street	**– proportion of pedestrians needing to wait before crossing**	Not applicable**	8 pp ↑
Postal survey (% expressing agreement)			
"There are too many vehicles on the road"	**– on School Streets**	6 pp ↓	33 pp ↓
	– on roads around School Streets	12 pp ↑	2 pp ↓
"There are unsafe or illegally parked cars"	**– on School Streets**	2 pp ↑	10 pp ↓
	– on roads around School Streets	25 pp ↑	20 pp ↓
"The road is safe"	**– on School Streets**	19 pp ↑	28 pp ↑
	– on roads around School Streets	6 pp ↑	11 pp ↑

* Due to installation issues and faults with monitoring equipment or corruption of data.
** Due to differing road contexts of the two schools, the measure was not applicable.

[14] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

4.1 Traffic volumes during School Street hours

Summary tables of the data described in this section can be found in Appendix 6.5.

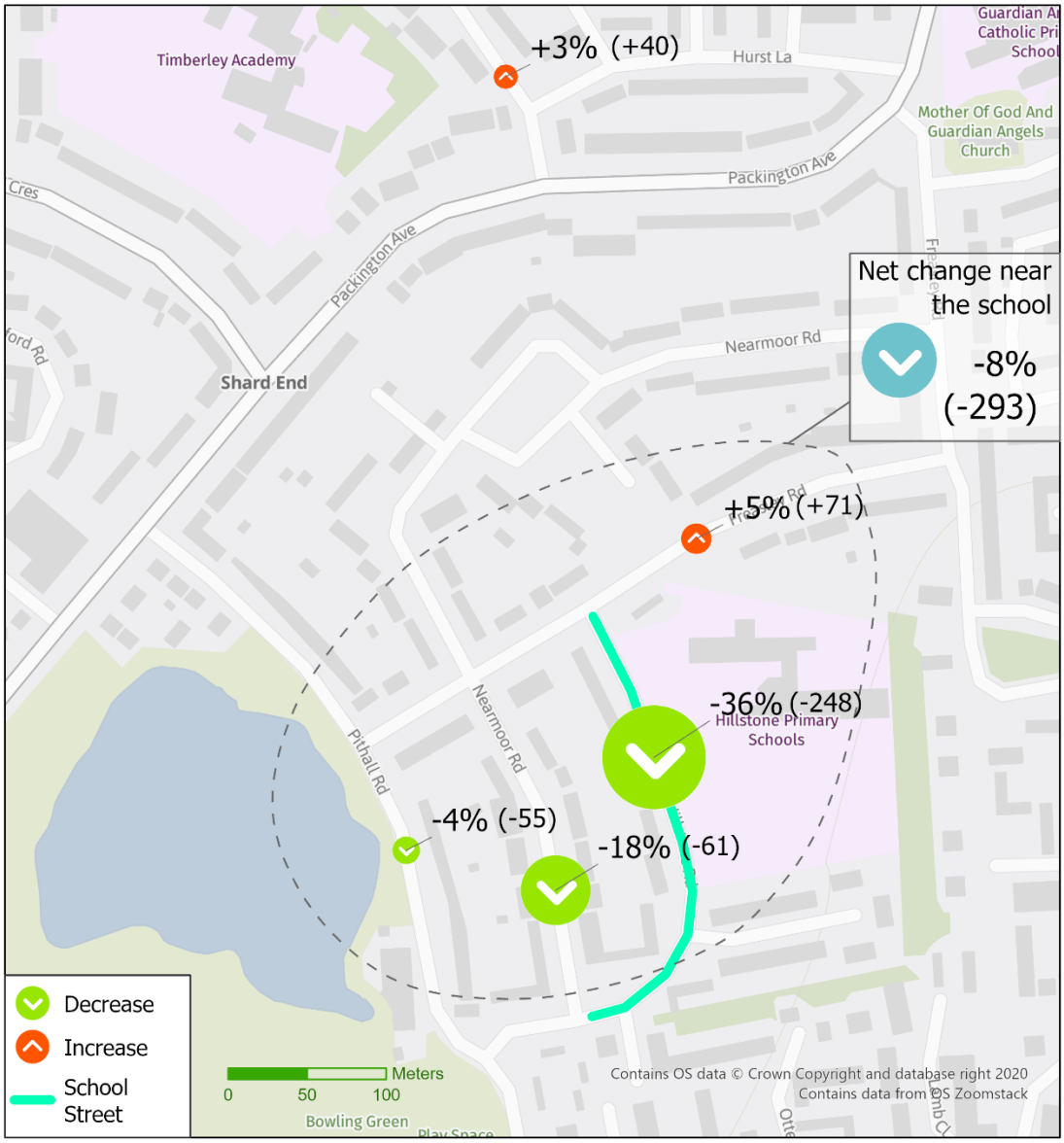
4.1.1 Hillstone

At Hillstone Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30. Here we discuss traffic volumes during the combined hours of 08:00 – 09:00 and 14:45 – 15:45 during the five working days in which data was collected, taken to represent the impact of the School Street.

Figure 9 and Figure 10 show the change in traffic volumes between the three data phases.

Figure 9: % change in traffic volumes (change in number of vehicles) around Hillstone Primary School between baseline and during intervention

Figure 10: % change in traffic volumes (change in number of vehicles) around Hillstone Primary School between baseline and follow-up



As expected, the Hillstone Road (School Street) location saw a large fall in traffic volume at both phases. The fall from baseline was perhaps not as large as expected though, at -44% (from 698 to 388 vehicles) during the School Street and then -36% (from 698 to 450 vehicles) at follow-up, considering the intervention prevented access to all through traffic. As the ATC data does not allow for differentiation between non-compliant drivers and exempt drivers on the School Street, it is not possible to comment on whether a degree of the traffic observed was attributable to non-compliant drivers or any lapse in enforcement.

The volume of traffic also fell on the non-School Street section of Hillstone Rd (-8% during intervention, from 659 to 604 vehicles), and on the two roads parallel to the School Street: Pithall Road (-6% during intervention, from 1,542 to 1,449 vehicles) and Nearmoor Rd south (-

18% at follow-up, from 330 to 269 vehicles). This indicates that the School Street led to no displacement of traffic onto these parallel roads.

Two locations did see a rise in traffic though. Freasley Road is the main perpendicular access road to the School Street, with a T-junction at the top of Hillstone Road. As such we expected that it might be a key road onto which traffic would be displaced. We observed a 5% rise in the traffic at this location at follow-up (from 1,310 to 1,381 vehicles), as well as a 3% rise on Nearmoor Road (north) at the during intervention phase, from 465 to 480 vehicles.

At the follow-up phase there was a 3% rise in traffic at the control location on Bradley Road (from 1,481 to 1,521 vehicles). This indicates that some rise may have been expected, even if the School Street was not in place, but the observed rise at Bradley Road of 3% may also represent random fluctuation.

It should also be noted that we counted 248 fewer vehicles on Hillstone Road (School Street sections) from Monday to Friday, between the baseline and during intervention phases. In comparison, we only counted 71 additional vehicles on Freasley Road. As such, the increase in vehicles on Freasley Road would account for less than a third of the reduced traffic on School Street section of Hillstone Road. Although there may have been some displacement of traffic onto Freasley Road, the low number of vehicles counted suggests a large degree of traffic evaporation has occurred amongst the reduced levels of traffic on Hillstone Road (the School Street location).

When comparing the two sets of changes, i.e. from baseline to during the School Street (Figure 9) and from baseline to follow-up (Figure 10), the direction of change is consistent at all locations, with relatively small variations in the extent of change. The most notable of these differences is at the Hillstone Road (School Street) location, where the fall was smaller at follow-up.

4.1.2 Somerville

At Somerville Primary school the School Street hours were 08:15 – 09:15 and 14:45 – 15:45. Here we discuss traffic volumes between 08:00 – 09:30 and 14:30 – 16:00, taken to represent the impact of the School Street. The number of weekdays of data included in the analysis varies depending on which locations and which monitoring phases are being looked at (see Table 6).

Table 6: Somerville Primary School – number of days of traffic volume data, by data collection phase and location (maximum 5 days of data from Monday – Friday)

Location number	Location name	No. of days of data available (used to calculate total change in average traffic volumes)			No. of days of data analysed for change in individual location traffic volumes
		Baseline	During	Follow-up	*All phases*
1	Somerville Road (School Street section)	5	4	3	2
2	Charles Road	5	5	3	3
3	Kenelm Road	5	5	3	3
4	Swanage Road	3	5	3	1
5	B4145	4	5	3	2
6	Somerville Road (outside of School Street)	5	5	~	5 (only baseline and during)
7- control	Carlton Road	5	5	3	3

Figure 11 and Figure 12 show the change in traffic volumes between the three data phases.

Figure 11: % change in traffic volumes (change in number of vehicles) around Somerville Primary School between baseline and during intervention

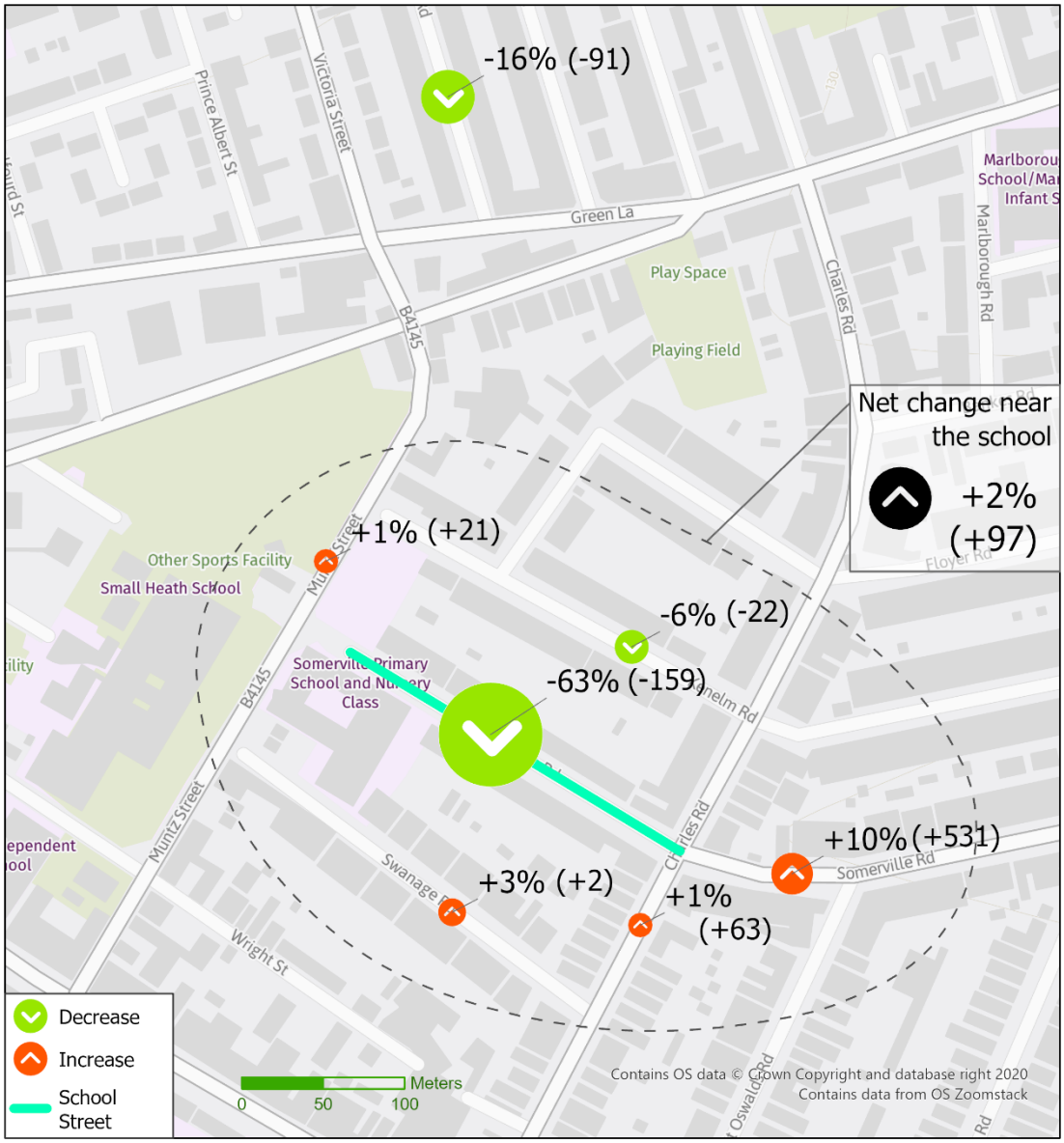
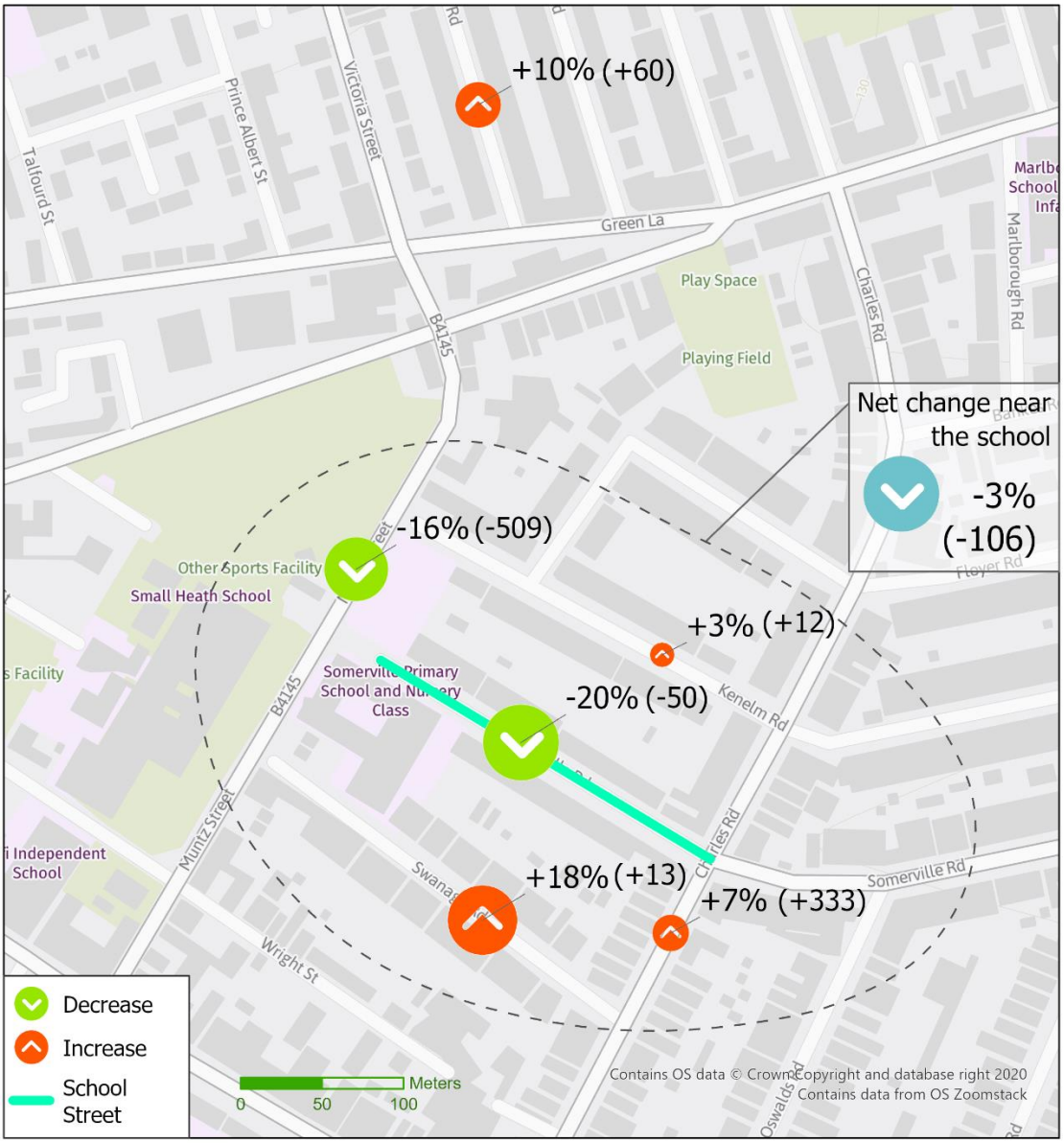


Figure 12: % change in traffic volumes (change in number of vehicles) around Somerville Primary School between baseline and follow-up



As expected, traffic volumes fell on Somerville Road due to the School Street. Traffic volumes fell by 63% (from 254 to 95 vehicles) from baseline to during the School Street, but only fell by 20% (from 254 to 204 vehicles) at the follow-up phase.

