BANNERDALE ROAD SCHOOL STREETS PILOT

EVALUATION REPORT

SEPTEMBER 2020

SUSTAINABLE TRAVEL AND ROAD SAFETY (STARS) GROUP
HOLT HOUSE AND CARTERKNOWLE SCHOOLS FEDERATION

ACKNOWLEDGEMENTS

Thank you to all the parents, children and staff at Holt House and Carterknowle schools who took part in the School Streets pilot and evaluation process. Many thanks to all the parents who were involved in collecting data for the road closure, particularly Jenny Johnson, Sam Robb-King, Jessica Auld and Eva Thompson. The writing of this report was coordinated by parents of children who attend Holt House and Carterknowle Schools (Dr Amy Barnes, Lecturer in Public Health, University of Sheffield; Nikki Rees, Co-opted Governor, Holt House and Carterknowle Schools Federation; Dr Maria Val Martin, Atmospheric Scientist, Leverhulme Centre for Climate Change Mitigation, University of Sheffield); with input from the wider STARS group and specific contributions from Dr Pippa Powell, European Lung Foundation Director. We would also like to thank the University of Sheffield Urban Flows Observatory for the invaluable use of air quality monitoring equipment. Thank you also to Sheffield City Council and Amey who made our local School Streets pilot possible.

TABLE OF CONTENTS

INTRODUCTION

This report presents findings from a school community-led evaluation of the recent School Streets pilot in Sheffield involving Holt House and Carterknowle Schools, which took place during 18-22 November 2019. The pilot involved closing part of Bannerdale Road (a busy road that goes past both schools) to vehicles at school drop-off (8.15-9.15am) and pick-up (2.45-3.45pm) times. The pilot also involved associated events organised by the two schools on active travel and road safety, to coincide with Road Safety Week, and was carried out with support from Sheffield City Council.

The report draws on a range of evidence (including data from surveys with parents and children, traffic counts, air quality data and Modeshift active travel surveys) to present our findings on whether and how the pilot provided an opportunity:

- for our children to enjoy and feel safe walking, cycling or scooting to and from school (active travel)
- for children and the wider community to benefit from the road closure (e.g. due to cleaner air)

The report suggests actions that could be taken by children/parents/families, the school and Council to create healthier and safer streets for our children and our communities.

WHY CREATING SCHOOL STREETS IS IMPORTANT FOR CHILDREN'S HEALTH AND WELLBEING

Exposure to air pollution is a pressing public health concern in the UK and in Sheffield. It is estimated that, in Sheffield alone, up to 500 deaths annually are attributed to air pollution[1]. Children are particularly vulnerable to the effects of air pollution due to their developing bodies. Air pollution can affect children's immune systems, inhibit lung development and increase vulnerability to chronic diseases (such as asthma and chronic obstructive pulmonary disease)[2]. Poor air quality can affect the development of unborn babies in the womb, and school children living in areas with high levels of particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2) have been shown to have reduced lung function, more acute respiratory exacerbations (e.g. involving hospitalisation) and an increased likelihood of getting lung infections (such as pneumonia)[3,4].

Regular physical activity and outdoor play is also important for children's health, development and wellbeing. As indicated in the Sheffield Joint Strategic Needs Assessment (JSNA), regular physical activity in children is not only associated with increased musculoskeletal and cardiovascular health, but is also linked to psychological benefits and improved mental wellbeing (e.g. reduced anxiety, improved concentration and enjoyment of everyday activities)[5]. Walking or cycling to school can be an important way to support these health and wellbeing benefits and is also a way to connect communities socially while people are 'out and about'. However, given issues with air pollution and also road safety, we need healthier and safer streets around schools in order for our children to benefit in these ways.

Acknowledgment of these linked public health issues has led to policy action at local level in England; for example, anti-idling initiatives, the promotion of active travel, installation of green walls, low emission/clean air zones, and 'School Street' schemes. School Street schemes involve closing roads near schools to vehicles during peak drop-off and pick-up times: Councils put up signs, barriers and/or cameras to stop non-residents driving through the area[6]. The pilot closure of Bannerdale Road outside Carterknowle and Holt House schools on 18-22 November 2020 is an example of a local 'School Streets' scheme to support children's health and wellbeing.

HOLT HOUSE AND CARTERKNOWLE SCHOOLS

Holt House Infant School and Pre-School and Carterknowle Junior School are located in the South-West of Sheffield, approximately 2.5 miles from the city centre (Figure 1). The schools are federated, remaining separate schools but with one governing body and one Headteacher.

Both schools lie within close proximity to Abbeydale Road, a main arterial route into and out of the city, and are located alongside Bannerdale Road – a busy 'cut through' from Abbeydale Road across to Nether Edge. Approximately 70% of the pupils at both schools live directly within the school catchment areas, with most pupils therefore living within a maximum estimated 20 minute walking distance of school. This presents a good opportunity to encourage active and sustainable travel to school, given its potential to be practicable for families.

Figure 1: Map of the location of Holt House and Carterknowle Schools.

RECENT SCHOOL-LED ACTION

The Schools set up a Sustainable Travel and Road Safety (STARS) Group in order to take action to address concerns about air pollution in the local area as well as road safety. The STARS Group brings together school leaders, governors and parents/families with the aim of making the streets around Carterknowle and Holt House schools healthier and safer for our children to play in and travel to school.

The STARS Group has supported a range of actions to improve the healthiness of our school environment:

- placing banners outside both schools highlighting road safety issues and discouraging dangerous parking to raise awareness of these issues
- increased promotion of active travel, including active travel events, and the use of the Modeshift travel tracker, with support from the Active Travel Officer, working in partnership with Sheffield City Council
- publishing a regular newsletter on the topic

- installing a ‘green barrier’ made up of ivy and photinia around part of the perimeter fence at Carterknowle School to help improve the quality of the air children are exposed to in the playground
- installing an air quality monitor at Carterknowle School with support from the University of Sheffield

Both Schools have now been awarded a ‘Gold’ Travel Award; recognising the effort that the whole school community has put into sustainable travel and road safety.

THE SCHOOL STREETS PILOT ON BANNERDALE ROAD

The STARS group made contact with Sheffield City Council in 2019 to raise concerns about high levels of air pollution around the schools and to seek support with actions to combat this. We were delighted when the Council agreed to pilot our School Streets idea locally. The pilot involved closing Bannerdale Road to vehicles (apart from emergency vehicles and blue badge holders) from 8:15am - 9:15am and 2:45pm -3:45pm during one week (18 - 22 November) to coincide with Road Safety Week.

We wanted the pilot to provide an opportunity for our children to reclaim their streets and enjoy walking, cycling or scooting to and from school, and for the wider community to benefit from cleaner air and improved local social interaction. For families living greater than a 20 minute walking distance from the schools, we produced a five minute ‘walk zone map’ and encouraged the option of ‘Park and Stride’. We also liaised with the nearby Tesco supermarket, who kindly gave permission for families to use their car park. The School Council also designed a ‘thank you postcard’ that was delivered to all the houses within the section of Bannerdale Road that was closed.

