Can School Streets Work for New York City?

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Introduction

As many children, parents and educators will be aware, the streets directly outside of schools present a unique problem for transportation planning. Schools are significant 'trip attractors' within cities meaning they are locations that a high concentration of people must travel to frequently. The volume of this travel is significant: 6.6% of all trips in New York City (NYC) are for education purposes.[1] These trips are also concentrated within a thin sliver of time and in locations where many children – some of society's most vulnerable road users – are concentrated. This situation presents a particular risk to children through exposure to air pollution and road danger, both of which have been clearly identified as leading threats to child health globally.[2][3] In NYC, motorized vehicles are the leading cause of injury-related death for children under 14.[4]

In New York City, most pupils get to school by walking or public transport. Recent data from the 2019 city-wide mobility survey shows that roughly three-quarters of trips to K-12 schools are by sustainable modes of transportation.[5] However, the remaining car trips to school and nearby schools still create significant air quality and safety issues, especially in a dense urban environment. There should be little surprise then that road safety is a topic of growing concern for parents in New York City. Starkly highlighting these issues, recent research conducted by Streetsblog NYC has shown that the streets around New York's schools are significantly more dangerous than average, with over 57%

[1] DOT (2019).
[2] Who (2018).
[3] Who (2022).
[4] https://www.nyc.gov/content/visionzero/pages/
[5] DOT (2019).

more crashes and 25% more injuries per mile of street during school drop-off times than the rest of the city's roads. This reflects a national as well as local failure, with children in the United States twice as likely to be killed by drivers as those in other wealthy countries.[6] Traffic fatalities in New York City have increased three years in a row between 2019 and 2021 (with a decline in 2022).[7] Although there have been a number of attempts to address these problems through policies such as Safe Routes to Schools[8], school slow zones[9], and city-wide schemes like Vision Zero[10], the issue of children's road safety clearly persists in the city. For example, 2022 saw 16 children killed in NYC, 2x higher than when Vision Zero was introduced in 2014.

The response to Covid-19 in many European cities included expanding a relatively new model of 'School Streets' policies to address some of these same pressing issues of children's safety. Cities such as London, Paris, and Barcelona have embarked on significant programs to improve the streets outside of schools. These cities have used a variety of methods to temporarily (or sometimes even permanently) close the street directly outside of the school to cars - often focusing on the school drop-off and pick-up times. Although a similar program was launched in NYC during Covid-19, its scale has been limited to only a handful of schools and has been largely self-coordinated and self-funded. Therefore, despite this promising early initiative, NYC has lagged behind other cities in implementing School Streets.

This report will look more closely at the feasibility of implementing a wider program of School Streets schemes in New York City, including addressing issues of equity in the

[6] Walker, A. (2018)
[7] Skelding, C. (2022)
[8] NYC DOT
[9] NYC.gov
[10] NYC.gov

current approach. We will examine existing examples of School Streets and the most up-to-date research on their benefits. We will also consider the unique issues facing NYC and how the School Streets policies adopted in other cities might be adapted to solve specific problems and adjust to the unique conditions of NYC's schools and streets. By analyzing several indicators around schools, such as the number of vehicle crashes, the size of its roads, and proximity to other schools, we also identify a list of which schools policymakers and campaigners in New York City’s five boroughs might prioritize in implementing a more extensive School Streets policy.

What are School Streets?

The Origins of School Streets

School Streets can be generally defined as the closure of all or part of the streets directly outside of a school to motor vehicles. In many examples, these closures are temporary and often concentrated on the hours surrounding a school's drop-off and pick-up times. Although the most extensive School Streets policies are currently in London and Paris, they originated in the town of Bolzano in Northern Italy, where they have been in operation since the 1980s.[11] Having spread nearby to Milan, they were noted during recent visits by transport planners from London and Edinburgh.[12] Facing similar issues around safety and air quality, in 2015, both cities quickly established their own schemes. Since then, several of London's borough councils, most notably Hackney in the northeast of the city, progressively implemented schemes over the following years; over 70 schemes were established before 2020.[13] At the time, cities in Belgium were also establishing similar programs.[14] Although clearly an existing policy priority in these cities, the Covid-19 pandemic and the need for physical distancing in public spaces brought the issue of school traffic congestion into greater focus in many other cities.

At many schools in London and elsewhere, maintaining a safe distance during crowded drop-off or collection times is impossible without stepping off the sidewalk and onto the road. Recognizing this problem, and perhaps sensing a window of opportunity to achieve significant change, several

[11] Eltis Urban Mobility Observatory. (2014)
[12] Thomas, A. Forthcoming
[13] Vision Zero Cities Journal (2021)
[14] Child Health Initiative. (2022)

local governments in London undertook a high-profile mobilization of School Streets in 2020; only two years later there are now over 500 in operation across the city.[15] Many other cities in the UK and the rest of Europe followed suit, albeit at a slightly smaller scale. Most notable are Paris' 160+ rues aux écoles and Barcelona's 150+ protegim les escoles schemes. Although, at the time of writing, many more municipal governments from towns and cities in Germany, Belgium and the Netherlands are also adopting similar schemes.

Outside of Western Europe, School Streets have also been introduced in Tirana, the capital of Albania as well as in Auckland, New Zealand. According to a recent survey, there are no comparable schemes in Asian, African or Latin American cities.[16] In North America, the examples are limited to two pilot programs in Seattle and Vancouver and the aforementioned schemes in New York, as well as a handful of one-off trials in several Canadian cities.[17]

Despite their limited expansion outside 'global cities', School Streets are fast becoming part of the accepted lexicon of sustainable transport planning and public health management.

Scheme Design Approaches

A critical issue that shapes decisions around the design of a School Street scheme is the management of car journeys of those who might justifiably need to be exempt from the closure. These might include residents whose houses are within the closure, deliveries for businesses within the closure, disabled students, and, in some cases, the staff of the schools themselves. Allowing these through journeys while

[15] Mayor of London. (2022)
[16] Child Health Initiative (2022)
[17] Child Health Initiative (2022)

adequately enforcing the closure to non-exempt drivers is key to the success of a scheme. The original School Street schemes in Bolzano and Milan operated by using either volunteers from the school or police officers to direct traffic away from the school, often with the aid of temporary signage or barriers.[18] Although many early schemes in Belgium and London replicated this model (Figure 2), several other more permanent methods have also since been developed. For example, London's first School Street in Camden used bollards which could be folded down into grooves in the road when the closure was not in place, only requiring supervision at the beginning and end of the closure period. Camden's approach is similar to the one used in Paris and in some cities in Belgium, where a simple gate is installed at the end of the street and closed during the morning and afternoon.