There is evidence that some of this traffic may have displaced onto Charles Road (7% rise at follow-up, from 4,725 to 5,058 vehicles) and Somerville Road (10% rise during intervention, from 5,198 to 5,729 vehicles) which both approach the entrance to the School Street, and onto parallel Swanage Road (18% rise at follow-up, from 71 to 84 vehicles) which also has school entrances.

This does suggest that there has been some displacement of school traffic arising from the School Street. However, given that the traffic did rise at the control location (Carlton Road) at the follow up (after an initial fall at the during intervention phase) some of this rise may have occurred irrespective of the School Street.

The remaining locations at Kenelm Road (parallel to School Street) and the B4145 (main road) had inconsistent changes between baseline to during and baseline to follow-up, showing a rise at one and a fall at the other.

There was a 2% rise in traffic across the area as a whole between baseline and during intervention phases, from 4,502 to 4,598 vehicles. However, between the baseline and follow-up phases there was a 3% drop, from 3,462 to 3,357 vehicles. This suggests that some of the traffic may have evaporated following the longer-term implementation of the School Street, however the variation is quite small and therefore could just be due to natural variation.

A caveat to this analysis is that we do not have data available, at the follow-up phase, for the potential displacement location on the non-School Street section of Somerville Road.

4.2 Comparing traffic volumes during and outside of the School Streets hours

To support an understanding of whether the changes in traffic volumes identified in section 4.1 occurred as a result of the School Streets or if they were representative of wider fluctuations in traffic flows, we can compare data collected during the School Streets hours with data collected outside of those hours at the same locations.

4.2.1 Hillstone

During the School Streets hours, total traffic levels across the area surrounding the school as a whole fell by 8% (from 3,880 to 3,587 vehicles, see Figure 10) from the baseline to follow-up phase. Conversely, outside of the School Streets hours, total traffic rose by 5% (from 14,792 to 15,517 vehicles) across the same area (monitoring locations 1 – 4, see Table 7). This shows that the change in traffic volumes on streets surrounding the School Street moved in opposite directions during and outside of the School Streets hours. The fact that no fall in traffic flow was observed outside the School Street hours suggests that the School Street was associated with a fall in traffic flow.

At Freasley Road (with the junction connection to the school road) there was a rise in traffic both during and outside of the School Street hours. This suggests that the rise in traffic at this location might not be attributable to the School Streets.

Table 7: Summary of Hillstone traffic volumes at all data collection phases, outside of the School Streets hours (sum of all traffic over 5 days)[15]

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Road (School Street section)	both directions	1,615	1,405	13.0% ↓	1,644	2% ↑
2	Freasley Road	both directions	4,483	4,317	3.7% ↓	4,696	5% ↑
3	Nearmoor Road (parallel to School Street)	both directions	1,021	896	12.2% ↓	960	6% ↓
4	Pithall Road	both directions	7,673	7,660	0.2% ↓	8,217	7% ↑
5	Hillstone Road (Not School Street section)	both directions	2,618	2,811	7.4% ↑	~	~
6	Nearmoor Road (section further away from School Street)	both directions	~	~	~	~	~
7 (control)	Bradley Road	both directions	4,180	3,776	9.7% ↓	4,148	1% ↓
Total (locations 1-4)			14,792	14,278	3.5% ↓	15,517	4.9% ↑
Total (locations 1-5)			17,410	17,089	1.8% ↓	~	~

4.2.2 Somerville

During the School Street hours, at the Somerville Road (School Street section) and B4145 locations, overall traffic levels fell by 16% (3,496 to 2,937 vehicles) from baseline to follow-up. Conversely, outside of the School Street hours, traffic on these roads rose by 7%, from 14,377 to 15,441 vehicles (see Table 8). This suggests that there is an evaporation in traffic around Somerville Primary School which may be attributable to the School Streets. It is noteworthy that both of the school locations show the same pattern, and so this effect is not singular to Somerville Road or its road context.

Unfortunately 24 hour data was not available for all monitoring locations[16], and therefore this can only give a limited view of the traffic levels around the school.

[15] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.
[16] This was due to video footage being used to derive the counts at several locations. The resource implications of generating counts for the whole 24 hour period, rather than just the School Streets hours, at those locations would have been very high.

Table 8: Sum of Somerville traffic volumes outside of School Street hours

Location number	Location name	Direction	Baseline	Follow-up	% Change
1	Somerville Road (School Street section)	one direction (eastbound)	542	639	18% ↑
5	B4145	both directions	13,835	14,802	7% ↑
Total (locations 1 and 5)			14,377	15,441	7% ↑

4.3 Wider traffic level changes

This section presents evidence of the direction, and extent, of change in general traffic levels over the period of the data collection phases. Although this data is not expected to be representative of the type of traffic observed at our monitoring locations, it provides some indication of the change in general levels of traffic, for comparison with the data collected in our monitoring exercise.

4.3.1 Traffic volumes across Great Britain

The Department for Transport provide quarterly traffic estimates for Great Britain, which are split by road type[17]. Although these statistics do not relate to Birmingham specifically, and the traffic levels are not broken down by individual months, they do provide statistics for minor urban roads[18], which are the type of road that were monitored for this study.

These statistics show that, on minor urban roads, there were an estimated 18.6 billion vehicle miles driven in the July-September 2020 quarter and 17.9 billion vehicle miles driven in the October-December 2020 quarter. These quarters best reflect the timing of the baseline (September) and during intervention (October) phases. The provisional estimate for the April-June 2021 quarter, which best reflects the timing of the follow-up monitoring phase (May), is 20.3 billion vehicle miles driven, a notable increase on the quarters covering the baseline and during intervention monitoring.

This provides an indication that the reduced vehicle volumes observed across the monitoring locations are not reflective of broader traffic trends.

[17] Table TRA2502e - https://www.gov.uk/government/statistical-data-sets/tra25-quarterly-estimates
[18] 'B', 'C' and unclassified roads

4.4 Traffic speed during School Streets hours

Summary tables for the data described in this section can be found in Appendix 6.6. Average traffic speed values are reported in this section. Summaries of the 85th percentile speed values are shown in Appendix 6.6 but are not reported in this section due to showing broadly the same patterns of change as the average speed values.

4.4.1 Hillstone

At Hillstone Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30. Here we discuss average traffic speed values from the hours of 08:00 – 09:00 (morning) and 14:45 – 15:45 (afternoon) separately.

The change in average traffic speeds at the locations around Hillstone Primary School during the morning School Street hours are shown in Figure 13 (baseline to during intervention) and Figure 14 (baseline to follow-up).

In all of the figures in this section, asterisks are used to denote a statistically significant change in speed at a location[19]. If there is no asterisk shown after the change value at a given location, this shows that the change was not statistically significant.

[19] Three commonly reported levels of statistical significance are flagged, with a lower p value relating to a greater degree of statistical significance in the result. 0.05 is a widely applied threshold for indicating statistical significance in a p value. * equates to p<0.05 (significant), ** equates to p<0.01 (very significant), *** equates to p<0.001 (extremely significant).

Figure 13: % (and numerical) change in average morning traffic speeds (08:00-09:00) between baseline and during intervention

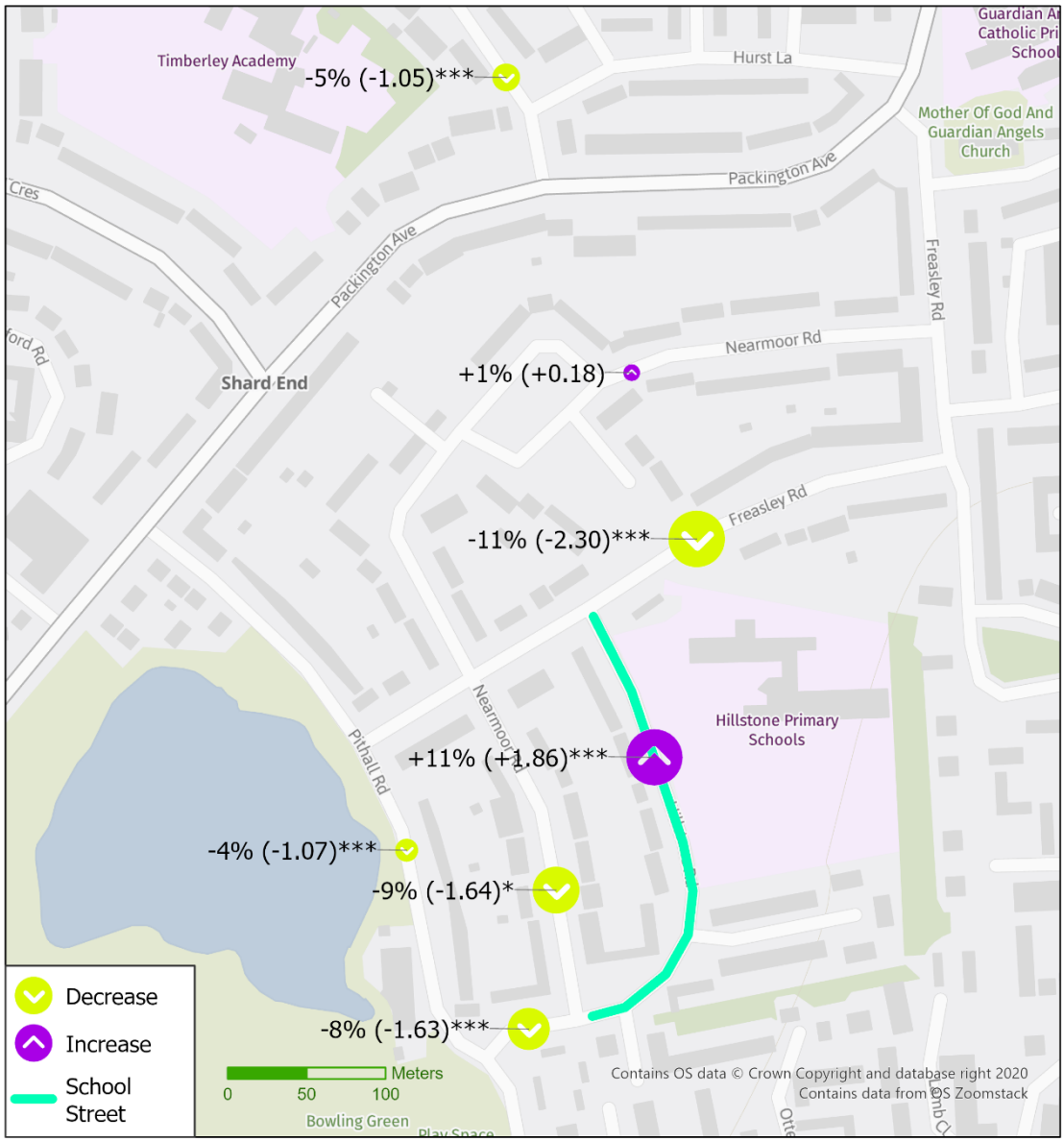


Figure 14: % (and numerical) change in average morning traffic speeds (08:00-09:00) between baseline and follow-up

The change in average traffic speeds at the locations around Hillstone Primary School during the afternoon School Street hours are shown in Figure 15 (baseline to during intervention) and Figure 16 (baseline to follow-up).

Figure 15: % (and numerical) change in average afternoon traffic speeds (14:45-15:45) between baseline and during intervention

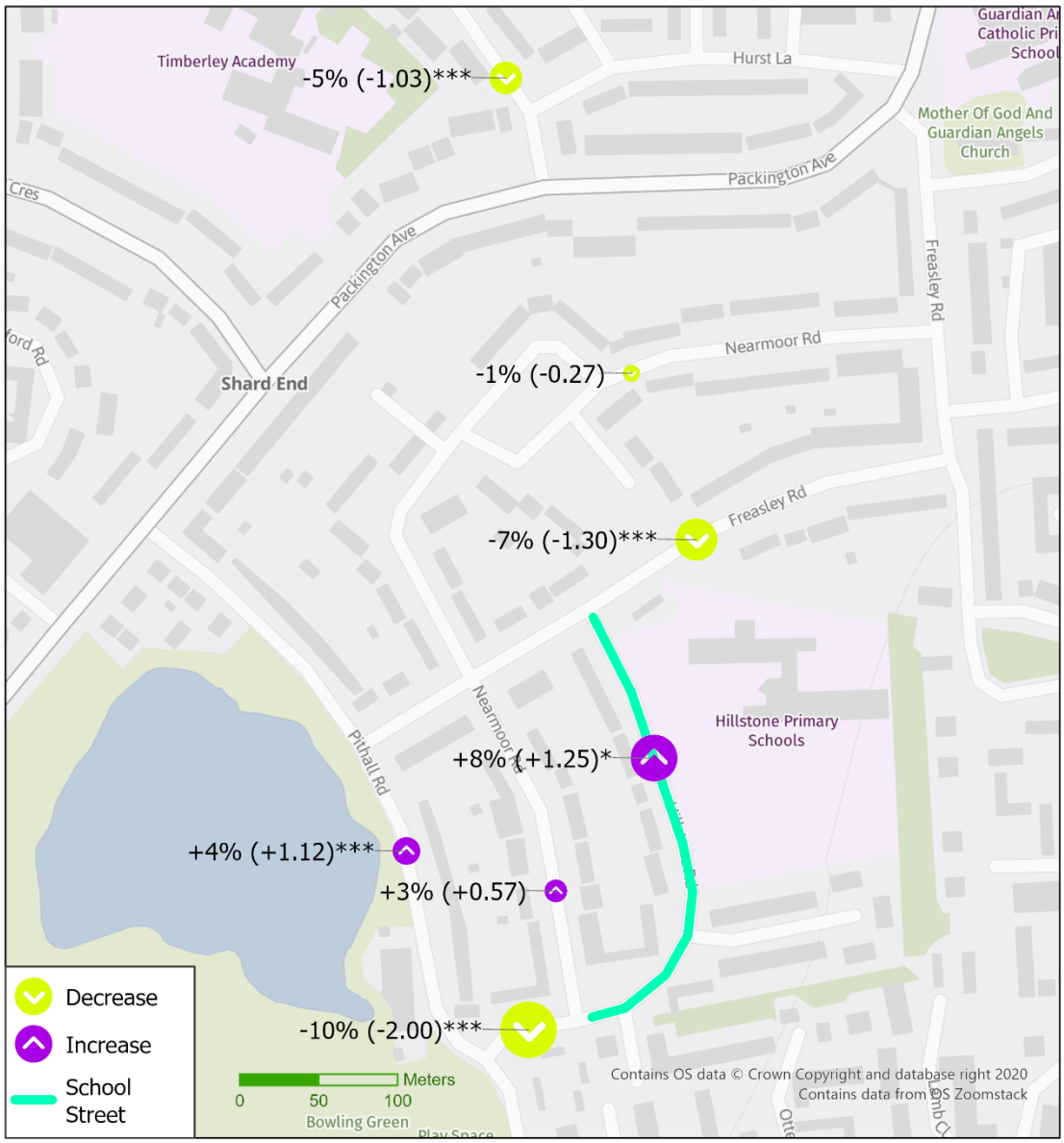
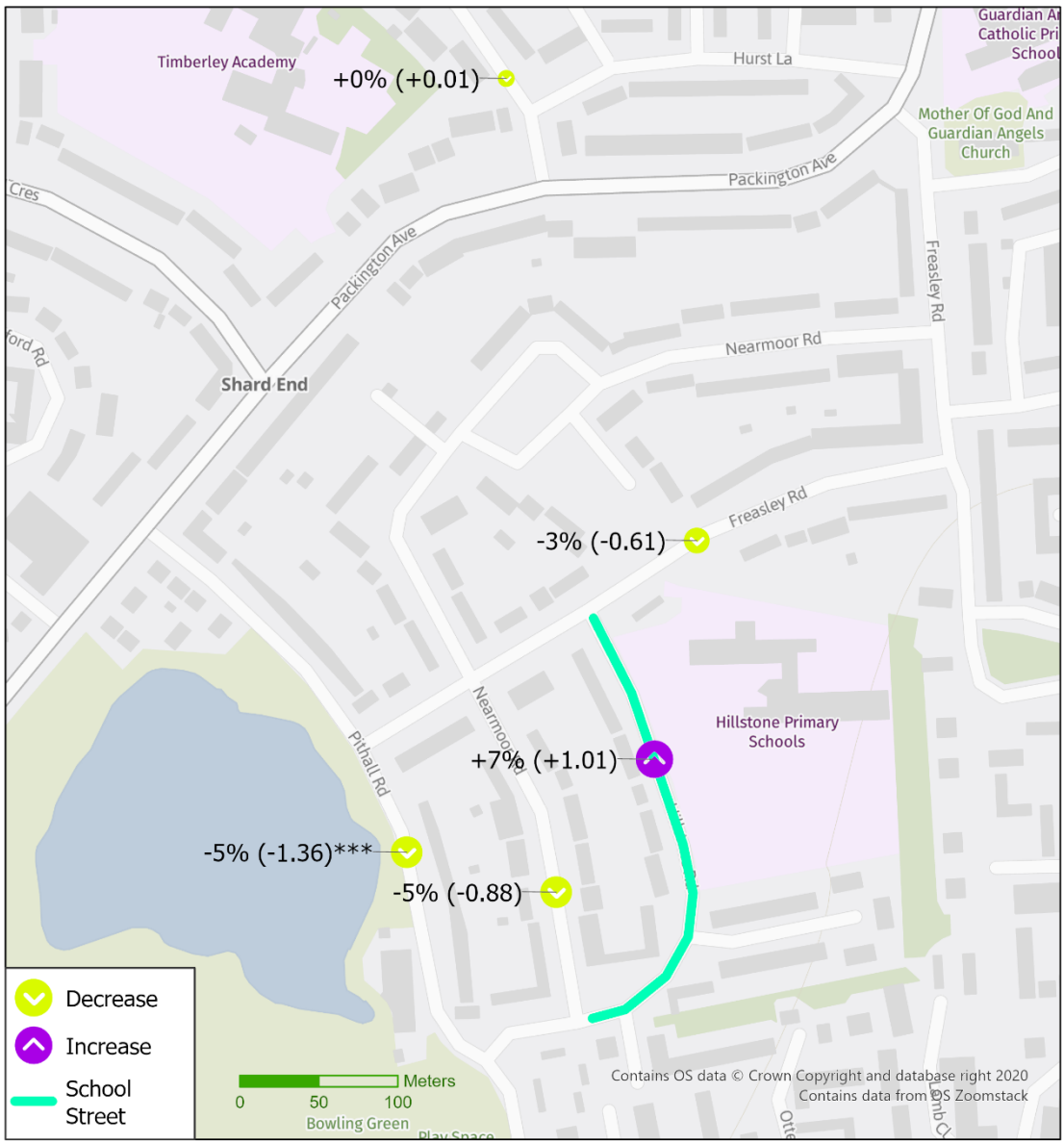