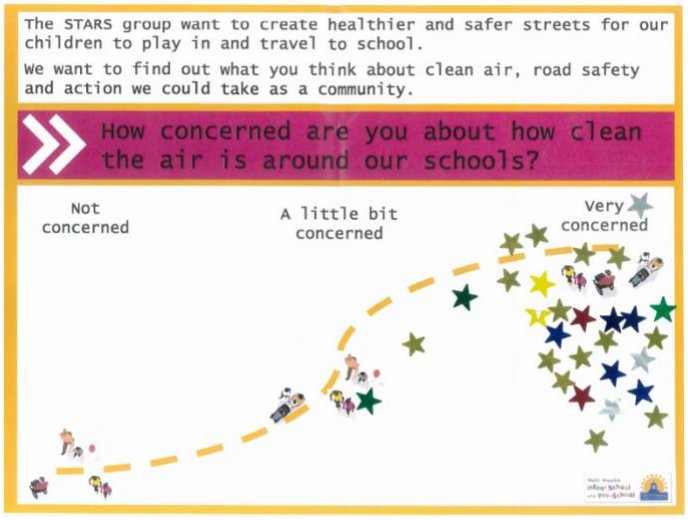
EVALUATION METHODS AND FINDINGS

The STARS group collected a range of evidence to evaluate the School Streets pilot in relation to our aims above (i.e. whether and how it provided an opportunity for our children to enjoy walking, cycling or scooting to and from school (active travel), and for the wider community to benefit, including from cleaner air). We surveyed parents', children's and residents' views and monitored comments on social media. We also organised traffic counts and worked in partnership with Urban Flows Observatory at the University of Sheffield to monitor air quality within the school grounds. Details of the evidence collected, methods and findings are detailed below.

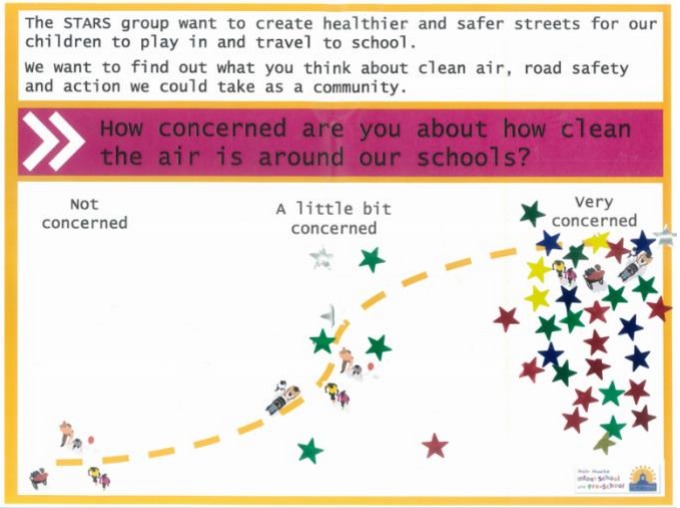
1. SURVEY OF PARENTS' VIEWS BEFORE THE ROAD CLOSURE

Our Methods

We designed a visually engaging, participatory survey as a fun way for parents to share their views about creating healthy and safe streets around Holt House and Carterknowle schools. The survey was carried out before the road closure (Figure 2). We wanted to capture views of parents who may not have responded to a traditional 'emailed out' questionnaire. We asked parents how concerned they were about how clear the air is around our schools and road safety, and about levels of support for different types of local action (e.g. traffic-free roads, promotion of walking/cycling and limits on car parking).



Holt House Infant School (n=27)



Carter Knowle School (n=38)

Figure 2. Participatory survey question on parents' concerns about clean air/road safety.

Our Findings

Across both schools, 65 parents participated in the survey (Holt House Infant School n=27; Carterknowle School n=38). The majority of those who participated indicated that:

- They were 'very concerned' about how clean the air is around our schools
- They were 'very concerned' about road safety around our schools

- That they were supportive of:
    - stopping traffic around the schools at drop-off and pick up
    - promoting walking / cycling to school
    - stopping car parking for parents between the two schools

2. Feedback from parents and local residents during/after the road closure

Our Methods

After the road closure, the Headteacher wrote to parents and carers asking for their views. Members of the STARS group also sought feedback informally from local residents. During the road closure, the STARs group also monitored views by members of the local community on social media (e.g. Twitter, Facebook groups). The road closures prompted considerable interaction online; for example, one post on the local Facebook 'Only in Nether Edge' had 156 comments.

Our Findings

Positive support / agreement on the need for action: Parents and residents who provided feedback generally emphasised / agreed with the need for action to address the volume of traffic, parking issues and pollution. As one resident explained:

> *It's a busy road, with two schools, one respite centre and two major supermarkets, all in a relatively small area. There is no supervised or pedestrian crossing along the lower half of the road which means children and parents frequently cross between parked cars. The area is heavily polluted as, Bannerdale Road crosses the main trunk road, plus the proximity of the supermarkets means the volume of traffic is high. There is frequently standing traffic on Bannerdale Road, exacerbated by poor parking particularly around the school*

A range of positive views were expressed by parents and local residents, with some emphasising that ***the road closure demonstrated a prioritisation of children and their health/wellbeing***:

> *The trial closure was literally a breath of fresh air!*
>
> *This is the first time it feels like the children have been put first by making them more visible and reducing the traffic and therefore pollution they are breathing in… I would be very supportive of this becoming permanent.*
>
> *…as a family with three primary aged children who don't have a car we thought this road closure trial was brilliant! It was wonderful for the children to be safe crossing the roads and not breathing in elevated levels of pollution whilst walking to school… We firmly believe that closing the road at peak times is a step in the right direction for encouraging people to ditch their cars to help protect the community's health and to start to tackle climate change.*

Others highlighted the positive effect of ***improving children's safety near the road and children's physical activity.*** Similarly, on social media, some members of the local community indicated ***how important this type of action was to protect children's health and safety***, as well as highlighting that ***the road closure was fun*** for the children (Figure 3).

> *…being able to cross the road with ease and seeing the children using the road to scoot or bike, was wonderful.*

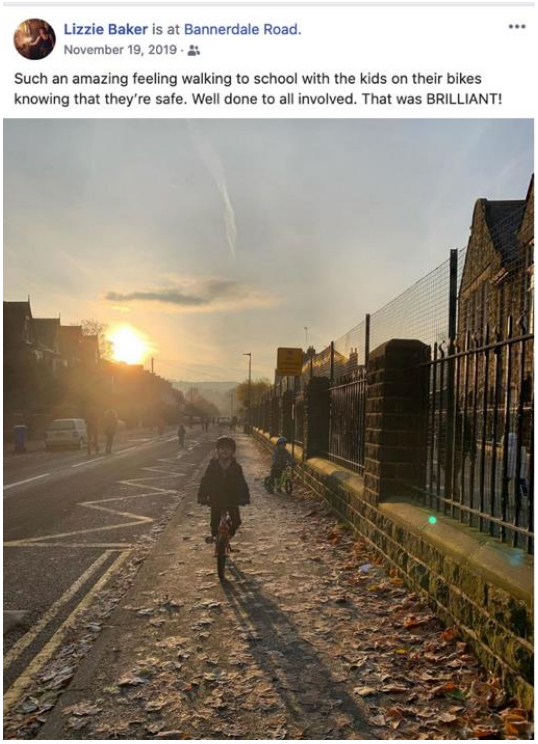


Figure 3: Comment posted on Facebook on November 19, 2019 (published with permission from Lizzie Baker)

Management of the road closure: Some concerns and issues were raised by parents and residents about ***how the road closure was managed***, as well as ***knock-on effects on adjacent roads***. Issues on the first day were, for example, raised as people 'got used' to the new arrangements:

> *There were some teething problems on the first day but once people who use the road were aware of the closure, there was a real difference around the peak hours. The road was not only quieter, but it also felt more open and calmer.*

Others indicated that the closure ***affected traffic flow/congestion on adjacent roads***, particularly the junction of Carterknowle and Abbeydale Roads; though some suggested ways in which ***traffic might be kept moving if the road is closed again in the future***:

…there was a definite build up in traffic on adjacent roads meaning idle cars so the issues that trying to mitigate by closing Bannerdale were just shifted to other nearby areas which still has some impact for kids on the way to school. As we walk a fair way to school we maybe noticed this more than others - the junction of Carterknowle Rd and Abbeydale Rd was particularly bad with standstill traffic and impatient drivers!