However, recognizing the burden these approaches can place on schools and volunteers, Hackney council in London have used automated traffic cameras to enforce their closures. These cameras issue fines to any driver who drives into the closure during the signposted periods. Camera-operated schemes use a 'safelist' of exempted license plates that have a permit to drive in and out of the streets without a fine. The signs can also have a folding panel to be obscured during the school holidays when the closure is not operating; in Edinburgh, similar signs have light fixtures programmed to flash when the closure is in place (although without cameras). The automated camera system, which does not require the intervention of volunteers, teachers, or police, has been widely adopted in London. Using temporary barriers and volunteers is still common but often serves as an initial trial phase for a scheme, with the cameras representing a longer-term solution. Movable cameras have also been

[18] Most schemes in North America have adopted the volunteer/temporary barrier model to date.

used in Hackney, with the camera shared across multiple sites. In some cases the threat of a possible fine has been enough to significantly reduce traffic without the need for constant enforcement. Although cameras have clear advantages, they do not physically prevent drivers from entering the road during closure times and can leave some residual traffic.

Other countries have interpreted the concept of a School Street slightly differently, including experimenting with more extensive changes to the streetscape. For instance, in Barcelona, where many schools are on busy roads, some schemes used railings to reclaim sections of parking or traffic lanes and protect pupils from the remaining flow of traffic (Figure 1). Reclaimed areas have been changed with paint on the street, new seating and, in some cases, simple play equipment. Schemes in Paris have also often included planting additional trees and in cases where vehicular access might not be totally necessary, streets have been fully pedestrianized.[19] The gates that close the street are sometimes designed to blend in, designed using wrought iron materials that match the existing street furniture. Despite such a disparity of approaches to designing School Streets schemes, there are common elements, such as the use of signage at the exit and entry points to alert drivers of the closure and prevent them from entering the closed road.

[19] Milan and Turin in Italy have followed a similar approach, including adopting Tactical Urbanism features to activate the new pedestrianization.

Table 1: Design approaches to School Streets

School Street Design Approach	Type of Street	Locations in use
Temporary or semi-permanent barrier, supervised.	Smaller residential streets	North America, Belgium, Italy, Trial schemes in the UK.
Unsupervised temporary physical barrier (collapsible bollard, gate).	Smaller residential streets	Paris, early schemes in London.
Unsupervised traffic camera.	Smaller residential streets but can allow local busses through	London
Full pedestrianization of the street, or segment of street in front of school.	Low traffic residential streets	Small number of examples in London and Paris
Partial pedestrianization of a traffic or parking lane, physical barriers	Busy main roads, smaller residential streets	Barcelona

Ensuring that the design of a School Street adequately prevents or discourages drivers from entering the street is a key element of the success of a scheme. Research on two School Streets in London found more significant traffic reduction and greater cycling once a scheme was upgraded from unenforced signage indicating the closure to fine-issuing traffic cameras.[20] Other research evaluating NYC's Open Streets program found similar issues with unenforced street closures. Streets where barriers were present, but cars could drive around had five times as many cars entering the street than those where a driver would have to move the barrier themselves. Where no barrier existed the

[20] Thomas, A. (2022)

number of cars was 10 times as many.[21] Design choices are sometimes stylistic or pragmatic, but they can also impact whether a scheme achieves a significant enough reduction in traffic to realize the potential benefits of a School Street.

Cities have taken a number of different approaches to implementing School Streets, and ensuring they're adequately enforced. This has meant adapting them to the different regulatory contexts and taking advantage of existing laws around temporary closures or signage. Some of these options may not be legal in NYC without new legislation. However, they provide a set of different frameworks that could potentially be adopted or adapted to fit the unique needs of New York City schools and neighborhoods.

Figure 1: A protected schools scheme in Barcelona, reclaiming part of a busy intersection in front of a school. (Image credit: City of Barcelona)

[21] Transportation Alternatives (2021)

Figure 2: A School Street in London, using generic removable barriers and signage indicating closure times and permit information for exempt drivers. (Image credit: Catherine Kenyon)

School Streets Benefits: Current Evidence

School Streets can have several interrelated benefits. These can be roughly separated into the benefits that result from simply removing cars from the street, and those that arise from any changes in transport behavior that might also result. The first are a more direct outcome of a School Street and can include improved air quality in front of the school and improved road safety. Research in London, where air pollution is a particularly salient issue, has shown that schools with School Streets have seen some improvement in air quality compared to control schools.[22] To date, there has been no research focusing on School Streets' impacts on road safety statistics such as collisions or injuries, largely because of the timescales needed to detect changes in these

[22] Air Quality Consultants (2021)

datasets. However, a recent study of schemes in Birmingham, UK looked at qualitative assessments of the safety of a street from the perspective of parents and residents and found significant improvements. The research also considered potential driver-pedestrian conflicts at the entrances to the closures[23], finding an increase in interactions between pedestrians and drivers at these locations but no significant new safety issues arising from this. Although only a few of New York City's Open Streets schemes (described in the next section) were located at schools, despite attracting many more pedestrians than usual, pedestrian injuries on these stretches of street decreased by 42% as compared with the year before the pandemic, a larger decrease than was seen across the rest of the city.[24]

Other direct benefits a School Street may provide are not only about removing the danger cars pose but are also derived from the activities made possible when streets are quieter. In line with the original rationale for introducing them, many of these schemes provided the space required to maintain physical distancing on narrow sidewalks and reduce the transmission of Covid-19. In doing so they can also provide a safe space for children to spend time outdoors, play and move around independently, and more pleasant environments for parents to stop and socialize. Undoubtedly, the school gates can serve as an important social space for all ages and reducing nearby traffic can facilitate socializing. These benefits are slightly harder to measure than air pollution or traffic fatalities reductions. However, they are reflected in studies that have asked for parental perceptions of schemes and in anecdotal evidence from their operation. A recent set of case studies conducted by Transport for London (TfL) found that school leaders regularly cited a more convivial atmosphere on the street as a key benefit of these

[23] Sustrans (2022)
[24] Transportation Alternatives (2021).

changes.[25] The study also found that the closures led to more people walking in the road as opposed to on the sidewalk, but that these changes were most noticeable at schools where the traffic had been almost entirely eliminated by strictly limiting the number of vehicles that were deemed exempt from the scheme. This reflects the relationship between some of the design choices outlined above and the benefits a School Street might provide.