Figure 16: % (and numerical) change in average afternoon traffic speeds (14:45-15:45) between baseline and follow-up



One issue to examine is whether patterns were the same in the morning and afternoon. When looking at the baseline to follow-up change (Figure 14 and Figure 16), all but one of the locations saw the same direction of change in average speeds in the morning and afternoon. This suggests that on a given street, any observed change in traffic speeds is likely to be the same during the morning and afternoon. The only exception was Nearmoor Road (parallel to School Street) which, at follow-up, saw morning speeds rise (from 19.2 mph to 19.8 mph) but afternoon speeds fall (from 17.4 mph to 16.5 mph); however, neither change was statistically significant. Generally the speeds were higher in the afternoon than in the morning.

On Freasley Road (with the junction connecting to the school road), average speeds fell from 21.7 mph to 19.2 mph in the morning, and 19.2 mph to 18.6 mph in the afternoon, from baseline

to follow-up. The reduction in speed in the morning was statistically significant, but the decrease in the afternoon was not. This is consistent with the rise in traffic volume, and rise in number of interactions observed in video footage (see section 4.5), at that location from baseline to follow-up. A rise in traffic is more likely to cause congestion, thus resulting in lower average speeds. We see the opposite effect on Hillstone Road (School Street section), where we saw lower traffic levels in conjunction with higher average speeds (a rise from 16.3 mph to 17.4 mph in the morning, and 15.3 mph to 16.3 mph in the afternoon, from baseline to follow-up). The increase in speed in the morning was statistically significant, but the change in the afternoon was not. Consequently, lower speeds on their own ought not to be interpreted necessarily as a good thing. This trend did not occur on Pithall Road, where there was a reduction in both the traffic volume and average vehicle speeds. At that location the average vehicle speed reduced from 28.0 mph to 25.8 mph in the morning, and 26.3 mph to 24.9 mph in the afternoon, from baseline to follow-up, both of which were statistically significant reductions.

The evidence suggests that drivers permitted to travel through the School Street on Hillstone Road during the hours of restrictions, were able to travel faster, on average, than at baseline. This does pose a potential safety risk to pupils, though the speeds are generally still low. On the other hand, there was a slowing down of traffic on neighbouring roads (Freasley Road, Pithall Road), which may provide a safer environment for pupils walking to school via these roads. However, there is potential for lower speeds to interact with increased congestion in a 'trade-off' and this ought to be considered on a road by road basis.

Encouragingly, as the speed limit is 30mph across all the monitoring locations, there was not any evidence of the average speed of traffic being over the speed limit at any of the locations across all the data collection phases.

4.4.2 Somerville

At Somerville Primary school the School Street hours were 08:15 – 09:15 and 14:45 – 15:45. Here we discuss average traffic speed values from the hours of 08:00 – 09:30 (morning) and 14:30 – 16:00 (afternoon) separately.

Unfortunately, due to the data collection issues at Somerville Primary School (see Appendix 6.3.3 for further explanation), we only have speed data for the B4145 monitoring location. Any commentary on changes in speed around the school is extremely limited.

At the B4145 monitoring location the direction and extent of speed change, between baseline and follow-up phases, varied between the morning and afternoon School Street hours.

During the morning School Street hours the average speed rose by 8% (from 22.8 mph at baseline to 24.5 mph at follow-up), whereas in the afternoon the average speed fell by 20% (from 20.7 mph at baseline to 16.6 mph at follow-up). In both cases the change in speed was

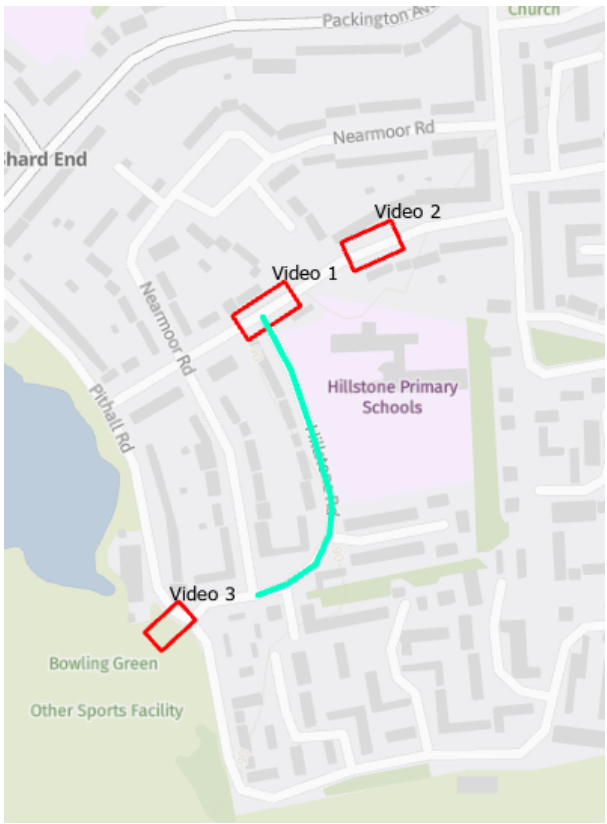
statistically significant. It is unclear why there was such a difference between the morning and afternoon hours, as no evidence of any local events (e.g. roadworks) that would interact with the traffic volume or speed has been identified.

4.5 Video Analysis

4.5.1 Hillstone

At Hillstone Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30. Here we discuss analysis of video footage during the combined hours of 08:00 – 09:00 and 14:45 – 15:45. A full explanation of the indicators analysed at each location is given in Appendix 6.3.4.

Figure 17: Map of video monitoring locations 1, 2 and 3 at Hillstone Primary School



Video location 1 – Freasley Road and Hillstone Road junction.

We monitored four behaviours at the junction of Freasley Road and Hillstone Road (Video location 1 in Figure 17) to do with driver parking and driver-pedestrian interaction. An overview of the indicators is shown in Figure 18.

As detailed in Table 9, the number of drivers parking on the grass verge on Freasley Road rose from 16 at baseline to 20 at the during intervention phase and 26 at the follow-up phase

(a 25% rise from baseline to follow-up). The number of parking drivers that were involved in a level 1 interaction also rose from baseline to during intervention and follow-up. Level 2 and 3 interactions were only observed at the during intervention phase (see Interaction Severity Index in Appendix 6.3.4).

Table 9: Number of drivers parking on the grass verge and associated behaviours[20]

Data collection phase	Number of instances	Number (%) picking up/dropping off children	Number (%) of interactions at level 1	Number (%) of interactions at level 2	Number (%) of interactions at level 3
Baseline	16	14 (88%)	3 (19%)	0 (0%)	0 (0%)
During intervention	20	18 (90%)	5 (25%)	3 (15%)	1 (5%)
Follow-up	26	21 (81%)	10 (38%)	0 (0%)	0 (0%)

Figure 18: Markings for behaviours at Hillstone Video Location 1. Parking on grass verge (top left), interactions between drivers within junction area (bottom left), drivers manoeuvring over give way lines (top right), and parking in School Street (bottom right).

[20] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

The number of interactions between drivers meeting at the junction of Hillstone Road and Freasley Road rose by 20 from baseline to during, but returned back to similar levels at follow-up (see Table 10). The number of level 1 interactions increased from the baseline (18) to the during intervention phase (19), but dropped below baseline levels at the follow-up phase (15). The number of level 2 interactions were markedly higher at the during intervention phase (58), compared to the baseline (39). At the follow-up phase the number of level 2 interactions were higher than at baseline, but much lower than at the during intervention phase. The number of level 3 interactions observed was consistent across the phases.

Table 10: Number of interactions between drivers within the Freasley Road/Hillstone Road junction[21]

Data collection phase	Number of interactions	Number (%) of interactions at level 1	Number (%) of interactions at level 2	Number (%) of interactions at level 3
Baseline	58	18 (31%)	39 (67%)	1 (2%)
During intervention	78	19 (24%)	58 (74%)	1 (1%)
Follow-up	62	15 (24%)	46 (74%)	1 (2%)

The number of drivers having to manoeuvre into the Hillstone Road junction also rose from baseline (17) to during intervention (42), but fell slightly at follow-up (33). Despite the drop between the during intervention and follow-up phases, there were still almost double the number of drivers having to manoeuvre into the Hillstone Road junction. The number of drivers that parked in the School Streets area halved from baseline (43) to during intervention (20) and follow-up (22) phases.

The findings suggest that there was a degree of traffic and parking displacement at this location. There was a rise in both drivers parking on the grass verge and interactions within the junction, suggesting there was an overall rise in traffic at the location. At the during intervention phase, there was not just a rise in the number of grass verge parked cars interacting with other road users, but also interactions of a higher severity compared to the baseline. At the follow-up phase the highest severity level of interaction was the same as at baseline, but the number of interactions was much higher, which still suggests an increased risk to road safety. In relation to the interactions arising from drivers meeting at the Hillstone Road/Freasley Road junction, at the during intervention phase there was a far greater number of level 1 and level 2 interactions occurring compared to baseline. At the follow-up phase, the number of level 1 interactions fell below the number at baseline, but the level 2 interactions were still higher than at baseline. A fall in the number of interactions within the junction between during intervention

[21] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

and follow-up suggests that given further time, the traffic displacement may fall further. Overall the rise in the number of interactions, with the observation that a higher proportion of interactions are of a more severe, but still moderate, level of interaction, suggests an increased risk to road safety. However we did not observe any actual rise in dangerous activity (e.g. collisions). Evidence of higher severity interactions at the during intervention phase may be due to road users adjusting to the recently implemented School Street intervention.

Video location 2 – Freasley Road

As well as noting any unsafe or illegal resident parking behaviour for case studies, we monitored two behaviours at Freasley Road (Video location 2 in Figure 17). The images in Figure 19 give a visual representation of the indicators analysed.

Figure 19: Markings for behaviours at Hillstone Video Location 2. Instances of drivers mounting the kerb/verge due to not being able to pass oncoming traffic (left), and instances of drivers parking (right)

The analysis revealed that there were no instances of drivers driving on the grass verge due to a lack of space on the road at baseline, but there were four at the during intervention phase and three at the follow-up phase. This unsafe driver response to the School Street causes obstructions and makes the road more dangerous for other road users. Despite this, the number of parked vehicles on the stretch of road saw a 42% reduction, from 12 at baseline to seven at follow-up (see Table 11), and the proportion of cases in which children were in the vehicle fell even further, suggesting that there had not been a displacement of school drop off/pick up parking.

Table 11: Behaviours recorded on Freasley Road[22]

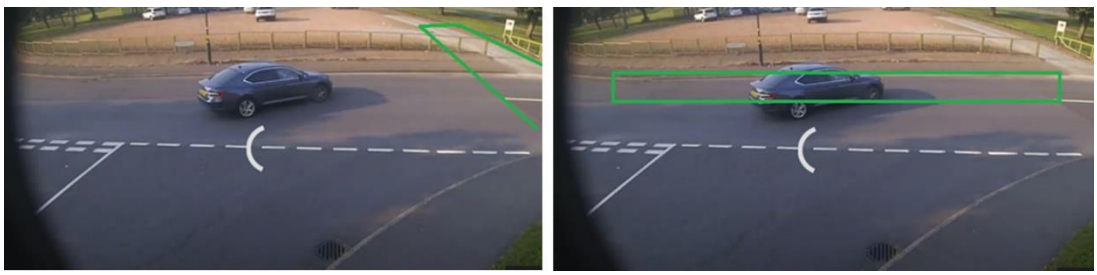
Data collection phase	Drivers driving on grass verge	Drivers parking on stretch of road	Number (%) of parked vehicles with children in
Baseline	0	12	7 (58%)
During intervention	4	11	5 (45%)
Follow-up	3	7	1 (14%)

There were instances in which a resident would fully drive on the grass verge to park up outside their house. We did not observe this at baseline, but observed it twice at the during intervention phase and once at the follow-up phase. The number of drivers parking fell after baseline, therefore this behaviour does not appear to have been caused by the School Street.

Video location 3 – Car park opposite the junction at Hillstone Road and Pithall Road

Two behaviours were recorded at the car park opposite the junction at Hillstone Road and Pithall Road (Video location 3 in Figure 17), shown in Figure 20.

Figure 20: Markings for behaviours at Hillstone Video Location 3. Instances of drivers entering the car park (left), and dropping someone off (right)



There were no instances of drivers parking on the road outside the car park at baseline, during intervention or follow-up phases. As shown in Table 12, the number of drivers entering the car park only fell between the baseline and during intervention and follow-up phases. This is surprising as it was expected that some of the school drop off parking would be displaced to the car park. The number of interactions remained low between baseline and follow-up, with only two interactions at both baseline and follow-up and zero interactions at the during intervention phase. We anticipated that there might be a rise in use of the car park following the introduction of the School Streets, which would increase the likelihood of drivers interacting with one another around the car park entrance, but this did not occur.