If it was to be a permanent closure then something would need to be done about the traffic flow on Carterknowle Road, especially for cars turning right at the bottom of CK road onto Abbeydale Road as I imagine this was the cause of some of the traffic backing up and frustration for commuters.

On social media, some people expressed ***frustration that their journeys were delayed/they were late*** due to the build-up of traffic on Carterknowle and Abbeydale Roads below Carterknowle School. One local resident who provided feedback emphasised that they thought road closures were an important form of action ***but only if resourced:***

Future road closures would be a really positive step provided they are properly resourced.

In terms of resourcing, those who provided feedback emphasised the ***importance of the visible support from the Council*** during the pilot, ***as well as engagement from the local MP and local councillors***:

There appeared to be a willingness to work creatively to try to manage this issue. It is great that this bold step is being taken at a point when there is heightened awareness of air quality and climate issues. Having a safer and cleaner environment around an area which directly impacts on children can only be something we should all be aspiring to.

Suggestions for future action: Residents and parents made ***a number of suggestions for future action*** to create healthier and safer streets around the schools, including:

- trialling the road closure for longer
- making the road closure permanent (with associated improvements to traffic lights etc on adjacent roads)
- making Bannerdale Road one-way

[It would] be better if Bannerdale Rd was pedestrianised as it becomes such an unpleasant and dangerous space as rush hour traffic collides with the school run

We live on Carterknowle Road, and despite the slightly increased traffic, I think the road closures were a great success and would like to see them made permanent. I think drivers would get used to taking other routes, so the impact on Carterknowle would decrease over time.

I would like to see it trialled for longer to take account of drivers finding a different route and the impact the weather has on the pollution levels.

Perhaps some traffic lights at the Ck/Abbeydale Road junction if feasible?

3. Feedback from school children following the road closure

Our Methods

The Chair of Governors visited Carterknowle School to talk to a sample of children about their views on the road closure and discuss their views.

Our Findings

Children knew about poor air quality and some children knew about potential impacts on peoples' heart and lungs.

The children generally supported the road closure: they particularly enjoyed riding their bikes and scooters on the road and using the space 'to do tricks'.

Some of them said that they celebrated the empty space whilst dancing their way home and walking 12 abreast down the road! They said that they would like it to happen again.

The children also said they felt much safer and gave examples of impacts on developing their independence: one had been allowed to come to school on her own and another felt much safer crossing the road at the junction of Bannerdale and Carterknowle Road. They said that it was often difficult to judge when to cross when there were queues of cars and you did not know whether they were queuing or "letting you go". Some children said that they would feel safer on darker days if the road was closed, as drivers are not as observant in those conditions.

Other children said they did not travel along Bannerdale Road to school and that, if it happened again, they would like it to include Carterknowle Road. Although there was concern about what would happen to the traffic because they thought that traffic had not decreased during the road closure pilot, just pushed somewhere else.

One of the children said that he avoided the walk from the Holt House School entrance to Carterknowle School along Bannerdale Road by walking through the woods at the back of Holt House and onto Carterknowle Road, because the pavements on Bannerdale Road were too narrow, too crowded with scooters, bikes, buggies and people, and too noisy.

4. TRAFFIC FLOW RATE

The STARS group completed traffic counts to calculate the traffic flow rate at set points on Bannerdale Road and Carterknowle Road near each school before the road closure to help assess the effect of the closure on traffic (Figure S1 in Appendix). This involved counting the number/type of vehicles for approximately 15 minutes at drop-off (8:30-8:45) and pick-up (15:00-15:15) times. Table S1 in Appendix summarizes the 26 surveys performed. Traffic was counted on Bannerdale Road near the schools during school half-term (October 18-November 1, 2019) and school term (October 14-24 and November 4-8, 2019). Similarly to Bannerdale Road, traffic was counted at Carterknowle Road outside the main gate before (November 13-15, 2019) and during road closure week (November 19-22, 2019). We also collected photographic evidence of the traffic along Bannerdale and Carterknowle Roads.

Our Findings

Approximately 90% of the vehicles counted on Bannerdale Road near the schools were private cars, 5% taxis, and 3% lorries and buses. On school days at Bannerdale Road, we counted 30% more vehicles at drop-off and pick-up than during half term (Figure 4). This finding was supported by photographic evidence that visually illustrates the reduced traffic on the roads during road closure week and also during half-term, as compared with 'normal' school drop-off/pick-ups (see comparative visual evidence in Figures 5-7).

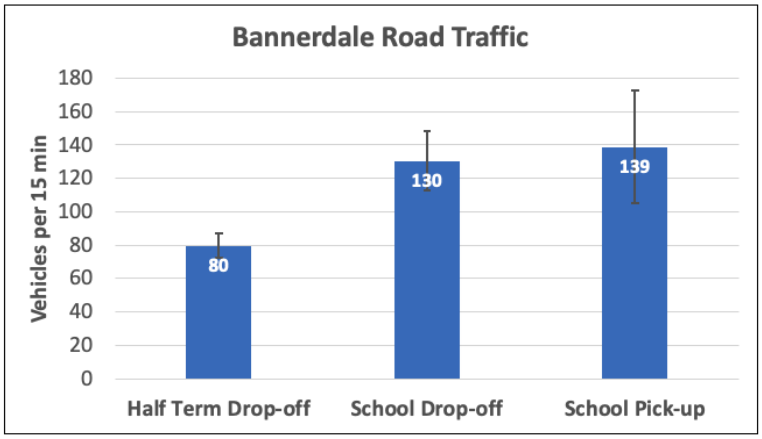


Figure 4: Summary of Bannerdale Road traffic surveys. Reported the average (blue bar) and standard deviation (black error bar).