The secondary benefits of School Streets derived from increased walking, cycling or rolling to school can be even more extensive. Changing the mode of travel taken to school from a motor vehicle to an active mode not only provides greater physical activity benefits to the children and adults involved, but also removes a car from the length of that journey, improving air quality and safety throughout the area as well as reducing greenhouse gas emissions. These benefits are, however, harder to achieve with a School Street alone. For example, closing the street directly outside of a school may not address the most pressing barrier to walking, cycling, or rolling - which is often inadequate infrastructure along the length of a route to and from school. However, there is some limited evidence of modal shift to active modes of travel; a recent meta-analysis[26] of the existing evidence from schemes in the UK estimated that a typical School Street might result in a 3 - 6% reduction in car travel. Changing the travel habits of parents and pupils has the greatest potential for positive change. However, these benefits are also contingent on more factors external to a School Street, such as parental mode of travel to work and existing neighborhood infrastructure.

[25] Transport for London (2022)
[26] Hopkinson et al. (2021)

Equity in provision

As an intervention, School Streets can also play a part in building more equitable urban transportation systems. Children are seldom included in decisions around transportation, and investment in the streets and infrastructure that would most benefit them also pales in comparison to other policy priorities. Children are also rarely able to make their own transportation decisions - especially as independent childhood mobility and active travel rates have decreased significantly internationally.[27] For example, in the US 41% of school-age children/teens walked or biked to school in 1969; in 2001, it was only 13%.[28][29] School Streets can make urban road networks more inclusive to children.

However, investment should be targeted to ensure that children at schools most in need for change benefit first. Lower income and Black, Indigenous, and people of color (BIPOC) communities often suffer from higher rates of road danger. International research has shown this in a number of different countries and has been supported in recent national-level analysis in the US[30]. A recent study by the Governor's Highway Safety Association found that nationally, BIPOC, particularly American Indian/Alaskan Native and Black populations, suffer higher rates of traffic fatality (145.6, and 68.5 deaths per 100,000 respectively vs 58.1 for the total population). This is even more so the case for pedestrian deaths with 30.7, and 15.0 per 100,000 vs 9.8 for general population and is confirmed by previous research using national datasets[31]. These trends are also similar when looking at income, with a $1000 decrease in a census tract's

[27] Marzi, I. (2018)
[28] McDonald, N. (2007)
[29] This is in spite of a survey of 6000 Canadian children from the same year finding that 75% would prefer to walk and cycle regularly. Obrien, C. (2008).
[30] Governor's Highway Safety Association (2021)
[31] Schneider, R. 2020.

median income associated with a 1% increase in pedestrian traffic fatalities.[32] Research in Oregon has found that census tracts where lower income and BIPOC populations were more concentrated were much more likely to have higher levels of traffic and contain high-speed arterial roads[33], which are in turn associated with higher rates of pedestrian fatality[34]. Furthermore, in New York City, BIPOC and lower income communities are also more likely to face a longer commute to school and thus higher levels of exposure to potential road danger.[35,36]

Therefore, inequities around children's travel are not just generational but also reflect wider socioeconomic disparities in road safety and transportation provision. School Streets can help to curtail the negative effects of motor traffic, which are the overwhelming cause of these deaths but they must also be prioritized at schools which serve the BIPOC and low income populations worst affected by these trends. Many early School Street pilot projects have focused on schools where the existing leadership and parent body are amenable to such schemes. However, this is not necessarily an equitable approach to implementing changes longer-term. Recent research on the equity of School Streets schemes in London found a generally equal distribution across the whole city in terms of income and ethnicity, but significant spatial disparities, with some districts having no School Streets at all despite nearly a quarter of all public elementary level schools across the city having one.[37] School Streets programs, while generally contributing to more inclusive transportation systems, should also seek to ensure that their benefits are equitably distributed across any city.

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[32] Roll and McNeil (2022)
[33] Governor's Highway Safety Association (2021)
[34] Roll and McNeil (2022)
[35] Corcoran, S.
[36] Urban Institute
[37] Thomas, A et al. (2022)

Why School Streets in NYC?

New York's Existing School Streets

Like many other cities discussed, New York City conducted a widespread policy of temporary street closures and road space reallocation schemes during the Covid-19 pandemic. Through their 'Open Streets' program, 247 closures were put in place on a variety of streets, which in 2021 amounted to roughly 26 miles of closures[38]. The program also saw the introduction of a number of closures on the streets outside of schools. These were sometimes concentrated at drop-off or pick-up times like the examples discussed from other cities; in others, the closure lasted the entire day, the space in some cases also being used during recess or for some classes. As part of the Open Street program, around 100 schools adopted some kind of closure. However, the policy has since faltered, with only 38 schools out of the more than 2,600 schools in New York City still regularly closing their streets, as visible in Figure 3. A recent analysis of these remaining schemes found them to be in significantly whiter and wealthier neighborhoods in the city, the only ones able to supply the resources needed to maintain such a scheme without active backing from city hall.[39]

[38] Transportation Alternatives (2021)
[39] Coburn, J. (2022)