[22] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

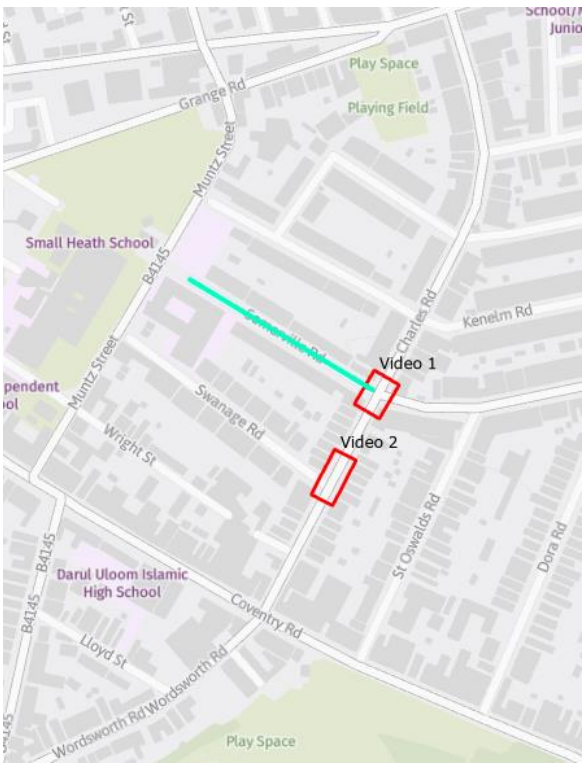
Table 12: Behaviours recorded at the car park opposite the junction at Hillstone Road and Pithall Road[23]

Data collection phase	Drivers entering the car park	Number (%) of interactions at level 1	Number (%) of interactions at level 2
Baseline	44	2 (5%)	0 (0%)
During intervention	43	0 (0%)	0 (0%)
Follow-up	31	1 (3%)	1 (3%)

4.5.2 Somerville

At Somerville Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30. Here we discuss analysis of video footage during the combined hours of 08:00 – 09:30 and 14:30 – 16:00. As with Hillstone Primary, a full explanation of the video monitoring indicators analysed at each location is given in Appendix 6.3.

Figure 21: Map of video monitoring locations 1 and 2 at Somerville Primary School



[23] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Video location 1 – Somerville Road and Charles Road junction

We monitored two behaviours at the junction between Charles Road and Somerville Road, the main entrance junction to the school (video location 1 in Figure 21), shown in Figure 22.

Figure 22: Markings for relevant behaviours at Somerville Video Location 1. Crossing points for pedestrians (left), and instances of drivers parking (right)

At crossing point C (the School Streets entrance) the number of pedestrians crossing rose by a large amount from baseline to during intervention, with another small rise at the follow-up phase. There were also rises in the number of pedestrians crossing at points A and B, while at crossing point D there was a slight rise initially followed by a fall at follow-up. Overall, the number of pedestrians crossing the road rose by 32% when looking at all four crossings as a whole. This indicates that the roads became busier with pedestrians during the School Street.

There was a fall in the proportion of pedestrians who waited before crossing at points B, C and D, which would suggest that these crossing points were easier to cross following the introduction of the School Streets. However, at crossing point A (junction between Charles Road and non-School Street section of Somerville Road) there was a large rise in the proportion of pedestrians waiting between baseline and follow-up. This coincided with a rise in traffic volumes at this location, which could cause pedestrians to have to wait before crossing. Overall, there was a 4 percentage point rise in the proportion of pedestrians waiting to cross when looking at all four crossings as a whole.

For context, Covid-19 cases were rising in the three weeks between our baseline and during intervention phases. This may have been expected to lead to a fall in the number of people travelling, yet the findings are the opposite for both drivers and pedestrians crossing, suggesting Covid-19 has little impact on the numbers of pedestrians in these phases of data collection.

Table 13: Road crossings recorded and proportion of pedestrians waiting before crossing[24]

Data collection phase	Crossing point A		Crossing point B		Crossing point C		Crossing point D		Overall	
	Total peds.	% waiting	Total peds.	% waiting	Total peds.	% waiting	Total peds.	% waiting	Total peds.	% waiting
Baseline	338	37%	52	81%	372	24%	22	73%	784	35%
During intervention	367	42%	73	74%	577	7%	27	56%	1044	26%
Follow-up	410	61%	74	68%	528	17%	24	54%	1036	39%

As shown in Table 14, we observed very few instances of illegal parking on the zig zag road markings: one at baseline, three during intervention, and one at follow-up. Although this is not enough to conclude a significant trend, three of these drivers did generate a level 1 interaction and one generated a level 2 interaction, suggesting it is a potentially hazardous behaviour to be aware of (see Interaction Severity Index in Appendix 6.3.4).

Table 14: Parking on zig zag road markings[25]

Data collection phase	Number of drivers parking on zig zags	Number (%) of interactions at level 1	Number (%) of interactions at level 2
Baseline	1	0 (0%)	1 (100%)
During intervention	3	2 (67%)	0 (0%)
Follow-up	1	1 (100%)	0 (0%)

Table 15 shows the number of drivers that parked on the pavement rose by 80%, from 30 drivers at baseline to 54 at during intervention and follow-up phases. At both during intervention and follow-up phases, the number of level 1 and 2 interactions was higher, than at baseline. However, the number of level 3 interactions was higher at baseline than at those subsequent monitoring phases. There was one level 4 interaction at the during intervention phases (none at baseline and follow-up).

[24] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.
[25] See footnote 23

Of the drivers parked on the pavement; none were transporting children at baseline, 10 were transporting children at during, and two were transporting children at follow-up. This suggests that at least some of the additional pavement parking is due to school pupil drop offs or pickups.

Overall, the rise in the number of drivers parking on the pavement does suggest that there has been some displacement of parking due to the School Street. The number of instances of drivers being involved in an interaction with another road user or pedestrian whilst parking did rise, however the interactions observed were generally cases in which there was ample time to manoeuvre, slow down or stop to avoid any kind of collision. Nonetheless, it still indicates a rise in road safety risk outside of the school street.

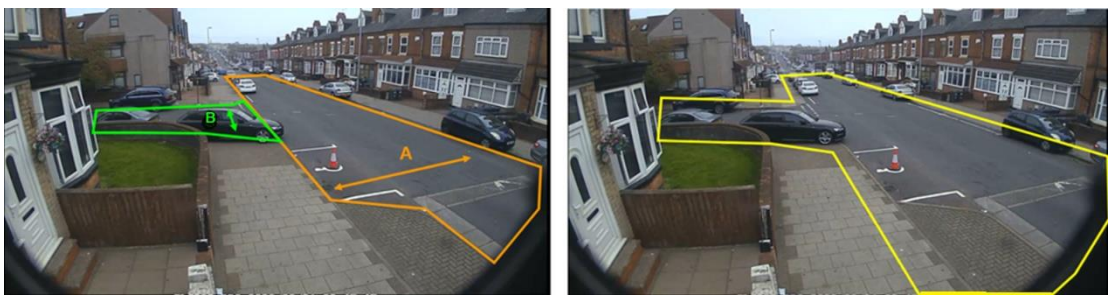
Table 15: Parking on the pavement behaviours[26]

Data collection phase	Number of drivers parking on pavement	Number (%) of interactions at level 1	Number (%) of interactions at level 2	Number (%) of interactions at level 3	Number (%) of interactions at level 4
Baseline	30	9 (30%)	7 (23%)	2 (7%)	0 (0%)
During intervention	54	24 (44%)	11 (20%)	1 (2%)	1 (2%)
Follow-up	54	19 (35%)	16 (30%)	0 (0%)	0 (0%)

Video location 2 – Charles Road (near entrance to Swanage Road)

We monitored two behaviours along Charles Road (video location 2 in Figure 21), shown in Figure 23.

Figure 23: Markings for behaviours at Somerville Video Location 2. Crossing points for pedestrians (left), and instances of drivers stopping (right)



[26] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

As shown in Table 16, at both crossing points A and B, the total number of pedestrians crossing initially fell between baseline and during intervention phases but then rose to above baseline levels at follow-up. The proportion of pedestrians waiting at crossing point A stayed relatively stable whereas the proportion waiting at crossing point B near doubled from 7% at baseline to 15% at follow-up. In addition, the proportion of child pedestrians needing to wait at crossing point B rose dramatically, from 6% at baseline to 32% at follow-up. This indicates that crossing point B was more difficult at the follow-up phase than at baseline. As there was an 18% rise in motorised traffic observed on Swanage Road, the junction of which is crossing point B, it is likely that displaced traffic has contributed to the rise in the proportion of pedestrians needing to wait to cross.

Table 16: Road crossings recorded and proportion of pedestrians waiting before crossing[27]

Data collection phase	Crossing point A		Crossing point B	
	Total peds.	% waiting	Total peds.	% waiting
Baseline	232	67%	417	7%
During intervention	213	62%	356	10%
Follow-up	262	64%	453	15%

The number of instances of drivers pulling over, dropping off or parking along the stretch of road fell by 48% between baseline and follow-up, despite only showing a slight fall at the during intervention phase (See Table 17). The number of interactions at level 1 and 3 fell at both during intervention and follow-up phases (see Interaction Severity Index in Appendix 6.3.4). The number of level 2 interactions rose consistently from baseline (zero) to follow-up (five). Of the drivers which pulled over, the percentage which were also dropping off children rose from 4% at baseline to 23% at follow-up. Overall, at this location, there were fewer drivers pulling over, dropping off or parking at the follow-up phase compared to baseline, but the proportion of these cases in which an interaction arose rose, as did the proportion of cases in which the vehicle contained children. This suggests that there may have been some displacement of school drop off/pick up parking, and that although pulling over, dropping off or parking instances fell, there was a higher likelihood that those cases would result in an interaction with other road users.

[27] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Table 17: Drivers pulling over/dropping off/parking behaviours[28]

Data collection phase	Number of instances of drivers pulling over/dropping off/parking	Number (%) of vehicles that contained children	Number (%) of interactions at level 1 or above	Number (%) of interactions at level 2 or above	Number (%) of interactions at level 3 or above
Baseline	50	2 (4%)	25 (50%)	0 (0%)	1 (2%)
During intervention	48	7 (15%)	15 (31%)	4 (8%)	0 (0%)
Follow-up	26	6 (23%)	12 (46%)	5 (19%)	0 (0%)

4.6 Resident's perceptions

This section presents the findings from the postal survey, supporting the previous evidence with perspectives of the people who live in the surrounding area. The numbers of surveys posted and responses received are shown in Table 18. Questions relating to the perception of the School Street were asked to all survey respondents, whereas questions relating to the perception of the surrounding streets were only posed to the residents living on the surrounding streets. Further information on questions asked about traffic issues and perceived safety is available in Appendix 6.3.5.

Table 18: Numbers of surveys posted and responses received, by data collection phase and school

School	Baseline			Follow-up		
	Number of surveys sent	Number of responses received	Number of responses from residents living on School Street	Number of surveys sent	Number of responses received	Number of responses from residents living on School Street
Somerville Primary School	554	32	7	554	23	3
Hillstone Primary School	504	50	9	504	48	11

[28] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

4.6.1 Hillstone

Perceived traffic volumes, speeds and parking

As shown in Table 19, after the School Street was introduced at Hillstone Primary School the proportion of residents who felt that these issues existed on surrounding streets rose for all three issues, when compared with before the School Street. This suggests that, from the experience of residents, there was at least some displacement of vehicles and related issues of speeds and parking onto surrounding streets. The change was especially striking with regards to drivers parked unsafely or illegally. Before the School Street, 68% of respondents reported this issue on surrounding streets, whereas during the School Street this figure rose to 93%.

We also asked residents about the same three issues but with regards to the School Street on Hillstone Road itself. During the School Streets, the proportion of residents who felt there were too many vehicles on Hillstone Road was lower than before, in line with our findings of reduced traffic counts on this road. Meanwhile, the proportion of residents who felt vehicle speeds and unsafely parked cars was an issue on Hillstone Road rose during the School Street. Again, this is in line with our findings on actual average vehicle speed and video analysis of drivers at the entrance to Hillstone Road.

Table 19: Proportions of Hillstone respondents (number agreeing / total responding to question) expressing agreement with vehicle volume, speed and parking statements at baseline and follow-up, with percentage point change[29]

Statement	Baseline	Follow-up	Percentage point change
Perception of surrounding streets during school drop off and pick up times			
There are too many vehicles on the road	68% (21/31)	80% (12/15)	12 pp ↑
Cars and other vehicles travel too fast	77% (24/31)	93% (13/14)	16 pp ↑
There are unsafe or illegally parked cars	68% (21/31)	93% (14/15)	25 pp ↑
Perception of Hillstone Road (School Street) during school drop off and pick up times			
There are too many vehicles on the road	94% (46/49)	88% (28/32)	-6 pp ↓
Cars and other vehicles travel too fast	81% (39/48)	87% (27/31)	+6 pp ↑
There are unsafe or illegally parked cars	88% (44/50)	90% (28/31)	+2 pp ↑

[29] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Perceived safety

For the surrounding streets, there was no discernible difference in responses to these safety statements before and after the School Street was implemented (see Table 20). Responses to the first statement about general safety became slightly more polarised, while there was a slight rise in the proportion of residents who felt the surrounding streets were not safe to cross and were not safe for children to journey to school. However, these were all very small changes considering the sample size of 29 responses before[30], and 15 responses during, the School Street. Overall, this suggests that while residents may have collectively perceived greater traffic displacement, this did not translate into these residents feeling significantly more unsafe.

When asked about Hillstone Road however, residents very clearly felt an improvement in safety during the School Street. The proportion of residents agreeing with the statements rose between baseline and follow-up for all four statements. As shown in Table 20, the largest change was in response to "the road is safe for children to travel to schools on". Agreement with this statement more than doubled, rising from 14% to 39%.

Table 20: Proportions of Hillstone respondents (number agreeing/total responding to question) expressing agreement with road safety statements at baseline and follow-up, with percentage point change[31]

Statement	Baseline	Follow-up	Percentage point change
Perception of surrounding streets during school drop off and pick up times			
The road is safe	21% (6/29)	27% (4/15)	6 pp ↑
The road is safe for children to travel to school on	25% (7/28)	27% (4/15)	2 pp ↑
The road is safe to cross	21% (6/28)	20% (3/15)	1 pp ↓
The road is a pleasant place to be	26% (7/27)	21% (3/14)	5 pp ↓
Perception of Hillstone Road (School Street) during school drop off and pick up times			
The road is safe	10% (5/48)	29% (9/31)	19 pp ↑
The road is safe for children to travel to school on	14% (7/49)	39% (12/31)	25 pp ↑
The road is safe to cross	8% (4/50)	31% (10/32)	23 pp ↑
The road is a pleasant place to be	21% (10/47)	29% (9/31)	8 pp ↑

[30] 29 responses was the largest sample size of the four statements, about the surrounding streets. "The road is safe" had a sample size of 29, "The road is safe for children to travel to school on" had a sample of 28, "The road is safe to cross" had a sample of 28 and "The road is a pleasant place to be" had a sample of 27.
[31] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Parent and teacher perceptions[32]

We asked residents who were also parents or teachers of pupils at Hillstone Primary School about their perception of pupils' travel to school (see Table 21).

There was a rise in the number of parents agreeing that the school was easy and safe to access (from two before the School Street to three during).

There was also a perceived rise in active travel. The number of parents expressing agreement with the statement "a lot of pupils walk or cycle to school" rose during the School Street, from zero to one. It is worth noting, though, that all the parents who responded also agreed that a lot of pupils were driven to school, both before (six) and during (five) the School Street.

Regarding the journey to and from school, there was a rise in the number of parents who felt it was safe to cycle (from one to two), but a fall in the proportion who thought it was safe to walk (from three to two).