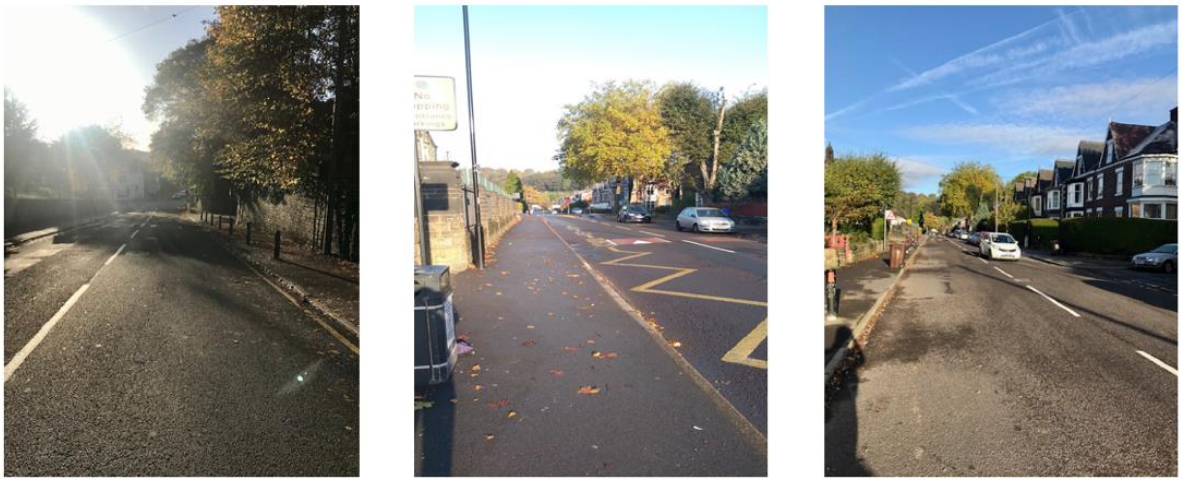


Figure 5: Views of Bannerdale Road during the October 2019 half-term at 8:30 am

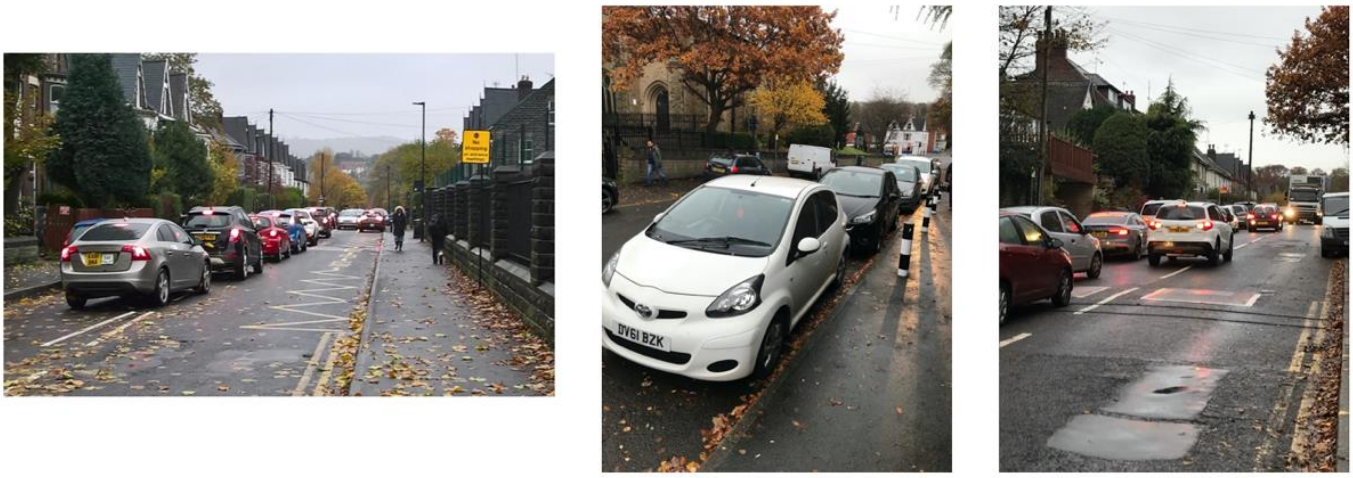


Figure 6: Views of Bannerdale Road during school term 2019 at 8:30 am (drop-off) and 3:30 pm (pick-up)

Figure 7: Views of Bannerdale Road during road closure week at drop-off and pick-up.

The road closure did not appear to affect the number of vehicles at Carterknowle Road, from the Fossdale to Bannerdale Road intersection: traffic flow rates were similar before and during the road closure (Figure 8). However, we did not count traffic further along Bannerdale Road – the section between Carterknowle School and Abbeydale Road - which was the stretch of road that members of the local community raised concerns about congestion in on social media in particular (see above). Sheffield City Council carried out traffic monitoring but were unable to share the data for this report. During our traffic surveys, we recorded at least 8 private cars stopping directly outside the Carterknowle School gate, and at least 3 cars performing a dangerous U-turn in the middle of the road (with associated risks for children's safety).

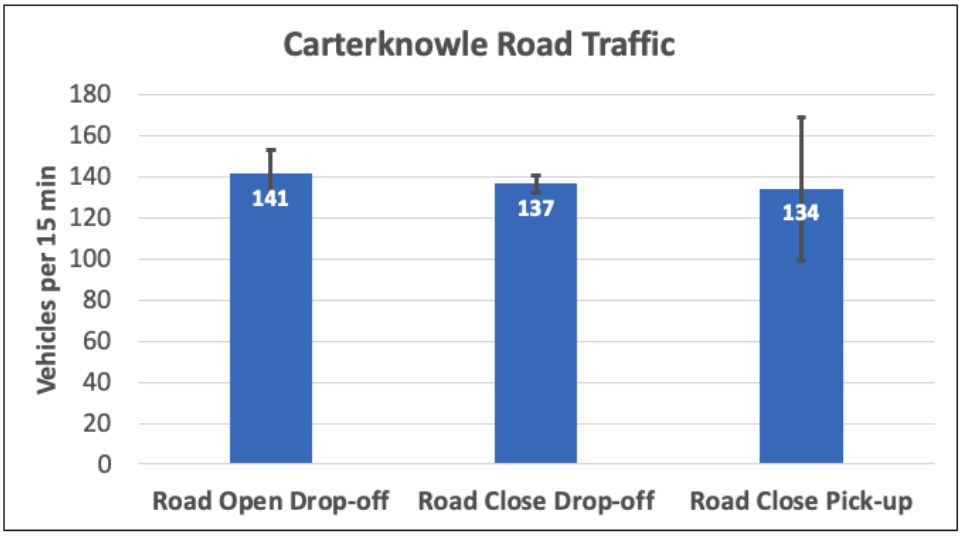


Figure 8. Summary of Carterknowle Road traffic survey, reporting average (blue bar) and standard deviation (black error bar).

5. AIR QUALITY

Our Methods

In collaboration with the University of Sheffield, we monitored air quality at Carterknowle Junior School playground. The school had an AQ Mesh sensor installed by Urban Flows Observatory, which measured continuously PM_{25}, PM_{10} and NO_2 as well as other air pollutants and key meteorological parameters from November 11 - December 19, 2019. Measurements of NO_2 stopped on December 5 due to a failure in the sensor.

Our Findings

During our measurement period (37 days), 45% of the daily values of $PM_{2.5}$ were above 10 µg/m³ (the WHO annual mean guideline value) and 16% were above 25 µg/m³ (the WHO 24-hour mean guideline value and mean annual target value in UK/EU air quality regulation) (Figure 9)**.** This is concerning given that the limits/targets have been set due to the health risks posed by these pollutants.

Levels of $PM_{2.5}$ and PM_{10} were higher (>10 µg/m^3 and 30 µg/m^3, respectively) during the Road Closure week than during school days without the Road Closure and weekends; levels of NO_2 were not significantly different (Figure 10). The road closure week coincided exactly with a high pressure system that brought dry/cold weather and stagnant atmospheric conditions (little vertical mixing and low wind speeds), which favoured the accumulation of particulate pollution.