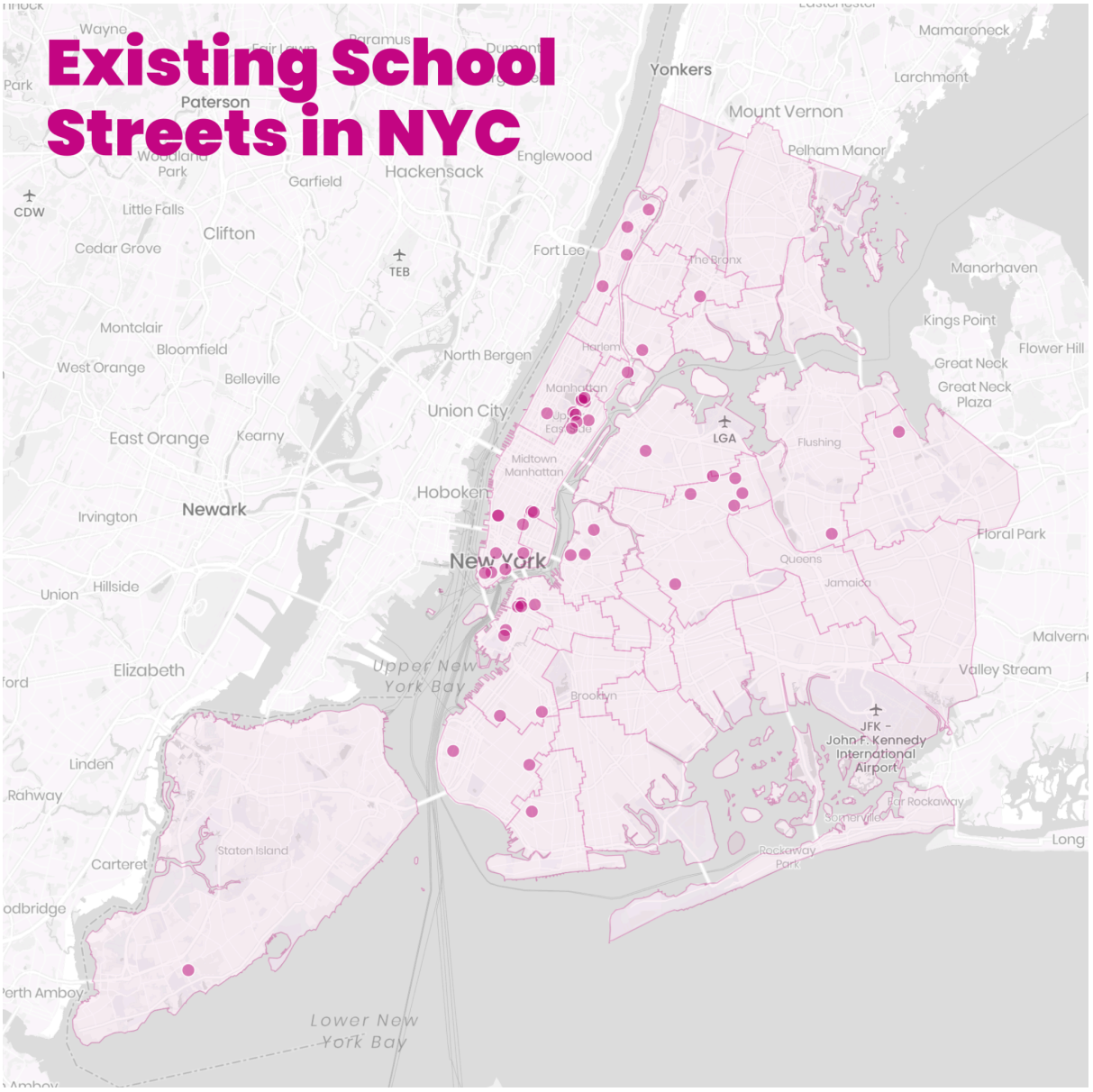

Figure 3: Existing School Streets in NYC. Source: Own elaboration of open data published by NYC DOT.

Although, to date, the adoption of School Streets in NYC remains somewhat patchy, the concept has the support of the chair of the New York City Council's Education Committee, Rita Joseph. Joseph is an advocate for school road safety and has also introduced legislation mandating traffic calming around parks of a certain size.[40] Such support is a hopeful sign of growing awareness of the potential benefits

[40] NYC StreetsBlog (2022)

that these kinds of closures could bring to the schools and pupils of New York City.

The Policy Context

As with the cities in which School Streets have been more extensively installed, New York City suffers from many interrelated problems around road safety, environmental quality and public health that School Streets could play an essential part in addressing. Although independent mobility has declined in almost all wealthy countries, due in great part to increasing levels of traffic, the objective safety of streets and accessibility to schools differs significantly between countries, cities, and, crucially, neighborhoods and communities. In London and other cities, School Streets have emphasized promoting sustainable travel as well as general road safety. In the 2019 NYC Citywide Mobility Survey, 39% of K-12 trips were walked[41], higher than the 11.4% of children that walk to school in the whole Tri-State area[42], and significantly higher than other urban regions in the US. However, this is based on a limited sample size and around 30% of school trips were still in either private hire vehicles or personal cars, something that could be improved. Although evidence for the impact of School Streets on transportation mode shift is less strong, if widely implemented, they are likely to have a part to play in increasing the number of children walking or biking to school in New York City. However, the most obvious direct benefits of School Streets for New York City are likely in their improvements to road safety and providing access to traffic-free public space for children.

[41] DOT (2019)
[42] Kontou, E et al. (2020)

Improving Road Safety

On the 1st of December 2021, the New York City Department of Transportation introduced its Streets plan.[43] This document sets out a vision for how the city's streets should be planned and designed with 14 key goals. Its "Safety, Equity, and Public Space" goals are particularly relevant to the introduction of School Streets. The goal of "Safety" bolsters a long-standing commitment to Vision Zero in New York City - a policy initiative that sees all traffic fatalities as avoidable and ultimately the consequence of poor street design and sets a bold goal for zero traffic fatalities in the city. In 2014, New York City became one of the first major cities to adopt this approach after similar successful initiatives in Sweden. By 2018[44] road fatalities had declined by a third but since then they have risen year on year until 2021, with a slight decrease in 2022.[45] Such an increase is within the context of a national decline in road safety.[46] This broader national trend has particularly affected pedestrians, fatalities of which have increased 40% between 2010 and 2018[47]; these trends also run counter the experience of most other wealthier nations which have generally seen ongoing improvements in road safety.[48] These issues are also more prevalent near schools. A recent report by Streetsblog NYC found that during the hours of 8 am-9 am, there were 57% more crashes and 25% more injuries per mile on the streets around schools than the rest of the city's streets.[49]