Table 21: Proportions of Hillstone respondents (number agreeing/total responding to question) expressing agreement with pupil travel to school statements at baseline and follow-up, with percentage point change[33]

Statement	Baseline	Follow-up	Percentage point change
The journey to and from school is safe to walk	50% (3/6)	40% (2/5)	10 pp ↓
The journey to and from school is safe to cycle	17% (1/6)	40% (2/5)	23 pp ↑
The school entrance is easy and safe to access	33% (2/6)	60% (3/5)	27 pp ↑
A lot of pupils are driven to school	100% (6/6)	100% (5/5)	0 pp
A lot of pupils walk or cycle to school	0% (0/6)	20% (1/5)	20 pp ↑

[32] These findings must be interpreted with the caveat that there were only 6 responses at baseline and 5 responses at follow-up.
[33] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Perceptions and impacts of the School Streets

The majority of residents (77%, 26 out of 34 that responded) said they would support the continuation of the School Street at Hillstone Primary School.

Among those who would not support it, their reasons included:

- the displacement effects of traffic and drivers parking dangerously (which this study has investigated)
- timings not being effective to stop motorists using the road.

> *"Restrictions have greater problems, with chaos on junctions, residents driveways and grass verges. Pavements are blocked, very dangerous to try and cross the road, especially with small children. Emergency vehicles would find it practically impossible to gain access to properties and indeed to find a way down Freasley Road"*

Only very small numbers of residents reported that they had been impacted by the School Street. 10% of respondents (three out of 31) reported to have walked more, while 3% (one out of 31) said they had driven less. 23% of residents (seven out of 31) had changed their routine and 13% (four out of 31) had been unable to access something.

Finally, half of the residents (17 out of 34) who responded to the survey felt that motorists failed to comply with the School Streets at least a few times a day.

4.6.2 Somerville

We asked residents the same set of questions in the local area around Somerville Primary School, about the School Street there.

Perceived traffic volumes, speeds and parking

Our survey indicated that after the School Street had been implemented, traffic speeds and dangerous parking actually became less of an issue on surrounding streets, according to residents. The proportion of residents on surrounding roads who felt drivers were travelling too fast fell from 81% to 60%, while the same figure regarding cars parking illegally dropped from 100% to 80% (see Table 22). This is in contrast to Hillstone Primary School where perceptions of speeds and parking grew worse on surrounding streets.

Table 22: Proportions of Somerville respondents (number agreeing/total responding to question) expressing agreement with vehicle volume, speed and parking statements at baseline and follow-up, with percentage point change[34]

Statement	Baseline	Follow-up	Percentage point change
Perception of surrounding streets during school drop off and pick up times			
There are too many vehicles on the road	91% (21/23)	89% (8/9)	2 pp ↓
Cars and other vehicles travel too fast	81% (17/21)	60% (6/10)	21 pp ↓
There are unsafe or illegally parked cars	100% (20/20)	80% (8/10)	20 pp ↓
Perception of Somerville Road (School Street) during school drop off and pick up times			
There are too many vehicles on the road	91% (29/32)	58% (11/19)	33 pp ↓
Cars and other vehicles travel too fast	84% (26/31)	68% (13/19)	16 pp ↓
There are unsafe or illegally parked cars	94% (29/31)	84% (16/19)	10 pp ↓

There was little change in how residents perceived the volume of vehicles on the streets around Somerville School. Overall, this suggests that road safety issues did not get worse due to displacement around the School Street, in the experience of residents.

Regarding Somerville Road itself, residents indicated that all three issues improved after the School Streets was put in place. The proportion of residents who felt drivers travelled too fast outside the school fell from 84% to 68%, while for unsafe or illegally parked cars the figure fell from 94% to 84%. In particular, the proportion of residents agreeing that there were too many vehicles on Somerville Road fell by over a third, from 91% to 58%. These improvements are to be expected due to the street being closed. However, just like on the surrounding streets, despite this improvement the issue did not disappear completely and still exists according to the majority of people surveyed. This mirrors our traffic counts which found that, at the follow-up phase, the School Street still saw 80% of the volume of traffic observed at baseline. Nonetheless, this is a strong indication that the School Streets had a positive impact on road safety on Somerville Road, and little to no negative impact on surrounding streets.

Perceived safety

On surrounding streets, perceptions of all four street characteristics improved. Before the School Street was implemented 14% of residents agreed that the surrounding streets were a pleasant place to be, whereas afterwards 30% agreed. Rises for the other three statements were smaller, as shown in Table 23. This evidence indicates that the perception of road safety

[34] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

on surrounding streets maintained or improved while the School Streets was in place, suggesting displacement of road safety issues is less likely to have occurred.

Table 23: Proportions of Somerville respondents (number agreeing/total responding to question) expressing agreement with road safety statements at baseline and follow-up, with percentage point change[35]

Statement	Baseline	Follow-up	Percentage point change
Perception of surrounding streets during school drop off and pick up times			
The road is safe	29% (6/21)	40% (4/10)	11 pp ↑
The road is safe for children to travel to school on	29% (6/21)	40% (4/10)	11 pp ↑
The road is safe to cross	24% (5/21)	30% (3/10)	6 pp ↑
The road is a pleasant place to be	14% (3/21)	30% (3/10)	16 pp ↑
Perception of Somerville Road (School Street) during school drop off and pick up times			
The road is safe	19% (6/32)	47% (8/17)	28 pp ↑
The road is safe for children to travel to school on	22% (7/32)	47% (8/17)	25 pp ↑
The road is safe to cross	16% (5/32)	50% (9/18)	34 pp ↑
The road is a pleasant place to be	16% (5/32)	44% (8/18)	28 pp ↑

When asked about Somerville Road itself, residents very clearly felt an improvement in safety across the board. Agreement with all four statements rose by at least a quarter. In particular, the number of residents agreeing that the road was safe to cross rose from 16% prior to the School Street, to 50% during it.

Parents and teachers perceptions[36]

As shown in Table 24, there was a rise in the proportion of parents who felt the journey to and from school was safe to cycle and safe to walk, rising from zero to two, and one to three, respectively.

[35] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.
[36] As is the case for Hillstone School, the following findings must be interpreted with the caveat that the sample size of parents and teachers is very low, with only 5 responses at baseline and 4 responses at follow-up

During the School Street, four parents who responded to the survey felt that the school was easy and safe to access, compared to three parents at baseline.

There was also a rise in the number of parents who perceived that a lot of pupils walk or cycle to school, from zero to three. This was mirrored by a fall in the proportion of parents who felt a lot of pupils were driven to school.

Table 24: Proportions of Somerville respondents (number agreeing/total responding to question) expressing agreement with pupil travel to school statements at baseline and follow-up, with percentage point change[37]

Statement	Baseline	Follow-up	Percentage point change
The journey to and from school is safe to walk	20% (1/5)	75% (3/4)	55 pp ↑
The journey to and from school is safe to cycle	0% (0/5)	25% (1/4)	50 pp ↑
The school entrance is easy and safe to access	60% (3/5)	100% (4/4)	40 pp ↑
A lot of pupils are driven to school	80% (4/5)	50% (2/4)	30 pp ↓
A lot of pupils walk or cycle to school	0% (0/5)	75% (3/4)	75 pp ↑

[37] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Perceptions and impacts of the School Streets

The majority of residents (80%, 16 out of the 20 that responded) said they would support the continuation of the School Streets.

Among those who would not support it, their reasons again revolved around displacement issues which this study seeks to investigate. The reasons were:

- displacement of school traffic and reduction in parking possibilities for residents
- not being able to access the school for drop-off.

> *"I now have to park further away to drop my child to school. As a result my other children are late for school"*

> *"All school pickup traffic is diverting to using Swanage Rd which is making it worse & pushing problem over"*

> *"Residents have problems parking, school staff park on our roads, it's not fair"*

A number of residents reported that they had been impacted by the School Street. 35% of respondents (seven out of 20) said that they had walked more, while 5% (one out of 20) said they had driven less. 20% of residents (four out of 20) had changed their routine and 15% (three out of 20) had been unable to access something.

Finally, 35% of residents (seven out of 20 felt that motorists failed to comply with the School Street at least a few times a day.

4.7 Discussion

This section presents discussion of the findings outlined above, including overall road safety implications, long and short term impacts, differences between the monitored schools, and a consideration of other influential factors.

Limitations to the findings are referred to throughout this report and summarised in appendix 6.7.

4.7.1 Overall road safety implications

This study found the following key road safety implications arising from the implementation of School Streets:

- Although there were indications of some roads around the School Streets experiencing slight rises in traffic - which are likely to be in part due to traffic displacement - the overall levels of traffic in the local area dropped during school pick-up and drop-off times, following the introduction of the School Streets at both schools. The monitored time windows included a 15-minute buffer each side of the School Street time window (e.g. for the morning School Street at Hillstone, which was enforced from 08:15 – 08:45, traffic monitoring was conducted from 08:00 – 09:00), in order to account for drivers that had changed the timing of their journeys in response to the School Street. Having accounted for this potential shift in journey timing, an overall drop in traffic was observed, indicating a degree of traffic being removed from the road (traffic evaporation), which is likely to have had an overall positive impact on road safety

- Across both schools the postal surveys showed strong improvements in perceived safety and quality of the streets for active travel, on both the School Street and surrounding ones. After the School Streets had been implemented, a higher proportion of local residents perceived the School Streets road and the surrounding roads to be safe. This demonstrates that School Streets have a strong impact on public perception of the road space in being safe and supportive of walking and cycling, as well as a pleasant place to be

- Analysis of video footage showed that, overall, drivers looking to park can be displaced and this leads to a higher number of drivers being involved in an interaction with other road users (i.e. one or more road user having to manoeuvre, stop and slow down to avoid a collision). The evidence did not suggest that the severity (e.g. a road user having to stop more imminently to avoid collision) of these interactions had risen as a result of the School Streets, but the increased number of interactions indicates a negative impact on road safety.

4.7.2 Individual schools

During the School Streets hours, overall traffic volumes in the area around Hillstone Primary School reduced by 8% from baseline to follow-up. Across the same area, outside of the School Street hours, traffic rose by 5%. In addition, the control monitoring location on Bradley Road saw a rise in traffic volume of 3% during the School Street hours, between baseline and follow-up. This suggests that the School Street led to some localised traffic evaporation.

Looking at individual roads, there was a 5% rise in traffic volumes on Freasley road, a road that directly joins with Hillstone Road, which might indicate that there was some displacement of traffic arising from the School Street. However, the traffic volumes rose by 5% at that location outside of the School Street hours as well. On the School Street section of Hillstone Road the average car speed rose slightly following the implementation of the School Street, posing a potential safety risk, although the speeds both before and after implementation were relatively low. With regards to the displacement of parking, there was a reduction in the number of drivers parking 50-70 metres away from the School Street, but there was a marked rise in the number of drivers parking on the grass verge right next to the entrance of the School Street, and a rise in the proportion of drivers that interacted with other road users whilst parking, but with little change in the level of severity of the interactions. This does suggest some impact on road safety, but that this impact is likely to be limited, with road users generally having ample time to manoeuvre, slow or stop to prevent any collision when drivers are parking on or leaving the grass verge.

Residents around the school were more likely to agree that there were too many vehicles on the roads around the School Street, and to agree that there were unsafe or illegally parked cars on both the School Street road and on the neighbouring roads, following the implementation of the School Street. Despite this, residents were more likely to agree that both the school road and the surrounding streets were safe at follow-up. Although this indicates that a higher proportion of residents perceive the school road and the surrounding roads to be safe following the implementation of the School Streets, low sample sizes limit the reliability of this finding.

At Somerville Primary School, the findings were broadly similar to Hillstone Primary School. Overall traffic volumes across the monitored locations reduced by 3%. At the two locations for which 24 hour data was available (the school street section of Somerville Road and the B4145) the traffic levels fell by 16% during the School Street hours, whereas the traffic rose by 7% outside of the School Street hours. In addition there was a 3% rise in traffic at the control monitoring location on Carlton Road. Collectively, these findings suggest a degree of traffic evaporation following the implementation of the School Street.

There was a reduction in the number of drivers parking around 50-75 meters from the School Street, but an 80% rise in the number of drivers parking on the pavement area next to the School Street entrance. Although there was a rise in the number of drivers that interacted with other road users whilst parking, there was little change in the severity of the interactions.

There was evidence of a rise in traffic levels on Swanage Road, which runs parallel to Somerville Road, and a higher proportion of pedestrians crossing Swanage Road had to wait before crossing, at the follow-up phase. In addition, the proportion of pedestrians having to wait before crossing the non-School Street section of Somerville Road saw a large rise at the follow-up. Collectively, these findings indicate that there are some roads that are less easy for pedestrians to cross following the implementation of the School Street. However, there were also several locations at which a lower proportion of pedestrians waited before crossing, suggesting greater ease of travel for pedestrians.

Following the implementation of the School Street, local residents around Somerville Primary School were less likely to perceive that there were too many vehicles on the road and that there were unsafe or illegally parked cars, and more likely to agree that the road is safe, in relation to both the School Street road and the surrounding roads. This suggests a positive change to the level of vehicle traffic and road safety, though the postal survey data should be interpreted with caution as the Somerville survey sample sizes were smaller than that at Hillstone.

Potential alternative explanations for a fall in overall traffic levels observed around both schools include drivers re-timing their journeys to avoid the School Street restrictions and natural variation in traffic levels. In relation to the possibility of drivers re-timing their journeys, the time windows for the traffic speed and volume monitoring started 15 minutes before the start, and finished 15 minutes after the end, of the School Street time window in an attempt to account for traffic that may have been re-timed due to the School Street. Although natural variation in traffic levels is a viable explanation for the change in overall traffic levels, the observations of an opposite direction of change in traffic levels at control locations and in the hours outside of the School Street monitoring windows suggest that the School Street has impacted on the traffic levels.

4.7.3 Comparing short-term and long-term impact

A comparison of data collected shortly after the school streets were implemented and seven months later allows for an understanding of whether the extent and direction of any impact changes after an initial ‘bedding in’ period. Across the majority of measures reported, the extent and direction of change was generally consistent, but there were some exceptions, outlined below.

Around both schools, there was a much bigger drop in the number of drivers parking 50-75 metres away from the School Streets at the follow-up phase. Next to the School Street entrances, there were some interactions between drivers and other road users that were of a higher severity at the during intervention phase, which we did not observe at the follow-up phase. Around Hillstone Primary School, the number of instances of grass verge parking continued to grow between the during intervention and follow-up phases, while the number of interactions within the Freasley Road junction with Hillstone Road fell between these two phases. Around Somerville Primary School, there was a 2% rise in the overall level of traffic across the local area at the during intervention phase, but at the follow-up phase the traffic levels had fallen by 3% compared to the baseline. The number of pedestrians crossing the road at the second video monitoring location fell at the during intervention phase, but rose above baseline levels at the follow-up phase.

This suggests that the impacts of School Streets are likely to see some degree of change over time, and so multiple phases of monitoring should ideally be undertaken to account for this. If it is only viable to conduct one phase of monitoring during the school street, this should be undertaken several months after it has started.

4.7.4 Parking

At both schools there was evidence of increased parking near the entrance to the School Street. There was also a higher proportion of parking drivers being involved in interactions with other road users at follow-up, though the severity of the interactions didn't worsen noticeably. This does indicate that there was some degree of increased safety risk due to apparent displacement of parking. Since there were falls in the levels of parking on the roads 50-70 meters away from the School Street entrance, as well as a reduction in drivers using the nearby car park at Hillstone Primary School, at follow-up, measures to deter drivers from parking in the area in the immediate vicinity of the School Streets may help to avoid the rising number of interactions between parking drivers and other road users. Examples of such measures might include regular communication to parents about nearby car parking facilities and implementation of street furniture on verges to prevent informal parking.

4.7.5 Stewarding and road layout

The two schools around which we monitored for the purposes of this research, Hillstone Primary School and Somerville Primary School, had some differences in the stewarding of their School Streets, and the road layout of the school roads. The stewarding was very consistent at Hillstone Primary School, but less consistent at Somerville Primary School (starting and finishing at variable times, or occasionally no stewarding being carried out at all, during the monitored period), which may have influenced the individual school findings. With regards to vehicle access to the schools, Hillstone Road had two points of School Street, whereas the cul-de-sac of Somerville Road only had one. Due to this difference, it may have been expected

that the Hillstone Road School Street would be harder to enforce, due to having one more entry point that need stewarding and due to the road having the potential to transport through traffic. The combination of these factors makes it hard to set expectations as to how the findings would be expected to differ between the two schools as it could be argued that both schools' School Streets were subject to challenges, with Hillstone Primary School having a more complicated road layout, and Somerville Primary School not experiencing as consistent a degree of stewarding of the School Street.