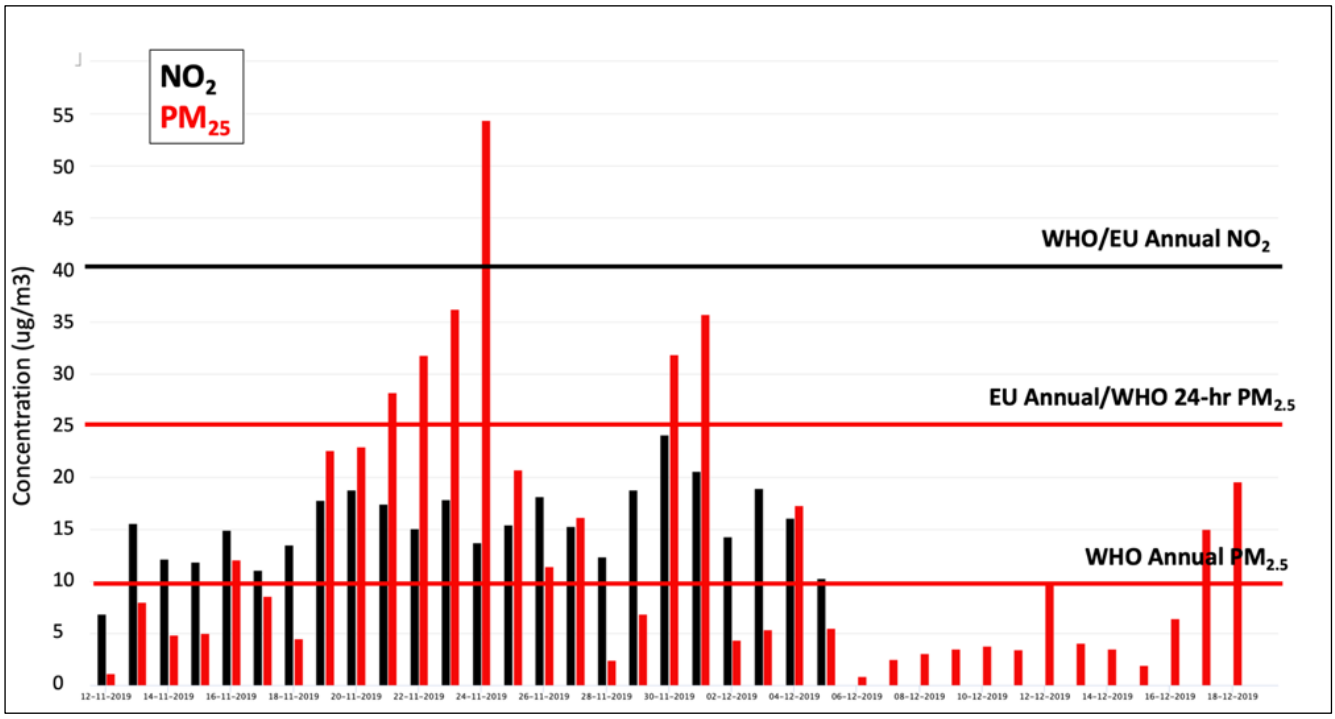


Figure 9: Daily average of $PM_{2.5}$ (red) and NO_2 (black) for the studied period. Indicated are the World Health Organisation (WHO) and EU/UK annual and 24-hr mean air quality standards to protect public health (horizontal lines).

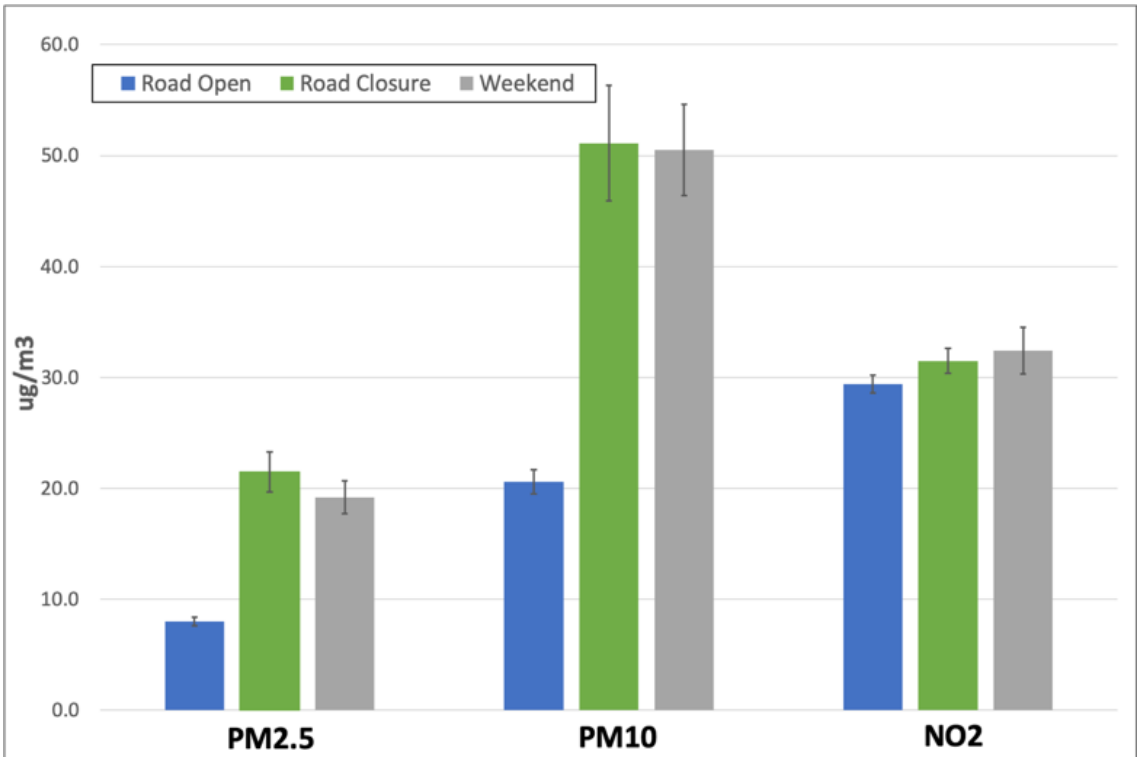


Figure 10: Average of $PM_{2.5}$, PM_{10} and NO_2 during road closure (green), road open (blue) and weekends (grey). Reported the average (coloured bars) and standard error of the mean (black error bars).

An analysis of the diurnal variability of NO_2 data showed that drop-off (7:00-9:00) and pick-up (15:00-17:00) times had consistently higher levels (> 20 µg/m^3) than the average for rest of the day during school days, regardless of the road closure week. We did not see that pattern during the weekends (Figure 11).

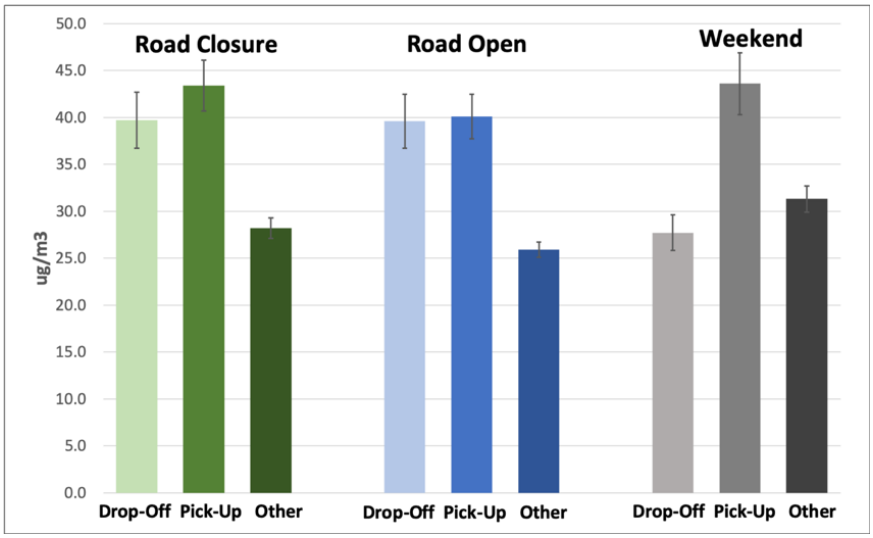


Figure 11: Average NO_2 during road closure (green), road open (blue) and weekends (grey) at drop-off (7:00-9:00), pick-up (15:00-17:00) and other times (9:00-15:00 and 17:00-7:00). Reported average (coloured bars) and standard error of the mean (black error bars).