Given such evidence, improving the safety of streets for children should be a key priority for New York City. To date, policies aiming to improve road safety at schools in New York

[43] NYC.gov (2021)
[44] NYC.gov
[45] Skelding, C. (2022)
[46] Zipper, D. (2022)
[47] Badger, E. and Parlapiano, A. (2022)
[48] Bloomberg (2022)
[49] Coburn, J. (2022)

have focused on Safe Routes to Schools (SRTS) programs and School Slow Zones. SRTS is a long-standing and federally supported program that's purpose is to improve the street environment so pupils can walk or bike to school more safely. This might include repairing sidewalks or introducing new crossings. Multiple evaluations nationally have found positive impacts on rates of walking and cycling to school, especially when including infrastructural interventions.[50] However, in New York state the overall presence of SRTS has been characterized as 'weak' to 'moderate' in a recent evaluation[51], and current trends in road safety statistics imply that there is still considerable work to do. However, some promising data is emerging at smaller scales. Despite the NYC Department of Transport (DOT) focusing so far on the less expensive improvements involving new signage and paint (in spite of the more limited evidence for their effectiveness)[52], some New York City school areas that have received significant improvements through SRTS policies saw a 33% decline in the rate of child pedestrian road traffic injuries[53] which have resulted in notable social and public health benefits.[54] Safe Routes to School have been highlighted in the Mayor's proposed 2024 budget so will likely continue as an significant policy in this area.[55]

Similar city legislation also requires the city to introduce improvements to the streets within ½ mile of over 50 schools every 2 years (up until 2024); although the city claims to be introducing improvements at over 100 schools annually through this avenue.[56] This policy has resulted in the introduction of some valuable schemes, including permanent closures of smaller roads adjacent to schools (Figure 4).

[50] LaRouche, R et al. (2018)
[51] Lieberman, M and Zimmerman, S. (2019)
[52] Coburn, J. (2022)
[53] DeMaggio, C and Li, G. (2013)
[54] Meunnig, P et al, (2014)
[55] NYC.gov (2023)
[56] NYC.gov (2022)

Although the more open-ended nature of this approach does not necessarily target improvements for those most in need, promisingly the DOT has recently made changes to the formula it uses to determine prioritization to now include crash data alongside demographics and other determinants of equity.[57] This may help to direct future investment to where known road danger hot spots in the city.

Figure 4: A slip road closed to motor traffic at the Academy of Language and Technology in the Bronx (Image credit: NYC DOT).

School Slow Zones are another notable road safety program in New York. These schemes reduce the speed limit outside of a school to 20 mph, or 15 mph if a speed bump is also installed.[58] These restrictions are in place at all times but are usually reserved for streets on which only one direction of traffic runs. The city installs around 50 school slow zones a year and uses traffic cameras to enforce these limits. Recent legislation has extended their remit so they can issue tickets

[57] Coburn, J. (2022).
[58] NYC.gov

24hrs a day.[59] Reducing speeds has several well-researched road safety benefits, particularly around reducing the severity of injuries and incidences of fatality, though rates of collisions have also been found to decrease.[60] However, issues around equity and prioritization remain. The Streetsblog investigation also included an analysis of the most dangerous school environments in East New York, finding that many had not yet benefited from measures installed through these existing school safety programs.

Several different policies are contributing to improvements in safety at the streets outside of New York's schools. However, the pace of change does not compare favorably with the speed at which School Streets schemes have been introduced in other cities. This is within a broader context where road safety in the city, and children's road safety, in particular, is worsening rather than improving, highlighting the need to increase the pace of change. Increasing investment in existing policies as well as introducing new, more stringent measures like School Streets should be a priority for policymakers in order to tackle school road safety.

The Need for Child-Friendly Public Space

Another major benefit of School Streets is the creation of new, albeit often only temporarily, traffic-free public spaces near schools. This approach has been emphasized more in the School Streets in cities like Barcelona and Paris, where traffic is usually entirely removed from a segment or lane of a street, and basic play equipment and seating are installed. New York has several examples of creating new public spaces on the city's streets. The streets-to-plazas program during Jannette Sadik-Khan's tenure at the DOT promoted the use of temporary materials to trial new, more pedestrian-friendly

[59] Governer.ny.gov (2022)
[60] Fridman, L. et al. (2020)

layouts.[61] These schemes have typically been focused on more central locations where people might congregate, and in spite of some interesting exceptions[62], more everyday spaces like smaller residential streets have been less well served.

However, these more quotidian streets are also important. Initiatives like School Streets, highlight the extent to which the public space that is accessible to children has been eroded by rising reliance on automobiles in cities. Increasingly play is confined to designated spaces in parks and playgrounds, whereas in previous decades, this may have been focused on streets close to home. The rise of formal playgrounds has in part, been the result of a deliberate and well-meaning set of planning initiatives to ensure children from all backgrounds had safe spaces to play away from the danger of the street, but the result has been to pave the way for unimpeded traffic even on smaller residential streets (see Krista Cowman's research[63] for more on this). However, while streets have become less safe for children to play in, the current provision of playgrounds is also an inadequate replacement. New York City sets out a limit for each neighborhood of 1,250 children per playground; this figure is exceeded in over half of all neighborhoods.[64] The emphasis on play in specifically sanctioned areas has also not necessarily had the desired effect of democratizing access to safe public spaces for play. Studies by the Trust for Public Land have examined the equity of access to green spaces in NYC - showing that low-income areas have 22% less park space than wealthier neighborhoods, and areas inhabited predominantly by people of color have 33% less.[65] Although these disparities are

[61] Sadik-Khan, J and Solomonow, S. (2016). *Streetfight.* Viking. New York.
[62] Like this mid-street playground in Brooklyn
[63] Cowman, K. (2017). Play streets: Women, children and the problem of urban traffic, 1930-1970. Social History. 42. 2
[64] NYC Departments of Health & Transportation
[65] Closson, T. (2021)

less extensive than for many other parts of the country, a number of initiatives to reduce these disparities have been launched by city hall.[66] Along with improving the quality of parks in areas of need, the city also highlights the importance of street space in providing public areas of congregation and play where access to parks is more limited.[67]