4.7.6 Covid-19 pandemic

The varying types and degrees of restrictions being imposed on people's lives as a result of the Covid-19 pandemic had the potential to impact the complexion of the findings. Over the course of the monitoring periods, it was instructed that people should work from home, where possible[38] (with the exception of the first half of the baseline monitoring period). In relation to socialising, indoor socialising with up to five other people was permitted at the baseline monitoring phase[39], but not at the follow-up or during intervention phases[4041], during which only outdoor socialising was permitted.

Despite there being some differences in the restrictions that were imposed at the different phases of the project, which could have justified lower levels of traffic at the during intervention and follow-up phases, the traffic volume data that was collected outside of the School Street time windows, showed an overall increase in traffic volumes from baseline to follow-up.

4.7.7 Weather

As the temperature and precipitation levels are likely to influence travel behaviour, it was important that the weather conditions were as similar as possible at the baseline, during intervention and follow-up phases of the project.

Across the monitoring phases, the main element of the weather that varied was the average daily temperature, with lower temperatures at the during intervention and follow-up phases. This would reasonably be expected to lead to a greater number of trips being driven compared to the baseline phase, but the findings indicated a reduction in driving trips. It is possible that the overall reduction traffic flow would have been greater if the temperature at the during and follow-up phases had been closer to those at the baseline phase. Further detail on the weather conditions during the monitoring phases can be found in Appendix 6.4.

[38] https://www.gov.uk/government/news/coronavirus-covid-19-what-has-changed-22-september
[39] https://www.gov.uk/government/news/coronavirus-covid-19-what-has-changed-9-september
[40] https://lordslibrary.parliament.uk/covid-19-local-alert-levels-three-tier-system-for-england/
[41] https://www.gov.uk/government/speeches/pm-statement-to-the-house-of-commons-on-roadmap-for-easing-lockdown-restrictions-in-england-22-february-2021

4.7.8 Future research

There are several elements of this research that would benefit from being changed or explored further in future research. In particular:

- in this study, for each school there was a control traffic monitoring point placed on a road that was outside of the immediate surrounding area of the school. The robustness of the control data could be improved by implementing a more sophisticated network of traffic monitoring points around a control school site, to more closely replicate the extent of monitoring at the School Street school. In addition, the comparability of prospective control traffic monitoring points, with the intervention monitoring points, could be better established, by conducting some initial traffic monitoring (prior to the baseline monitoring phase) to compare the trends in traffic between the intervention monitoring points and the prospective control monitoring points. An additional consideration for future approaches to selecting both intervention and control monitoring locations, is to apply traffic modelling to estimate traffic flows and the impact of school streets on traffic locations at nearby locations.

- there are several contextual variables that warrant further exploration to obtain a fuller understanding of how they influence the impact of School Streets. For example, within this study, all but one of the traffic monitoring locations were on 30 mph roads, with average traffic speeds seeing little change between monitoring phases. It could be useful to explore whether the impact of traffic speed is different on schools that are surrounded by higher or lower speed limited roads

- the literature review that was commissioned as part of this research, highlights instances in which some kind of mitigation measure was applied after the initial School Street intervention measure, in order to prevent undesirable road safety behaviours. Further research could investigate the mitigation of such undesirable behaviours, seeking to highlight what kinds of School Street contexts have required further interventions, what kind of interventions have been applied, and to what effect. This could provide valuable School Street delivery insights for practitioners

- although only indirectly indicative of a change in the safety around the school entrance, collecting pre and post intervention school travel data from the intervention schools would provide an indication of whether more pupils are travelling actively or fewer are arriving to school by car. In particular, the change in the proportion of children arriving to school by car, would provide a useful source of substantiation of the traffic monitoring findings.

- the sample size from the postal survey data collection was quite low, in particular in the follow up survey, and in the analysis of teachers and parents responses to questions relating to pupils' travel to school. This limits the robustness of some of the

postal survey findings. Future research could explore perceptions amongst local resident and stakeholder groups in more depth, by incentivising survey responses, carrying out face to face surveying and/or holding additional interview or focus group sessions.

5. Conclusion

The findings from this research add to the understanding of traffic displacement and road safety impacts around School Streets. By generating a specific methodology that is supported by a literature review and utilises more monitoring tools than in previous studies, this research provides a rigorous investigation into the full picture of the impacts, and can be used as a starting point for future research. Primarily, this study finds that School Streets lead to overall falls in volume of traffic. Although traffic may be displaced to some degree to surrounding streets the literature review suggests that measures can be applied to successfully mitigate any associated road safety issues. As mentioned above, future research could investigate the types of School Street contexts that have required mitigation measures, what kind of measures have been applied, and to what effect.

6. Appendices

6.1 Key terms

This section defines key terms as they are used throughout the report.

School Street: an initiative aiming to improve road safety, congestion and air quality by implementing restrictions to through-traffic on the road outside a school's gates during drop-off and pick-up times.

School Street hours: the hours during which the restrictions to through traffic are in place, i.e. drop-off and pick-up times. In our study, these were 08:15-08:45 and 14:45-15:30 at one school, and 08:15-09:15 and 14:45-15:45 at another.

Road safety: road safety can be seen as freedom from the liability of exposure to harm or injury on the highway. It must also consider the *perception* of risk of harm, at an individual and community level.

Traffic displacement: the flow of traffic shifting from one road to another; in this study, referring to drivers responding to the restrictions on the street outside of a school by using adjacent streets instead.

Traffic evaporation: the loss of traffic from an area; in this study, referring to drivers responding to the restrictions on the street outside of a school by simply not driving to the area, rather than using adjacent streets instead.

Surrounding streets: in this study, taken to mean those streets which either have a junction connecting to the road on which the School Street is taking place, lie parallel to the School Street, or lie within roughly 200 metres of the School Street.

Data collection phase: a period of time at which data is collected from a range of monitoring tools, and repeated at three iterations to capture road safety changes in relation to the School Street.

'Baseline' data collection phase: the first data collection phase, to capture what road safety was like before the School Street took place.

‘During intervention’ data collection phase: the second data collection phase, to capture what road safety was like shortly after the School Street was implemented.

‘Follow-up’ data collection phase: the third and final data collection phase, to capture what road safety was like several months in to the School Street being implemented.

Monitoring location: a specific location on a road near the School Street, or on the School Street itself, at which multiple types of data were collected relating to traffic volume, speed and road safety. One monitoring location was chosen per street, and as far as possible is taken to represent the volumes, speeds and road safety of the length of that street.

Automatic traffic counter: equipment which is installed at the side of a road to digitally record the number and speed of vehicles crossing tubes laid across the road.

Video monitoring: a monitoring tool whereby footage of the road is recorded on-site, then visually analysed off-site to quantify a number of indicators relating to road safety, such as interactions between drivers and pedestrians.

Postal survey: a monitoring tool whereby paper questionnaires are mailed to residents, self-completed and returned via pre-paid envelope.

Traffic volumes: the number of motorised vehicles travelling past a fixed point along a road over a certain period of time; in this study collected over 5 days and reported as either the mean average daily traffic volume or 5-day total traffic volume, during the School Street hours.

Traffic speeds: the speed of motorised vehicles travelling past a fixed point along a road over a certain period of time; in this study collected over 5 days and reported as the mean average traffic speed over the 5 days, during the School Street hours.

6.2 Literature review examples

The literature review found the following impacts at specific School Streets:

Edinburgh

- Reduction in vehicle speeds on both School Streets and surrounding streets
- Reduction of 3,179 vehicles on the School Street; increase of 920 vehicles on surrounding streets; overall net reduction of 2,259 fewer vehicles in the area
- Compliance with speed limits on the vast majority of surrounding streets
- A need for infrastructure provision; ensuring peripheral streets can accommodate displaced traffic movements e.g. via parking and 'Park and 'Stride' movements
- An approximate equal split of residents on peripheral streets agreed and disagreed that the initiative made their daily life more difficult.

City of Edinburgh Council, 2016. School Street pilot project evaluation, 30th August. Edinburgh: CEC.

Solihull

- Majority of residents of adjacent roads (60%) supported the scheme
- In general, residents living in adjacent streets had not seen a significant increase in displacement parking as a result of the scheme
- Anecdotal evidence of an improvement in the level of children walking to school
- Whilst the scheme undoubtedly required some parents to change their route to school and cross additional roads, there was no evidence that this resulted in any change in reportable incidents
- Provision of alternative parking identified at the start of the scheme minimised the impact of displacement parking on surrounding roads.

Solihull MBC, 2018. School Streets Pilot Project – Six month update and Review, June. Report to Cabinet Member for Transport & Highways.

Solihull MBC, 2018. School Streets Pilot.

Solihull MBC, 2019. SCHOOL STREETS PILOT PROJECT - 12 MONTH UPDATE AND REVIEW.

Perth & Kinross

- 88% of respondents perceived a displacement of vehicles, with complaints about inappropriate parking resulting in the road becoming restricted for other road users
- However, local anecdotal evidence reported that this was not significant relative to the level of school congestion prior to the initiative, was localised to one junction, and was mitigated by a Park & Stride route.

Perth and Kinross Council, 2016. Environment and Infrastructure Committee, School Exclusion Zones.

London Borough of Camden

- A 74% reduction in motor traffic on the School Street during the morning hours and a 65% reduction during the afternoon hours, with a 13% decrease in motor traffic across adjacent roads
- Officers described that the restrictions had not led to significant displacement elsewhere.

London Borough of Camden, 2019. Acland Burghley School Healthy School Street Scheme – permanent arrangement, 19th September. https://consultations.wearecamden.org/supporting-communities/hss-acland-burghley/results/aclandbhssreporttomakepermanentfv.pdf accessed 15th April 2020.

London Borough of Croydon

- Whilst planning the School Street, practitioners stated that it should have a tolerable impact on surrounding streets, and the start and end points of the closure must avoid potentially hazardous U-turns
- Initial concerns from residents, about displaced school run congestion, ceased after implementation of the scheme.

School Streets presentation, 2020. Sarah Randell, March 16th.

London Borough of Croydon, 2019. Traffic Management Advisory Committee, 2nd May. School Streets https://democracy.croydon.gov.uk/documents/g1501/Public%20reports%20pack%2002nd-May-2019%2018.30%20Traffic%20Management%20Advisory%20Committee.pdf?T=10 Item 10 accessed 29th April 2020.

6.3 Methodology

This section provides a full explanation of the data collection and analysis approach employed in this research study.

6.3.1 School contexts

Table 25 summarises key information about the schools.

Table 25: School information

Feature	Hillstone Primary School	Somerville Primary School
Address	**Hillstone Rd, Shard End, B34 7PY**	**Somerville Rd, Small Heath, B10 9EN**
No. pupils (with SEN)	**509 (25%)**	**771 (15%)**
Points of closure	**2**	**1**
Car Free School Streets enforcement times	**08:15 – 08:45; 15:00 – 15:30**	**08:15 – 09:15; 14:45 – 15:45**
Catchment area	**Up to 1 - 1.3 miles from school**	**Up to 0.5 miles from school**
School travel	**47% car (based on 2013/14 Hands Up Survey data)**	**23% car (based on 2012/13 Hands Up Survey data)**

6.3.2 Examples of School Streets implementation

Images of the School Street entrances at Hillstone and Somerville primary schools are shown in Figure 24 and Figure 25. Signage, stewarding and cones were implemented at both schools.

Figure 24: Example of School Streets signage on Hillstone Road

Figure 25: Example of School Streets stewarding on Somerville Road

6.3.3 Automatic traffic counter data

Automatic traffic counters (ATCs) were temporarily installed on roadsides to count vehicles and record their speeds. At each data collection phase, ATCs were deployed for seven days of 24-hour data recording.

ATC locations

At each school, TSV data was collected by ATCs at the following locations:

- on the School Street itself
- on several adjacent streets, onto which traffic had the potential to be displaced
- on a 'control' street; a road similar to that of the School Street but not within an area that is likely to be impacted by the School Streets, to account for local background fluctuations in traffic levels.

Due to drivers being required to drive at a slower speed when turning in and out of a road junction, we did not conduct traffic monitoring at or near junctions, as this would not provide the best indication of flowing traffic speeds.

Where ATCs could not be deployed due to parked cars obstructing the location, we used video footage to count traffic volume instead. This meant speed data was not available at these locations and times (see below for further explanation).

Analysing traffic volumes

We compared volumes of traffic during the School Street hours at the different monitoring phases (baseline versus during intervention, and baseline versus follow-up). There are two strands of analysis here that support the above objectives:

- **displacement from one road to another:** by comparing the change in traffic volumes between individual monitoring locations, we can see whether there is displacement of traffic from the School Street to the surrounding streets. We analyse this as a percentage change in mean weekday traffic volumes between baseline, during and follow-up, within the School Streets hours
- **evaporation of traffic from the school area:** by looking at the net change in traffic volumes across all the monitoring locations as a whole, we can see whether traffic has simply stopped entering the area during the School Streets. We analyse this as a percentage change in the total mean weekday traffic volume of all locations together, between baseline, during and follow-up, within the School Streets hours.

In the cases of cul-de-sac roads, traffic was only counted one way. This was to avoid double counting drivers turning around in the cul-de-sac and make it more comparable to through roads, i.e. by only counting each journey once.

Analysing traffic speeds

We compared the average weekday speed[42] of traffic during the School Streets hours between the baseline and during intervention phases, and between the baseline and follow-up phases. For Somerville Primary School, speed data is only available for one location across all three phases of monitoring, due to issues with the installation of the ATC equipment.

We performed statistical testing of the weekday speed of traffic to test if the differences in speed between baseline and intervention phases, and baseline and follow-up phases, were statistically significant. When the samples had equal variances, the Student's t-test for unpaired samples was applied. In the case of unequal variances, Welch's t-test for unpaired samples was applied.

Using control data

We also compared the volumes of traffic during the School Street hours with two sources of control data:

- Comparison of the change in traffic volumes during School Streets time window, with the change in traffic volumes outside of the School Streets time window

- Comparison of change in traffic volumes during the School Streets time window with changes at the specific control TSV locations near the schools, and changes in traffic levels around Birmingham.

These comparisons were used to indicate whether any rises or falls in traffic levels on the TSV locations on and around the School Street could be attributed to broader trends in traffic levels over the course of the study.

Missing traffic speed and volume data

Around both Hillstone and Somerville primary schools there were cases of missing data due to installation issues, with high levels of parked cars in the study area restricting opportunities to install the monitoring equipment. Despite the sites being visited repeatedly to attempt to install the equipment, there were some locations where opportunity to install the monitoring equipment did not arise. Future studies that are attempting to collect data in areas with high levels of on-street parking should try to install the monitoring equipment in good time prior to the data collection period, to allow for re-attempts if needed.

In some cases the equipment was installed successfully but there were faults with monitoring equipment or corruption of data in the course of the data collection.

[42] Comparisons of the 85th percentile traffic speed (i.e. the speed at or below which 85 percent of all vehicles are observed to travel under free-flowing conditions past a monitored location) are also presented in this report, in appendix 6.6.

In addition, the Thursday and Friday of the follow-up data collection phase were Somerville Primary School's Eid-Ul-Fitr celebrations (marking the end of Ramadan). This appears to have had a marked difference to traffic levels on these two days (13th and 14th of May)[43].

Table 26 shows the number of days of traffic volume data available for Somerville Primary School.

Table 26: Somerville Primary School – number of days of traffic volume data, by data collection phase and location (maximum 5 days of data from Monday – Friday)

Location number	Location name	No. of days of data available (used to calculate overall change in average traffic volumes)			No. of days of data analysed (for change in individual location traffic volumes)
		Baseline	During	Follow-up	*All phases*
1	Somerville Road (School Street section)	5	4	3	2
2	Charles Road	5	5	3	3
3	Kenelm Road	5	5	3	3
4	Swanage Road	3	5	3	1
5	B4145	4	5	3	2
6	Somerville Road (outside of School Street)	5	5	~	5 (only baseline and during)
7- control	Carlton Road	5	5	3	3

Because of this missing data at Somerville Primary School, we applied two slightly different data cleaning approaches to the two parts of the traffic volume analysis.