A more detailed analysis of the daily pattern of NO_2 shows that pupils at Carterknowle School are exposed almost on a daily basis to levels of NO_2 associated with traffic pollution at drop-off and pick-up times that are >40 µg/m^3 (the annual target value set to protect human health) (Figure 12).

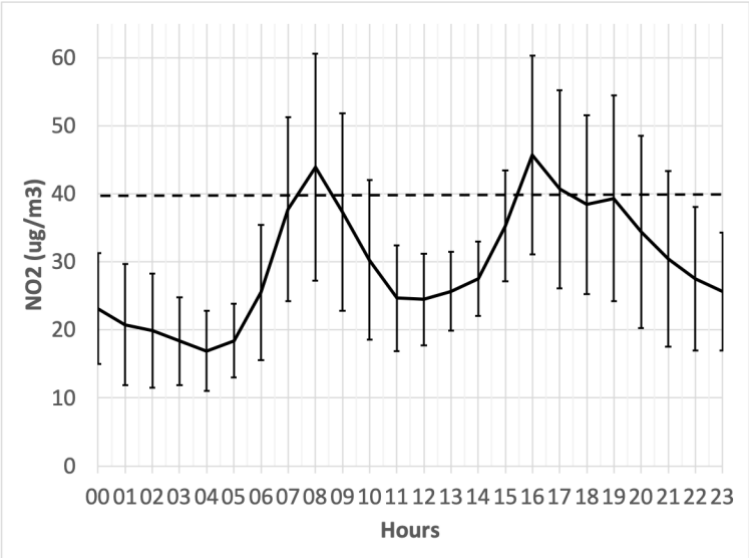


Figure 12. Hourly NO_2 during school days (average and standard deviation), with WHO (and EU/UK) NO_2 annual air quality standard to protect public health (dotted line).

$PM_{2.5}$ and PM_{10} behaved slightly different than NO_2 as particles are more sensitive to weather and atmospheric conditions (Figure 13; only showing $PM_{2.5}$). We did not see a consistent daily $PM_{2.5}$ and PM_{10} pattern related to traffic. We found the highest values (36 µg/m^3) at drop-off time during the road closure week. This suggests that particles may have accumulated near the surface during night time due to a low atmospheric boundary layer (and hence little mixing) due to cold conditions. Interestingly, we also found high levels of $PM_{2.5}$ during the weekend (~20 µg/m^3) and at night time, which may suggest that another local source of particle pollution, e.g. wood burners and/or allotment bonfires, affects the school grounds in addition to traffic.

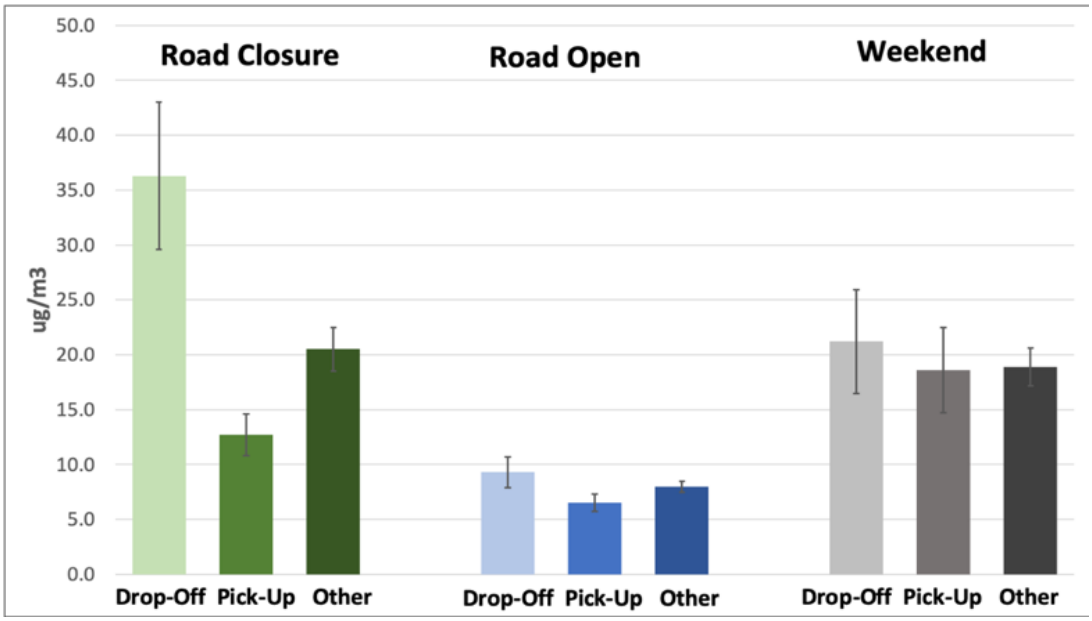


Figure 13: Average of $PM_{2.5}$ during road closure (green), road open (blue) and weekends (grey) at drop-off (7:00-9:00), pick-up (15:00-17:00) and other times (9:00-15:00 and 17:00-7:00). Reported the average (coloured bars) and standard error of the mean (black error bars).

6. MODESHIFT SUSTAINABLE TRAVEL DATA

Our Methods

We analysed the travel tracker data gathered as a part of the Modeshift program for both schools.

Our Findings

Holt House and Carterknowle Schools have a high baseline for active travel, i.e. about 70-75% of the pupils walk, cycle or scoot to school (Figures 16-17). ***During the road closure (Week 9 on Figures 16-17), active travel increased with approximately 80-82% of pupils walking or cycling/scooting***. After the road closure, active travel percentages remained slightly higher than before in Carterknowle School (Figure 14), whereas they returned to the same level as prior to the road closure in Holt House School (Figure 15).

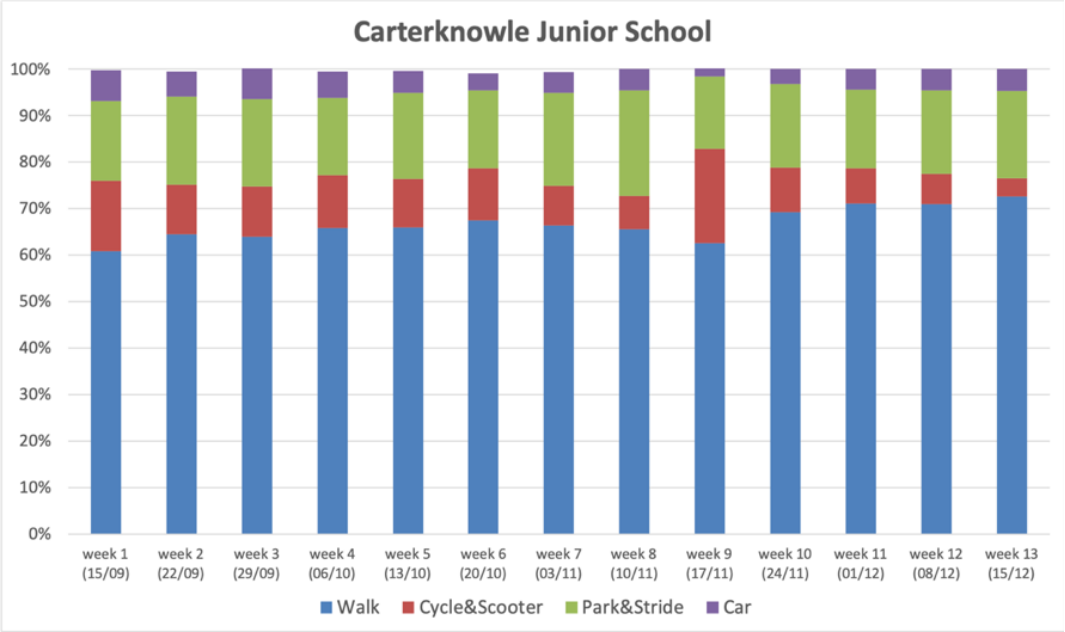


Figure 14: Weekly summary of main travel modes for Carterknowle Junior School from September to December, 2019. Road closure in Bannerdale was week 9 (November 18-22, 2019).