There are, however, a number of long-standing precedents for facilitating play at street-level. As the automobile increased in prominence in urban areas in the early decades of the 20th century, many traffic-free 'play streets' were established in New York to preserve children's access to the streets near their homes for play and socializing.[68] Although these initial streets ultimately disappeared in New York City, play streets have seen a resurgence in European cities as temporary managed street closures, often on weekends. Examples of temporary closures to facilitate play, physical activity and socializing are also prominent in Latin America, for example, with Bogota's Ciclovia and equivalent schemes in Quito or Mexico City. In the UK, the increasing network of play street events served as an early model for how School Streets might operate - namely with volunteers marshaling traffic using temporary barriers. Play streets in this model have also made a return in NYC[69], and may also provide a framework for NYC's School Streets as they set out clearly which types of streets the city has deemed appropriate for closure.[70] The city's Open Streets initiatives instituted during the pandemic rely on similar principles to the Play Streets with a variety of temporary barriers and stewards - making these kinds of initiatives already an increasingly familiar sight to New Yorkers.

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[66] NYC Council (2022)
[67] NYC.gov
[68] Lydon, M and Garcia, A. (2015). *Tactical Urbanism: Short-term action for long-term change.* Island Press. Washington
[69] NYC.gov
[70] Although the DOT's street design manual limits them perhaps unnecessarily to streets with only one direction of traffic

To date many of the School Streets installed in New York City have been conducted as part of the Covid-19 Open Streets policy, with a greater emphasis on facilitating outdoor learning[71], echoing the responses to past pandemics.[72] However, it is clear that they could also play a part in a number of other agendas around increasing children's access to much-needed urban public space. Some schemes like the closure on 34th Avenue in Queens, which has seven schools within a block of it, are beginning to provide such space.[73] However, there is scope for much more. A recent poll by the well-known polling group Siena College and Transportation Alternatives showed majority support in New York for further Open Streets-style initiatives, and significant 83% support for greater provision for children's play space, even if it means less space for parking.[74] School Streets themselves also appear popular, with 66% of New Yorkers supporting closures.[75] As temporary closures and flexible approaches to street space have become more commonplace, there is a clear demand in the city for greater provision of safe public space. Interventions like School Streets may be able to help provide such space in areas where density or budget make introducing new dedicated off-street play space challenging.

Adapting School Streets to the New York Context

Across the different cities that have led the way in implementing them to date, the reasons for installing School Streets vary. Although a wide range of benefits have been cited by advocates and policymakers in London, the emphasis has perhaps been on the improvement of air

[71] NYC.gov
[72] Bellafante, G. (2020)
[73] Kuntzman, G. 2022
[74] Transportation Alternatives (2021)
[75] Transportation Alternatives. 2021

quality as well as encouraging modal shift from driving to walking and cycling. On the other hand, Barcelona has emphasized children's play and the creation of new public space in their designs. In NYC, two of the most salient issues are children's road safety and access to public space. School Streets can impact these issues but approaches to their design and implementation should reflect these aims. For example, a School Street that aims to make driving less convenient to prompt modal shift will look different to one aiming to create a new public space for play and congregation. In this case, traffic reduction through strict enforcement or passive barriers is particularly important to ensure vehicle movements are minimized to the extent that the street can be safely reclaimed by children and parents. This may also impact the types of schools that are prioritized for a School Street.

In the UK, schools on busier roads are sometimes less likely to receive a closure as the street directly outside the main entrance cannot be closed. In Barcelona, School Streets are introduced also on busier roads by reallocating, for example, one lane. In New York, many schools that are in need of an improved public realm are on busier roads and closing a perpendicular street away from main entrances may still provide significant benefits in terms of increasing the public space accessible to pupils at the beginning and end of the school day. Indeed, in the US over 6 million children attend public school within 250 meters of a busy road[76]. Ensuring that schools in a variety of different urban contexts are able to benefit from a School Street is also important if they are to become a tool to increase the equity of safety and access for children in New York City.

Equity needs may also impact the operating model for School Streets. The schemes installed to date under New York City's Open Streets policy, as well as many pilot schemes in other

[76] Hopkins, J. (2017)

cities, have relied on volunteers - often parents of pupils at the school - to marshal traffic. Although this has been effective in Play Streets, as part of a long-term solution, it may disadvantage schools with pupils from lower-income families who may have less availability, time, and resources to assist the school in operating the School Street scheme. These are perhaps some of the reasons why Transportation Alternatives found more numerous and higher quality examples of the city's Open Streets program to be located in Manhattan, especially as compared with the Bronx. Having rated the quality of each scheme in the city they found that households with incomes in excess of $100,000 were more likely to live closest to a higher-quality scheme, while those with less than $50,000 were closer to lower-rated streets.[77] In London, some of these issues have been overcome with the use of automatic traffic cameras and, in a handful of cases, a permanent passive closure. This may or may not be an appropriate approach in NYC where legislation currently exists to issue tickets to speeding drivers outside of schools, and perhaps could be adapted to enforce a closure. Whichever approach is adopted, considerations will need to be made to ensure that the operation of any School Street does not place unsustainable burdens on either parents or the school. This will likely also require dedicating funding and staff resources to helping schools to pursue these policies rather than having individual schools self-organize their measures as is currently the case.

[77] Transportation Alternati (2021). https://www.transalt.org/open-streets-forever-nyc

Identifying suitable School Street locations in NYC

School Streets constitute a key measure to improve, at least temporarily, children's experience of public space and exposure to environmental risks. When introduced as part of broader packages of measures to reduce car journeys, they can also contribute to vastly improving physical activity levels, air quality and road safety. Although all schools should provide children and pupils safe space to play and socialize, some schools have much greater need than others and should be prioritized in any School Streets policy to ensure that these improvements are both equitable and effective. Similarly, some schools are better placed to receive a School Street because of their location in their road network. Both these factors should be considered in creating a School Streets policy.

In this section, we introduce two indicators to analyze the potential for School Streets in NYC and help in prioritizing their introduction: a School Street feasibility score and a School Street priority score. From this we also produce a list of priority schools for School Streets for policy makers considering these measures.