For the analysis of displacement between individual locations, we used total traffic volumes. These totals had to be comparable over the three data collection phases, so any weekdays which did not have data at all three phases were removed (e.g. Thursday and Friday were removed for all locations because they did not have data at the follow-up phase due to Eid-Ul-Fitr - except for Location 6 which is only a comparison of the baseline and during phases). The remaining number of days used for total traffic volume analysis at Somerville Primary School is shown in the final column of Table 26.

[43] There is no indication that the traffic levels at Hillstone School were impacted by Eid-Ul-Fitr.

For the analysis of evaporation of traffic from the school area as a whole, we used average traffic volumes. We used all days of available data in this approach, because averages are comparable.

At the monitoring locations around Hillstone Primary School, we collected data on all of the weekdays during all of the data collection phases, with the only exceptions being Hillstone Road (not School Street section) and Nearmoor Road (parallel to Freasley Road) at the follow-up phase.

6.3.4 Video monitoring

Video monitoring involved temporarily installing cameras on street furniture (such as lamp posts) to record footage. We then analysed the footage ex-situ to provide objective evidence on the behaviour of road users, including drivers, around the School Streets. Footage was recorded for five days at each monitoring phase. Of this, we sampled the hours of the School Streets (08:00-09:00 and 14:45-15:45 at Hillstone Primary School and 08:00-09:30 and 14:30-16:00 at Somerville Primary School) on two of the five days (Tuesday and Thursday) at each of the three data collection phases[44].

The video monitoring locations around Hillstone and Somerville Primary Schools are shown in Figure 26.

Around Hillstone Primary School we chose three video monitoring locations:

- location 1 captured the junction of the School Streets and Freasley Road
- location 2 captured activity along Freasley Road away from the School Streets
- location 3 captured a car park that it was thought may be used as a park and stride location.

Freasley Road is deemed the primary access road to the school for drivers coming from anywhere other than the few small roads south of the school within the same residential zone. There is also pre-existing roadside parking along Freasley Road where displacement might be apparent, which is why video was captured at location 2.

Around Somerville Primary School we chose two video monitoring locations:

- location 1 captured activity at the entrance junction to Somerville Road on Charles Road

[44] The exception to this was the follow up around Somerville primary school, where the Wednesday video footage was analysed instead of the Thursday due to the impact of the Eid-Ul-Fitr celebrations. There was no evidence to suggest that there was any difference between the nature of the Wednesday traffic and the Thursday traffic.

- location 2 captured activity further along Charles road where there is pre-existing roadside parking, where traffic was anticipated to stop during the School Street, being unable to turn down Somerville Road.

Figure 26: Video locations for Hillstone Primary School (left) and Somerville Primary School (right), with School Streets indicated by turquoise line

Video monitoring analysis

We identified the planned behaviours to analyse from a combination of the literature review, a pilot study of one hour of footage, and discussions with Birmingham City Council. They are:

- **illegal or hazardous parking and driving behaviour**: A comparison of the number of instances of illegal parking (parking on double yellow or keep clear lines, mounting the kerb) and hazardous driving behaviour (manoeuvring in the School Street junction) during the School Streets hours, across the different phases of the project, will help affirm the existence and scale of this issue

- **traffic interactions**: A traffic interaction is defined as an observable situation in which two or more road users approach each other in space and time to such an extent that a collision is imminent if their movements remain unchanged. Cases of interaction were counted and graded in severity (see Table 27). The number of interactions in each grade is presented as a proportion of the total number of interactions. The number of interactions and the % of interactions within each severity grade was compared between the phases of the project. It should be noted that only interaction severity levels 5 and 6 denote actual physical contact between road users.

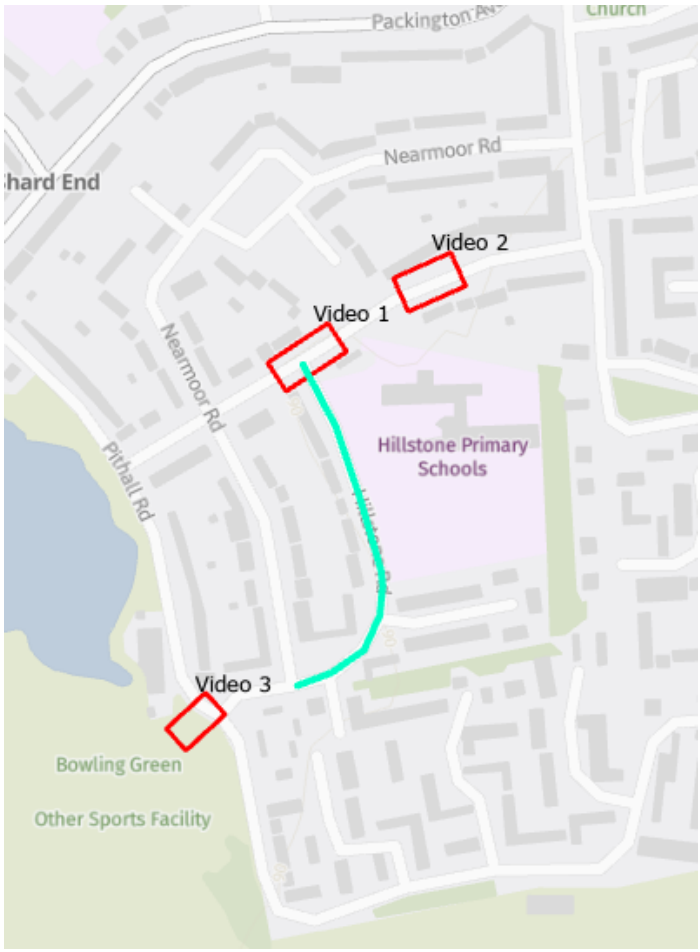
Table 27: Severity of interactions

Level	Severity of interactions
0	No interaction with another road user/pedestrian
1	One participant required to manoeuvre, stop or slow down to avoid the another, but with ample time
2	Both participants required to manoeuvre, stop or slow down to avoid one another, but with ample time
3	One participant required to suddenly manoeuvre, stop or slow down to avoid the another, resulting in a near miss situation
4	Both participants required to suddenly manoeuvre, stop or slow down to avoid one another, resulting in a near miss situation
5	Light contact is made between the two parties, but no injuries
6	Full contact is made between the two parties, requiring emergency action

Video analysis locations – Hillstone

At Hillstone Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30.

Figure 27: Map of video monitoring locations 1, 2 and 3 at Hillstone Primary School



Video location 1 – Freasley Road and Hillstone Road junction.

We monitored four behaviours at the junction of Freasley Road and Hillstone Road (Video location 1 in Figure 27):

- instances of drivers parking on the grass verge near the entrance to the School Streets. We noted whether there were children being dropped off/picked up by the drivers and the most severe interaction (if any) the driver engaged in whilst parking, waiting or pulling away (top left in Figure 28)
- interactions between drivers within the Freasley Road and Hillstone Road junction area. We scored the interaction according to the drivers at the front of the queue of traffic (in cases where there was a queue) (bottom left in Figure 28)
- drivers manoeuvring over the give way lines into Hillstone Road in order to travel along Freasley Road. We included a driver if any part of their vehicle crossed the green line marked in the image and any vehicles within the following 5 seconds were logged in the same instance (top right in Figure 28)

- drivers parking in the School Streets zone that was visible on camera. We also noted whether the driver mounted the kerb to park or not (bottom right in Figure 28).

Figure 28: Markings for behaviours at Hillstone Video Location 1. Parking on grass verge (top left), interactions between drivers within junction area (bottom left), drivers manoeuvring over give way lines (top right), and parking in the School Street (bottom right).

Video location 2 – Freasley Road

As well as noting any unsafe or illegal resident parking behaviour for case studies, we monitored two behaviours at Freasley Road

- drivers mounting the kerb/verge due to not being able to pass oncoming traffic, and any notes about subsequent interactions because of this (left, Figure 29).
- drivers parking on the specific stretch of road marked in the adjacent image and whether there were children picked up or dropped off from the vehicle (right, Figure 29).

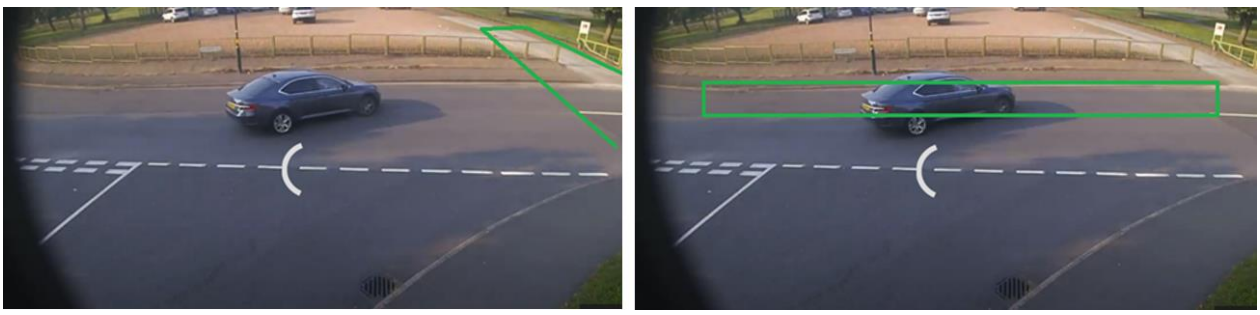
Figure 29: Markings for behaviours at Hillstone Video Location 2. Instances of drivers mounting the kerb/verge due to not being able to pass oncoming traffic (left), and instances of drivers parking (right)

Video location 3 – Car park opposite the junction at Hillstone Road and Pithall Road

Two behaviours were recorded at the car park opposite the junction at Hillstone Road and Pithall Road (Video location 3 in Figure 27).

- drivers entering the car park, plus the interaction severity of any interaction with other drivers or pedestrians (left, Figure 30)
- drivers parking or stopping to drop someone off on the road next to the car park, plus any interactions with other road users (right, Figure 30).

Figure 30: Markings for behaviours at Hillstone Video Location 3. Instances of drivers entering the car park (left), and dropping someone off (right)



Video analysis locations – Somerville

At Somerville Primary school the School Street hours were 08:15 – 08:45 and 15:00 – 15:30.

Figure 31: Map of video monitoring locations 1 and 2 at Somerville Primary School

Video location 1- Somerville Road and Charles Road junction

We monitored two behaviours at the junction between Charles Road and Somerville Road, the main entrance junction to the school (video location 1 in Figure 31):

- pedestrians (or group of pedestrians) crossing the road, including whether they needed to wait, on the pavement or in the road (see arrows in Figure 32, left). These are informal crossings, which do not use a zebra or pelican crossing.
- drivers parking on the pavement or zig zags (Figure 32, right). We recorded which location the driver parked in, whether there were children present in the vehicle, and the most severe interaction (if any) the driver engaged in whilst parking, waiting or pulling away.

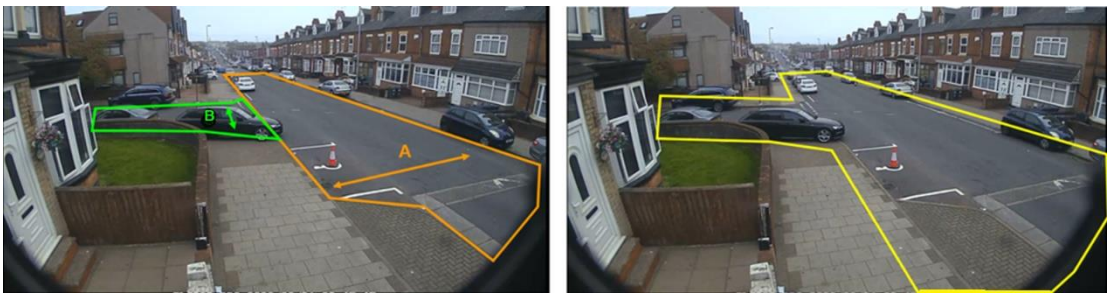
Figure 32: Markings for relevant behaviours at Somerville Video Location 1. Crossing points for pedestrians (left), and instances of drivers parking (right)

Video location 2 – Charles Road (near entrance to Swanage Road)

We monitored two behaviours along Charles Road (video location 2 in Figure 31), shown in Figure 33.

- pedestrians (or group of pedestrians) crossing the road at the crossing points, including whether the pedestrians needed to wait, on the pavement or in the road (Figure 33, left)
- drivers parking or pulling over (in the area in Figure 33, right), including whether there were any children in the vehicle and the most severe interaction (if any) at any point during the manoeuvre.

Figure 33: Markings for behaviours at Somerville Video Location 2. Crossing points for pedestrians (left), and instances of drivers stopping (right)



6.3.5 Postal survey

We sent surveys to the same residential addresses at baseline and during the School Streets. A £50 shopping voucher prize draw was offered to participants at both baseline and follow-up.

The surveys contained questions designed to gather data on:

- **perceptions of School Streets:** support for the School Street, impacts relating to their experience of the School Street, and motorist compliance with the restrictions
- **perceptions of traffic behaviour:** quantity of traffic, speed of traffic, and cases of drivers parking badly or illegally
- **perceptions of road safety (including the impact of the School Streets on road safety):** perceived safety for the individual, perceived safety for children, perceived safety when crossing the street, and quality of place
- **travel to and from school and perceived safety of travelling by active modes:** perceived usage of different modes of transport to get to and from school, and the safety of travelling to school by active travel (cycling, walking or wheeling).

Questions were repeated at baseline and follow-up.

We asked residents about the prevalence of three traffic issues, both before and during the School Streets. The three issues were:

- too many vehicles
- vehicles travelling too fast
- unsafe or illegally parked vehicles.

We also asked residents to agree or disagree with the following statements about safety:

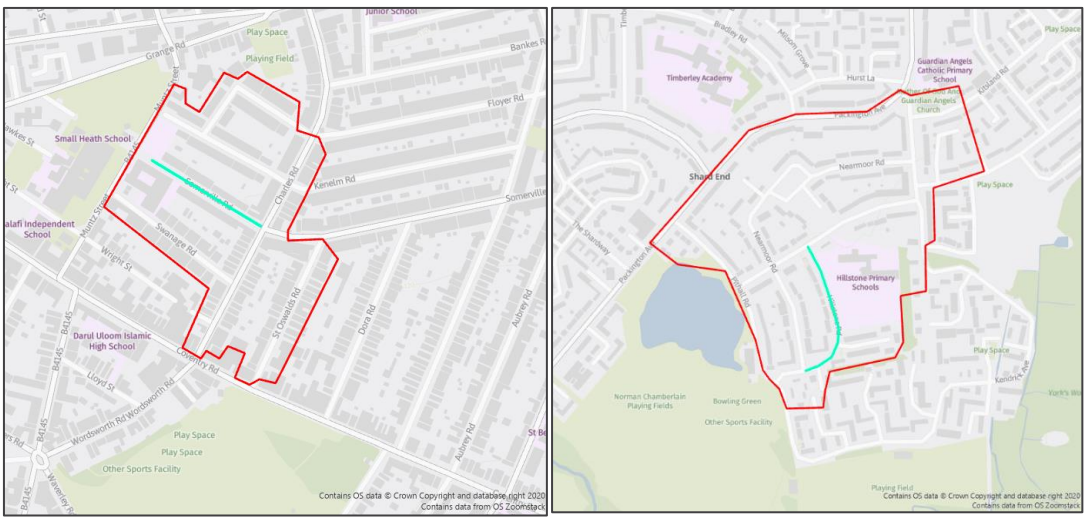
- the road is safe
- the road is safe for children to travel to school
- the road is safe to cross
- the road is a pleasant place to be.

To observe the impact of the School Streets we compared, for example, the baseline and follow-up percentages of respondents agreeing with the statement ‘The road is safe’.

Postal survey distribution areas

The areas in which we delivered the postal survey are mapped in Figure 34, largely mirroring the traffic speed and volume monitoring area.