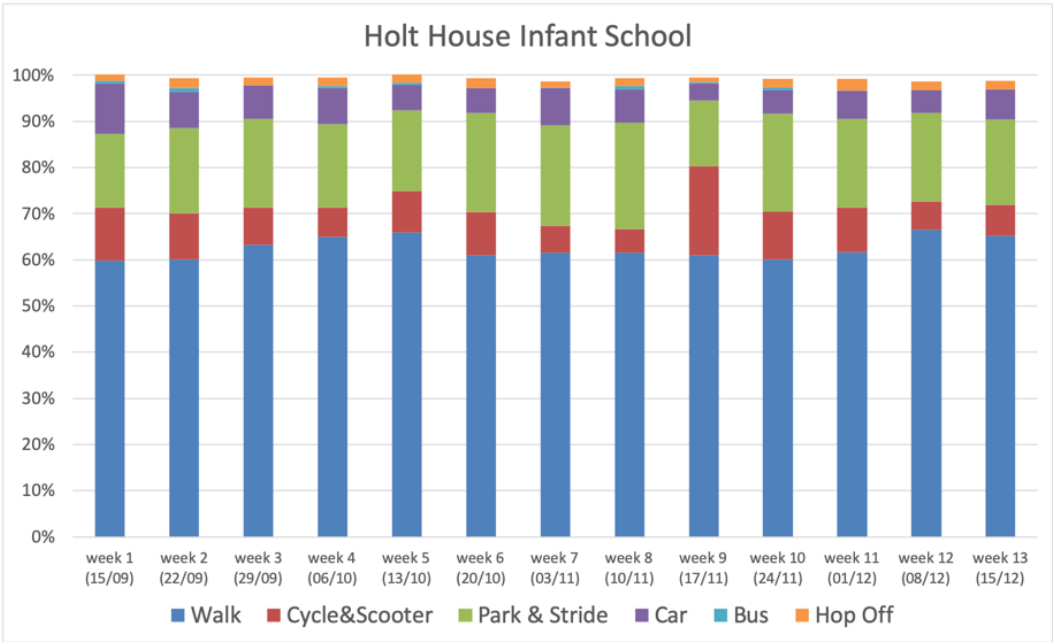


Figure 15: Weekly summary of main travel modes for Holt House Infant School from September to December, 2019. Road closure in Bannerdale was week 9 (November 18-22, 2019).

FIVE KEY CONCLUSIONS AND NEXT STEPS

1. **TAKE ADVANTAGE OF LOCAL SUPPORT FOR SAFE AND HEALTHY SCHOOL STREETS**

   The pilot has shown there is support within our school and wider communities to create safer and healthier 'School Streets', including for the closure of Bannerdale Road during school drop-off and pick-ups. There is also enthusiasm for getting involved in monitoring impacts of local action to improve the environment around our schools. This support could be mobilised in future: we have learnt it is important to reach out, listen and discuss with all stakeholders to co-develop plans and monitor together. Involving children is essential.

2. **INVOLVE DIFFERENT PEOPLE AND WORK TOGETHER (EXPECT TEETHING PROBLEMS!)**

   We have learnt that road closures are not simple to implement given the resources needed to plan and carry out this type of change within a local area. The 'School Streets' road closure pilot was only possible through concerted community action centred around the schools (e.g. parent/children/teacher support to develop promotional materials, plan, collect data/monitor/evaluate, liaise with Council). And, crucially, in combination with support and investment by the Council with its delivery partner Amey (e.g. organisational support to plan, put up/supervise barriers, symbolic/visible support during the closure). There were some issues. For example, with drivers not following closure rules/not knowing about them, and with traffic flows changing in adjacent streets. These are 'to be expected' and would need to be actively monitored and addressed on an ongoing basis in any future initiatives.

3. **CREATE A NEW COMMUNITY SPACE WITH MANY POTENTIAL OUTCOMES**

   The 'School Streets' road closure created a new local space for children/families: a space to play, have fun, interact, be active, feel safe, be independent/feel empowered. It was a space that was celebrated! A one-week pilot is not long enough to provide conclusive evidence on outcomes of the road closure. It is clear, however, that there are multiple potential outcomes from this type of action including on: road safety/traffic/driving behaviours, air quality, dimensions of children's health and wellbeing (e.g. physical activity, independence, mental health, safety). There may also be community-wellbeing outcomes related to changes in social interaction in the new space (e.g. sense of community/belonging). A longer pilot would be needed to gather more robust data, to have a longer-term impact on people's daily choices (e.g. driving behaviours) and to reflect on who (children/parents/teachers/road users) experience which outcomes and why.

4. **ADDRESS THE COMPLEX AIR QUALITY PROBLEM THROUGH SCHOOL & COUNCIL LEADERSHIP & ENGAGE PEOPLE IN DISCUSSING SOLUTIONS**

   It is not possible to conclude that the road closure pilot improved air quality around or within the school environment: air quality data was not collected for long enough, nor indoors; weather conditions affected particle pollution during the pilot week; and effects of displaced traffic travelling along Carterknowle Road (possibly going slower and idling) on air pollution are unclear. Nevertheless, air quality monitoring data collected revealed a persistent and complex air quality problem in the area; particularly relating to the harmful pollutants $PM_{2.5}$ and NO_2.

   On 'normal' school days, the high volume of parked cars on Bannerdale Road mean that it is difficult for traffic to pass easily, making it difficult for pedestrians to cross the road safely, and leading to engine idling and air pollution. During our monitoring periods, not only were NO_2 levels (predominantly from

private cars) high during school drop-offs and pick-ups, but particulate matter was high at weekends (potentially from wood burners). We know from our traffic surveys that Bannerdale Road had approximately 30% more traffic during drop-off and pick-up times in school term-time compared with half term. This may not be related to family journeys to get to school as our travel tracker data suggests a high baseline for active travel in our school community. Instead, many vehicles appear to be 'travelling through' the area, rather than 'to it' as a destination.