School Street feasibility in NYC

To better understand the potential for School Streets introduction in New York City, we developed a School Street feasibility indicator (Figure 5), building on previous work on School Streets in 4 UK cities published in 2021 by Possible.[78] The original indicator judged School Streets feasibility based on proximity to a main road, key locations judged to plausibly

[78] Hopkinson et al. (2021)

involve constant essential traffic (e.g. hospitals or industrial sites), or bus routes, as shown in the below flowchart. The results of the automated geographical scoring was checked using manual assessments of a proportion of schools. From this it was found that, in the four UK cities considered, around half of schools were either already School Streets or likely to be feasible for a School Street.

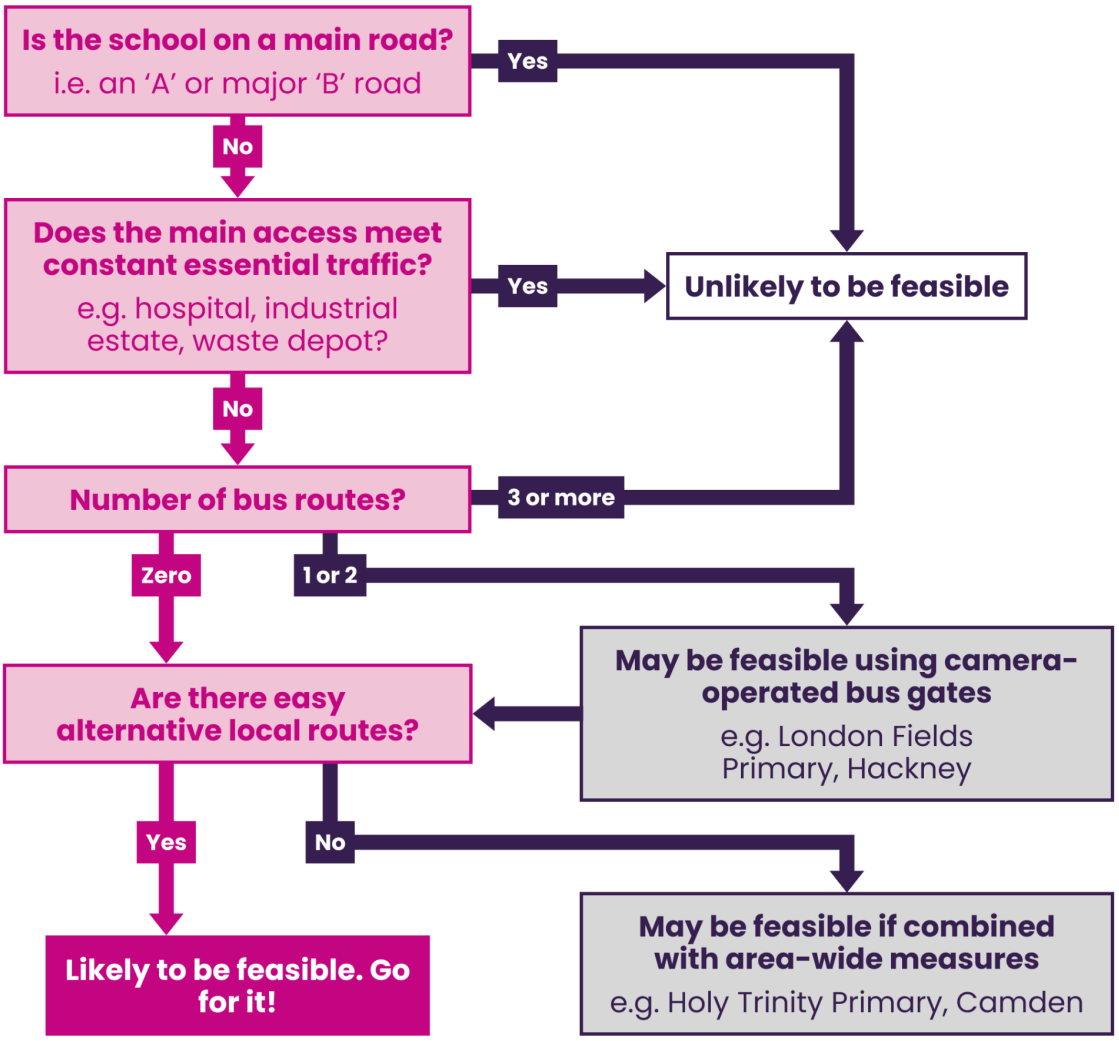

Figure 5: Flow chart showing the decision-making process behind deciding if a school street is feasible in the UK.

For New York City, we started with geographical lookups readjusting the feasibility indicator to the unique context and the data available. Particularly considering NYC urban fabric and traffic regulations, we considered as markers of 'infeasibility':

1. Location on a main road (wider than 10m);
2. Proximity to a main road (within 100m);
3. Proximity to multiple bus stops (within 100m);
4. Proximity to any key location involving constant essential traffic (within 100m).

We divided the schools in three difficulty groups as low, medium and high difficulty.

We then combined the results of this analysis with manual feasibility lookups of 10% of all schools, which were able to refine and consider further feasibility aspects not accounted for by the geographical lookups. The manual lookups considered the above indicators together with other aspects not available on GIS, such as proximity to truck or bus routes, presence of especially steep street incline, proximity to police or fire departments (not included in the POIs). When performing manual lookups, schools were considered also on the basis of proximity to parks and other schools (e.g. when those conditions were present their feasibility was enhanced). The manual lookups divided the schools in three feasibility categories: 'unlikely to be feasible', 'may be feasible', or 'likely to be feasible'.

The results of the two analyses were combined by multiplying the total number of schools in each difficulty group by the above probabilities to estimate the proportion of schools in each feasibility category. We then summed across the different difficulty scores to estimate the total proportion of all schools in three final feasibility categories. A full description of

the feasibility score and these results is available in appendix one.