Figure 34: Postal survey distribution area around Somerville Primary School (left) and Hillstone Primary School (right)



6.4 Monitoring considerations

There are a number of considerations that influence the impact and monitoring of School Streets. It is important to acknowledge these when evaluating School Streets as they may affect whether the findings established in this study are applicable in other contexts.

Defining the area impacted by School Streets

The literature review identified the lack of generally agreed definitions of the expected area in which School Streets are likely to have an impact. The general approach appears to be that the project team (which typically includes officers who are involved in road network development) use maps and their local knowledge to identify which nearby roads are likely to be impacted (e.g. what roads are expected to receive displaced traffic).

The London Borough of Croydon defined their project area as being 300 metres road distance from the ends of the School Streets zone. This distance was established after noticing that consultations received consistently low response rates from residents living beyond this distance, indicating the residents felt indifferent or unconcerned by the proposal and its impacts.

For this research, the monitoring locations were selected in collaboration with Birmingham City Council, who had consulted with residents to ascertain the likely area impacted by the School Streets, and with the 300 metre distance as guidance. A possible future research point could be to use route network distances rather than a simple radius.

Weather

As the temperature and precipitation levels are likely to influence travel behaviour, it was important that the weather conditions were as similar as possible at the baseline, during intervention and follow-up phases of the project.

The historic average weather conditions in Birmingham[45] during the months of our data collection phases were as follows:

- baseline: September (high/low = 18°C/10°C, Rain= 9 days)
- during intervention: October (high/low = 14°C/7°C, Rain= 11 days)
- follow-up: May (high/low = 16°C/7°C, Rain= 9 days).

The actual weather conditions over the days of ATC data collection[46] are summarised in Table 28.

The average of the average daily temperatures within each monitoring phases show a higher average temperature at the baseline phase than at the subsequent monitoring phases. Lower temperatures would reasonably be expected to lead to increased vehicle traffic, but this was not observed in overall traffic levels at the during intervention and follow-up monitoring phases. The maximum wind speed varied very little between the monitoring phases, however there was one day, during the baseline monitoring at Somerville School, on which the maximum wind speed was 48 mph. This has had a large influence on the average, with an average of 17.75 mph when that day is excluded. It's possible that that windier day may have impacted on travel mode choice. Across all of the days of ATC monitoring, at all phases, there were zero inches of precipitation.

[45] Weather detail taken from Google, whose source is The National Oceanic and Atmospheric Administration (NOAA) which is a United States agency.
[46] The ATC data collection was carried out over a large range of days with most of the video monitoring taking place within the same time windows.

Table 28: Summary of weather conditions at each phase of monitoring[47].

Monitoring phase	Average temperature (°C)		Maximum wind speed (mph)	
	Average	Standard deviation	Average	Standard deviation
Baseline – Hillstone	16.4	2.7	19.2	6.1
Baseline – Somerville	12.8	3.2	23.8	14.5
During intervention	8.9	0.4	20.0	3.1
Follow-up	10.3	1.0	20.4	6.6

Non-compliance with School Streets

It would be useful to have data on the number of non-complying drivers entering the School Street without exemptions, in order to know the extent to which observed impacts are being caused by the School Street. If non-compliance is very high, it becomes difficult to attribute any observations to the School Street since it is effectively not being implemented.

In this study, we have limited understanding of the extent of non-compliance with School Streets. Our ATC data does not allow us to distinguish between non-compliant drivers and exempt drivers no the School Street. As a proxy indicator of non-compliance, we can take data from our postal survey regarding residents' perceptions of non-compliance.

[47] Weather detail taken from https://www.wunderground.com/history/daily/EGBB. Reflecting weather conditions at Birmingham Airport. Baseline monitoring at Hillstone School was conducted a week earlier than at Somerville School.

6.5 Traffic volume summaries

This Appendix shows the summaries of individual location, and total, traffic volumes at Hillstone and Somerville primary schools. The percentage changes in traffic volumes from baseline to during intervention and baseline to follow-up are shown in each table.

Table 29: Summary of Hillstone traffic volumes at all phases of monitoring, during the School Streets hours (sum of all traffic over weekdays, 08:00-09:00 and 14:45-15:45)[48]

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Rd (School Street)	both directions	698	388	44.4% ↓	450	35.5% ↓
2	Freasley Rd	both directions	1310	1367	4.4% ↑	1381	5.4% ↑
3	Nearmoor Rd (parallel to School Street)	both directions	330	286	13.3% ↓	269	18.5% ↓
4	Pithall Rd	both directions	1542	1449	6% ↓	1487	3.6% ↓
5	Hillstone Rd (not School Street)	both directions	659	604	8.3% ↓	~	~
6	Nearmoor Rd (further from School Street)	both directions	465	480	3.2% ↑	~	~
7 (control)	Bradley Rd	both directions	1481	1491	0.7% ↑	1521	2.7% ↑
Total (locations 1-4)			3,880	3,490	10.1% ↓	3,587	7.6% ↓
Total (locations 1-6)			1001	915	8.6% ↓	~	~

[48] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Table 30: Summary of Somerville traffic volumes at all phases of monitoring, during the School Streets hours (sum of all traffic over weekdays, 08:00-09:30 and 14:30-16:00)[49]

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Somerville Rd (School Street)	one direction (eastbound)	254	95	62.6% ↓	204	19.7% ↓
2	Charles Rd	both directions	4725	4788	1.3% ↑	5058	7.0% ↑
3	Kenelm Rd	one direction (eastbound)	381	359	5.8% ↓	393	3.1% ↑
4	Swanage Rd	one direction (eastbound)	71	73	2.8% ↑	84	18.3% ↑
5	B4145	both directions	3242	3263	0.6% ↑	2733	15.7% ↓
6	Somerville Rd (not School Street)	both directions	5198	5729	10.2% ↑	~	~
7 (control)	Carlton Rd	both directions	582	491	15.6% ↓	642	10.3% ↑

Table 31: Summary of Somerville traffic volumes at all phases of monitoring, during the School Streets hours (Sum of individual location daily averages of all traffic over weekdays, 08:00-09:30 and 14:30-16:00)[50]

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
Total (locations 1-5)			3,462	3,453	0.3% ↓	3,357	3.0% ↓
Total (locations 1-6)			4,502	4,598	2.1% ↑	~	~

[49] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.
[50] Same as footnote 48

6.6 Traffic speed summaries

This Appendix shows the summaries of the morning and afternoon monitoring period traffic speeds at Hillstone and Somerville primary schools.

Table 32: Hillstone average traffic speeds (mph) across weekdays between 08:00 and 09:00[51]

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Road (School Street section)	both directions	16.32	18.18	11% ↑	17.35	6% ↑
2	Freasley Road	both directions	21.74	19.44	11% ↓	19.24	11% ↓
3	Nearmoor Road (parallel to School Street)	both directions	19.18	17.54	9% ↓	19.79	3% ↑
4	Pithall Road	both directions	28.01	26.94	4% ↓	25.83	8% ↓
5	Hillstone Road (Not School Street section)	both directions	21.05	19.42	8% ↓	~	~
6	Nearmoor Road (section further away from School Street)	both directions	23.81	23.99	1% ↑	~	~
7 (control)	Bradley Road	both directions	20.01	18.96	5% ↓	19.84	1% ↓

[51] Table cells that have a green fill indicate changes that relate to improved road safety; cells that have a red fill indicate changes that relate to poorer road safety.

Table 33: T-tests of Hillstone average traffic speeds (mph) across weekdays between 08:00 and 09:00, comparing speeds at baseline and during the intervention.

Location number	Location name	Baseline		During intervention		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
1	Hillstone Road (School Street section)	16.32	349	18.18	205	0.492	No	<0.001
2	Freasley Road	21.74	673	19.44	703	0.315	Yes	<0.001
3	Nearmoor Road (parallel to School Street)	19.18	141	17.54	111	0.735	No	0.027
4	Pithall Road	28.01	716	26.94	646	0.315	No	<0.001
5	Hillstone Road (Not School Street section)	21.05	316	19.42	274	0.333	No	<0.001
6	Nearmoor Road (section further away from School Street)	23.81	177	23.99	199	0.580	No	0.756
7 (control)	Bradley Road	20.01	700	18.96	714	0.272	No	<0.001

Table 34: T-tests of Hillstone average traffic speeds (mph) across weekdays between 08:00 and 09:00, comparing speeds at baseline and follow-up.

Location number	Location name	Baseline		Follow-up		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
1	Hillstone Road (School Street section)	16.32	349	17.35	248	0.489	No	0.034
2	Freasley Road	21.74	673	19.24	726	0.291	No	<0.001
3	Nearmoor Road (parallel to School Street)	19.18	141	19.79	104	0.691	No	0.377
4	Pithall Road	28.01	716	25.83	702	0.293	Yes	<0.001
5	Hillstone Road (Not School Street section)	21.05	316	~	~	~	~	~
6	Nearmoor Road (section further away from School Street)	23.81	177	~	~	~	~	~
7 (control)	Bradley Road	20.01	700	19.84	774	0.273	No	0.537

Table 35: Hillstone average traffic speeds (mph) across weekdays between 14:45 and 15:45

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Road (School Street section)	both directions	15.29	16.54	8% ↑	16.30	7% ↑
2	Freasley Road	both directions	19.16	17.86	7% ↓	18.56	3% ↓
3	Nearmoor Road (parallel to School Street)	both directions	17.42	17.99	3% ↑	16.54	5% ↓
4	Pithall Road	both directions	26.33	27.45	4% ↑	24.97	5% ↓
5	Hillstone Road (Not School Street section)	both directions	20.33	18.33	10% ↓	~	~
6	Nearmoor Road (section further away from School Street)	both directions	24.06	23.79	1% ↓	~	~
7 (control)	Bradley Road	both directions	19.67	18.64	5% ↓	19.68	0% ↑

Table 36: T-tests of Hillstone average traffic speeds (mph) across weekdays between 14:45 and 15:45, comparing speeds at baseline and during the intervention.

Location number	Location name	Baseline		During intervention		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
1	Hillstone Road (School Street section)	15.29	349	16.54	183	0.519	No	0.017
2	Freasley Road	19.16	637	17.86	664	0.348	No	<0.001
3	Nearmoor Road (parallel to School Street)	17.42	189	17.99	175	0.513	No	0.267
4	Pithall Road	26.33	826	27.45	803	0.297	Yes	<0.001
5	Hillstone Road (Not School Street section)	20.33	343	18.33	330	0.297	No	<0.001
6	Nearmoor Road (section further away from School Street)	24.06	288	23.79	281	0.462	No	0.554
7 (control)	Bradley Road	19.67	781	18.64	777	0.281	No	<0.001

Table 37: T-tests of Hillstone average traffic speeds (mph) across weekdays between 14:45 and 15:45, comparing speeds at baseline and follow-up.

Location number	Location name	Baseline		Follow-up		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
1	Hillstone Road (School Street section)	15.29	349	16.30	202	0.530	No	0.058
2	Freasley Road	19.16	637	18.56	655	0.353	No	0.086
3	Nearmoor Road (parallel to School Street)	17.42	189	16.54	165	0.516	No	0.089
4	Pithall Road	26.33	826	24.97	785	0.291	No	<0.001
5	Hillstone Road (Not School Street section)	20.33	343	~	~	~	~	~
6	Nearmoor Road (section further away from School Street)	24.06	288	~	~	~	~	~
7 (control)	Bradley Road	19.67	781	19.68	747	0.286	No	0.982

Table 38: Hillstone 85th percentile traffic speeds (mph) across weekdays between 08:00 and 09:00

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Road (School Street section)	both directions	22.45	24.30	8% ↑	23.61	5% ↑
2	Freasley Road	both directions	27.43	25.81	6% ↓	24.21	12% ↓
3	Nearmoor Road (parallel to School Street)	both directions	24.75	23.34	6% ↓	25.61	3% ↑
4	Pithall Road	both directions	33.10	32.57	2% ↓	31.06	6% ↓
5	Hillstone Road (Not School Street section)	both directions	25.41	23.27	8% ↓	~	~
6	Nearmoor Road (section further away from School Street)	both directions	29.94	29.36	2% ↓	~	~
7 (control)	Bradley Road	both directions	24.97	24.21	3% ↓	25.38	2% ↑

Table 39: Hillstone 85th percentile traffic speeds (mph) across weekdays between 14:45 and 15:45

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
1	Hillstone Road (School Street section)	both directions	20.99	23.04	10% ↑	22.20	6% ↑
2	Freasley Road	both directions	25.66	23.83	7% ↓	24.98	3% ↓
3	Nearmoor Road (parallel to School Street)	both directions	22.06	22.37	1% ↑	22.20	1% ↑
4	Pithall Road	both directions	31.91	32.69	2% ↑	30.12	6% ↓
5	Hillstone Road (Not School Street section)	both directions	24.70	21.50	13% ↓	~	~
6	Nearmoor Road (section further away from School Street)	both directions	30.02	28.43	5% ↓	~	~
7 (control)	Bradley Road	both directions	24.97	24.62	1% ↓	25.22	1% ↑

Table 40: Somerville average traffic speeds (mph) across weekdays between 08:00 and 09:30.

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
5	B4145	both directions	22.78	22.59	1% ↓	24.52	8% ↑

Table 41: T-test of Somerville average traffic speeds (mph) across weekdays between 08:00 and 09:30, comparing speeds at baseline and during the intervention.

		Baseline		During intervention				
Location number	Location name	Mean	Sample size	Mean	Sample size	Std error	Equal variances between samples?	p-value
5	B4145	22.78	4226	22.59	4162	0.163	No	0.232

Table 42: T-test of Somerville average traffic speeds (mph) across weekdays between 08:00 and 09:30, comparing speeds at baseline and follow-up.

Location number	Location name	Baseline		Follow-up		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
5	B4145	22.78	4226	24.52	3597	0.163	No	<0.001

Table 43: Somerville average traffic speeds (mph) across weekdays between 14:30 and 16:00

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
5	B4145	both directions	20.68	22.10	7% ↑	16.57	20% ↓

Table 44: T-test of Somerville average traffic speeds (mph) across weekdays between 14:30 and 16:00, comparing speeds at baseline and during the intervention.

Location number	Location name	Baseline		During intervention		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
5	B4145	20.68	3577	22.10	3882	0.166	No	<0.001

Table 45: T-test of Somerville average traffic speeds (mph) across weekdays between 14:30 and 16:00, comparing speeds at baseline and follow-up.

Location number	Location name	Baseline		Follow-up		Std error	Equal variances between samples?	p-value
		Mean	Sample size	Mean	Sample size			
5	B4145	20.68	3577	16.57	3008	0.210	No	<0.001

Table 46: Somerville 85th percentile traffic speeds (mph) across weekdays between 08:00 and 09:30.

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
5	B4145	both directions	29.73	29.55	1% ↓	30.99	4% ↑

Table 47: Somerville 85th percentile traffic speeds (mph) across weekdays between 14:30 and 16:00.

Location number	Location name	Direction	Baseline	During intervention	% Change	Follow-up	% Change
5	B4145	both directions	27.85	28.27	2% ↑	26.62	4% ↓

6.7 Limitations

There are several limitations to this study:

- there were some locations where there were issues with the TSV data collection that limited the amount of usable data. In particular, the lack of data for the non-School Street section on Somerville Road at follow-up is likely to have obscured the findings to some extent. At the during intervention phase, the non-School Street section of Somerville Road saw traffic levels rise by 10%

- Although collecting TSV data at several locations around each school is expected to have provided an indication of whether school traffic has been displaced from the school road to neighbouring roads, as that traffic could reasonably be expected to remain near the school due to it being the destination for that traffic, for other traffic it is possible that the journeys took a different route, outside of the project area, to get to their destination. Without a wider network of monitoring it is not possible to ascertain whether the drop in overall traffic observed was in part due to traffic shifting to outside of the monitoring area

- the postal survey received a low level of response, with a response rate of 11% at its highest (baseline survey around Hillstone Primary School), and a 5% response rate at its lowest (follow-up survey around Somerville Primary School), limiting the reliability of the results

- the Eid Ul-Fitr celebrations in May 2021 had a clear impact on the delivery of the School Street and the degree of pedestrian and vehicle traffic around Somerville Primary School. This led to us using fewer days of TSV data in the summarising of traffic volumes than was initially planned.