Air quality locally is therefore affected by issues like parking, idling, household burning & private cars 'travelling through' the area. Because these are complex to change, future action must involve leadership by the Council as well as within our school communities: with transport planners, public health, parking teams, teachers, parents, children all involved. Options to consider include:

- Longer road closure (+ improve traffic lights/flow on adjacent roads)
- Citizen science / participatory research to get children / communities involved in understanding the issue, discussing options & monitoring
- Make Bannerdale Road one-way (+ pavement widening) to improve traffic flow and create space for active travel
- Resident-only parking to reduce school-related parking/engine idling
- Action on use of home stoves
- More enforcement of engine idling restrictions

5. TAKE INTEGRATED ACTION TO CREATE SAFE AND HEALTHY 'SCHOOL STREETS': IT IS NEEDED NOW MORE THAN EVER IN THE CITY IN A TIME OF COVID-19

Although we want to do more in our area to create safe and healthy 'School Streets' around our schools, we want all Sheffield communities to have the resources to take action to create safe and healthy 'School Streets'. This is more important than ever as we collectively deal with COVID-19: air pollution may be an environmental risk factor for more severe disease and creating spaces to interact in physically distanced ways (closing roads, widening pavements) is one way to help manage risk. There are clear health inequalities in the city relating to air quality and safe environments. All children & families should have opportunities to access healthy 'School Streets'. We need integrated discussion and action across the city to make this a reality.

REFERENCES

[1] Sheffield City Council, (2015), Sheffield Air Quality Report. Available at:https://www.sheffield.gov.uk/environment/air-quality.html

[2] Kim, J. J. (2004) Ambient air pollution: health hazards to children, *Pediatrics*

[3] Gauderman W.J., et al (2015), Association of improved air quality with lung development in children. *N Engl J Med*.

[4] Gehring, U., et al., (2013) Air pollution exposure and lung function in children: the ESCAPE project, *Environmental Health Perspectives*

[5] Sheffield City Council (2019) Joint Strategic Needs Assessment. Available at: https://sheffieldcc.maps.arcgis.com/apps/Cascade/index.html?appid=96383090af4149b49112b66dadf2ea3a

[6] https://www.livingstreets.org.uk/media/4313/school_streets_toolkit.pdf

APPENDIX

STARS Traffic Survey

Date:_____ Start Time: _____ End Time: _____ Total Survey Time:_____
Location: _____ Weather: _____
Surveyor initials (if you are ok to share): _____

Traffic type	Tally - by direction of travel		Totals	
	1. From HH to CK 	2. From CK to HH 	1.	2.
Car				
Taxi				
Motorcycle				
Bicycle				
Van				
Bus /mini bus				
Lorry (small or articulated)				
Other (note down details e.g. digger)				
Notes:				

Figure S1. Traffic flow rate survey designed for the Road Closure week.

Table S1. Compilation of the traffic surveys performed at Bannerdale Road and Carterknowle Road during October and November, 2019.

Bannerdale Road

Avg time 00:15

Date	Surveyor	AM / PM	Start	End	Length	School Break?	Road Closure	Weather	Cars		Taxi		Moto		Bike		Van		Bus		Lorry		TOTAL		NORMALIZED TOTAL		TOTAL
									HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	HH-CK	CK-HH	
16/10/2019	Amy	AM	08:17	08:35	00:18	N	N	wet	79	58	nc	nc	0	0	2	1	11	3	0	0	1	0	93	62	78	52	131
23/10/2019	Sam	AM	08:29	08:43	00:14	N	N	dry	75	36	0	nc	0	0	1	0	0	4	0	0	0	0	76	40	82	43	125
23/10/2019	Sam	PM	15:15	15:30	00:15	N	N	dry	40	54	0	4	0	0	0	1	0	0	0	0	0	0	40	59	40	60	100
24/10/2019	Sam	AM	08:30	08:45	00:15	N	N	dry	68	39	1	4	0	0	0	1	0	2	0	1	0	1	69	48	70	49	118
24/10/2019	Sam	PM	15:15	15:32	00:17	N	N	wet	71	82	0	4	0	0	1	0	2	8	0	0	0	0	74	94	66	84	150
28/10/2019	Maria	AM	08:31	08:46	00:15	Y	N	dry	37	24	0	1	0	0	0	0	4	3	0	0	0	0	41	28	41	28	70
30/10/2019	Nikki	AM	08:31	08:46	00:15	Y	N	dry	39	33	3	1	0	0	0	0	4	2	0	0	0	0	46	36	47	36	83
31/10/2019	Nikki	AM	08:30	08:46	00:16	Y	N	dry	45	35	2	1	0	0	0	1	6	2	0	0	0	0	53	39	50	37	87
01/11/2019	Maria	AM	08:31	08:46	00:15	Y	N	wet	35	36	0	0	0	0	0	3	2	0	0	0	0	2	37	41	37	41	79
04/11/2019	Sam	AM	08:31	08:44	00:13	N	N	wet	48	38	0	1	0	0	0	0	2	0	0	0	0	1	50	40	58	47	105
04/11/2019	Sam	PM	15:15	15:30	00:15	N	N	wet	58	78	1	4	0	0	1	1	1	6	0	0	0	0	61	89	62	90	152
05/11/2019	Jenny	AM	08:33	08:45	00:12	N	N	wet	61	46	2	1	0	0	1	1	0	2	0	0	0	0	64	50	81	63	144
05/11/2019	Jenny	AM	08:45	09:00	00:15	N	N	wet	76	50	3	3	1	0	0	0	3	4	0	0	0	0	83	57	84	58	142
05/11/2019	Jenny	PM	15:19	15:37	00:18	N	N	wet	53	65	7	6	0	0	0	2	7	9	0	0	0	1	67	83	56	70	126
06/11/2019	Amy	AM	08:21	08:36	00:15	N	N	wet	99	32	2	3	0	0	3	1	6	3	0	0	0	0	110	39	111	39	151
08/11/2019	Sam	AM	08:30	08:45	00:15	N	N	wet	43	48	0	0	0	0	0	2	6	3	0	3	0	0	49	56	50	57	106
08/11/2019	Sam	PM	15:15	15:30	00:15	N	N	wet	75	82	3	6	0	0	0	1	1	8	0	0	0	1	79	98	80	99	179

Drop-off
Pick-up
Half Term (Drop-off)

Caterknowle Road

Date	Surveyor	AM / PM	Start	End	Length	School Break?	Road Closure	Weather	Cars		Taxi		Moto		Bike		Van		Bus		Lorry		TOTAL		NORMALIZED TOTAL		TOTAL
									Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	Uphill	Downhill	
13/11/2019	Maria	AM	08:31	08:46	00:15	N	N	dry/cold	42	75	7	2	0	0	1	3	11	1	1	3	2	0	64	84	65	85	150
15/11/2019	Nikki	AM	08:30	08:47	00:17	N	N	wet/cold	54	74	4	2	0	0	0	0	9	4	1	1	0	0	68	81	61	72	133
19/11/2019	Maria	AM	08:34	08:51	00:17	N	Y	dry/cold	55	59	4	4	0	0	0	0	19	3	2	2	4	1	84	69	75	62	137
20/11/2019	Amy	AM	08:32	08:42	00:10	N	Y	dry/cold	39	43	0	0	0	0	1	0	5	2	0	0	3	1	47	47	71	71	143
21/11/2019	Sam	AM	08:30	08:45	00:15	N	Y	dry/cold	53	54	4	4	0	0	0	0	8	4	0	0	1	3	66	65	67	66	133
21/11/2019	Sam	PM	03:15	03:30	00:15	N	Y	dry/cold	95	50	3	0	0	0	3	0	3	4	0	0	0	2	101	56	102	57	159
22/11/2019	Jenny	AM	08:45	09:00	00:15	N	Y	dry/cold	48	65	3	3	0	0	0	0	4	9	0	1	0	0	55	78	56	79	135
22/11/2019	Jenny	PM	14:55	15:15	00:20	N	Y	dry/cold	72	43	6	3	0	0	0	0	5	9	1	2	0	3	84	60	64	46	109

Drop-off (Road Open)
Drop-off (Road Closure)
Pick-up (Road Closure)