Our revised decision tree (Figure 6) is:

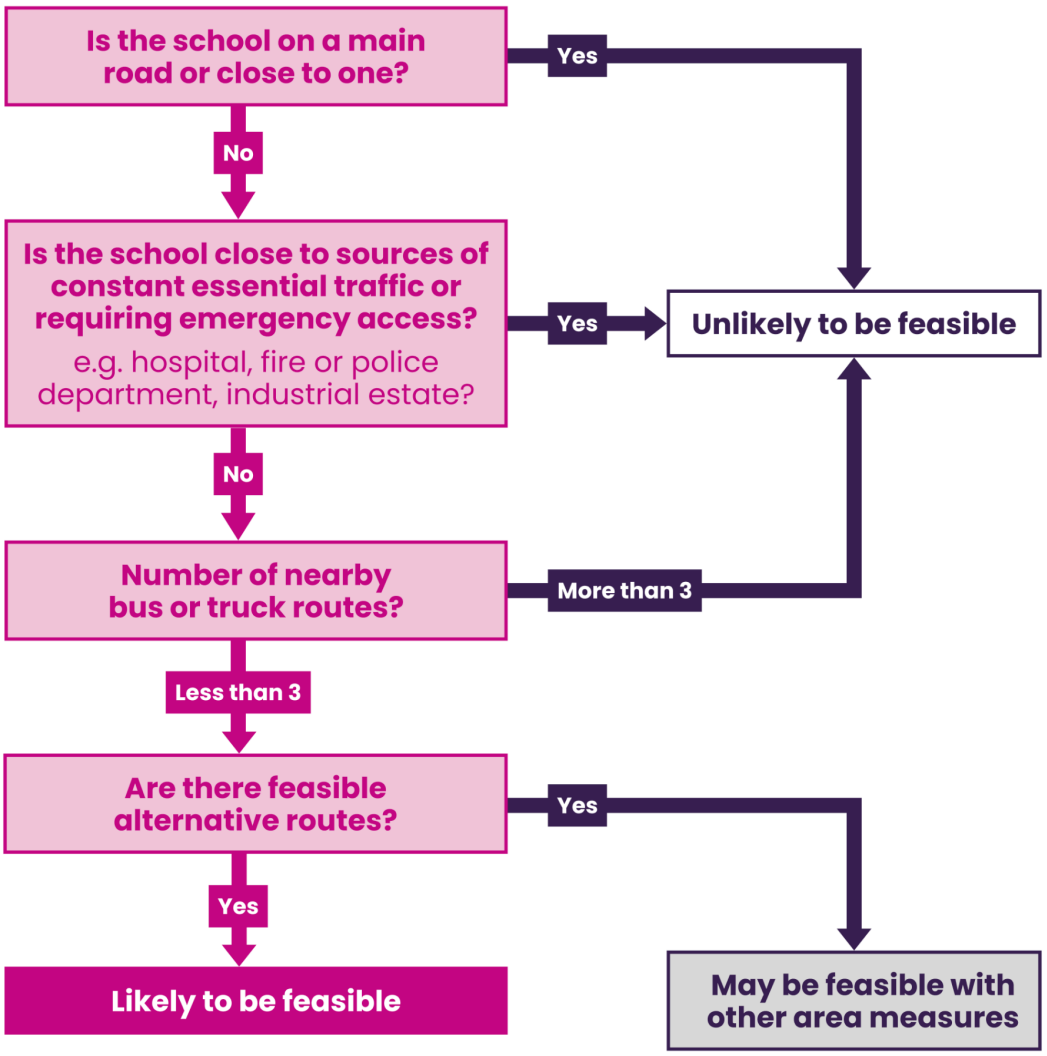

Figure 6: Flow chart showing the decision-making process behind deciding if a school street is feasible in New York.

The result of the combined analysis shows that, across all 1709 schools in NYC, 14% are likely feasible, 51% might be feasible, and only 35% are unlikely feasible (Figure 7).

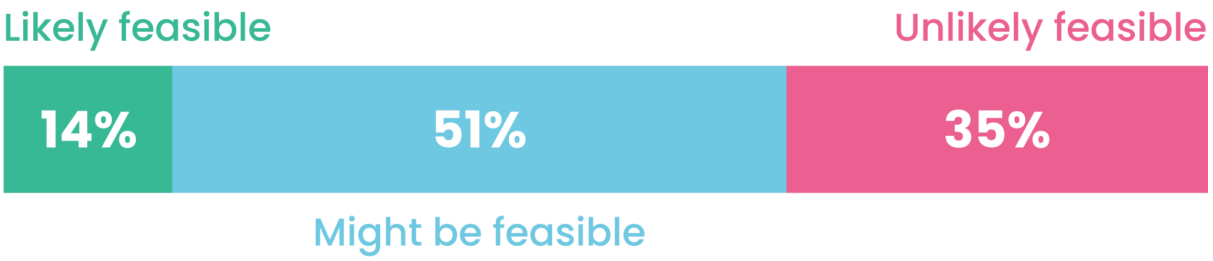

Figure 7: Feasibility of school streets at schools across NYC.

With such a degree of feasibility, it is clear that there is significant potential for widespread adoption of School Streets across NYC and subsequent substantial improvements to young people's experience of public space and travel.

School Street priority in NYC

The feasibility score developed above allows for a better understanding of the overall potential of School Street adoption across NYC and ease of technical implementation. Such definition of feasibility, however, does not take account of other factors that might influence decisions on which schools should receive a School Street scheme, including public acceptability and perception of need. It also does not give clear policy indications on which schools should be prioritized.

To overcome this, we developed a second score that considered which schools should be in the priority list for receiving a School Street in NYC. Based on current mounting public concerns regarding road danger for younger New Yorkers (see Section 3.5), we prioritized those schools that had reported a high number of crashes in their proximity. We also consider higher priority those schools that were close to others, as one intervention would then benefit a higher number of students. Furthermore, our priority list accounted for proximity to a minor road as a factor that would make a School Street easier to be implemented and therefore more

likely to be introduced rapidly. Our final priority score considered as high priority those schools that: 1) had a high number of crashes within 200mt of the schools; 2) were in close proximity to other schools; and 3) were on a minor road. The first factor counted twice as much as the second two, reflecting the importance of reducing road danger compared to ensuring that more schools are targeted with one scheme or the possibility of using a minor road to introduce the scheme. Figure 8 reports the number of crashes for all NYC schools.

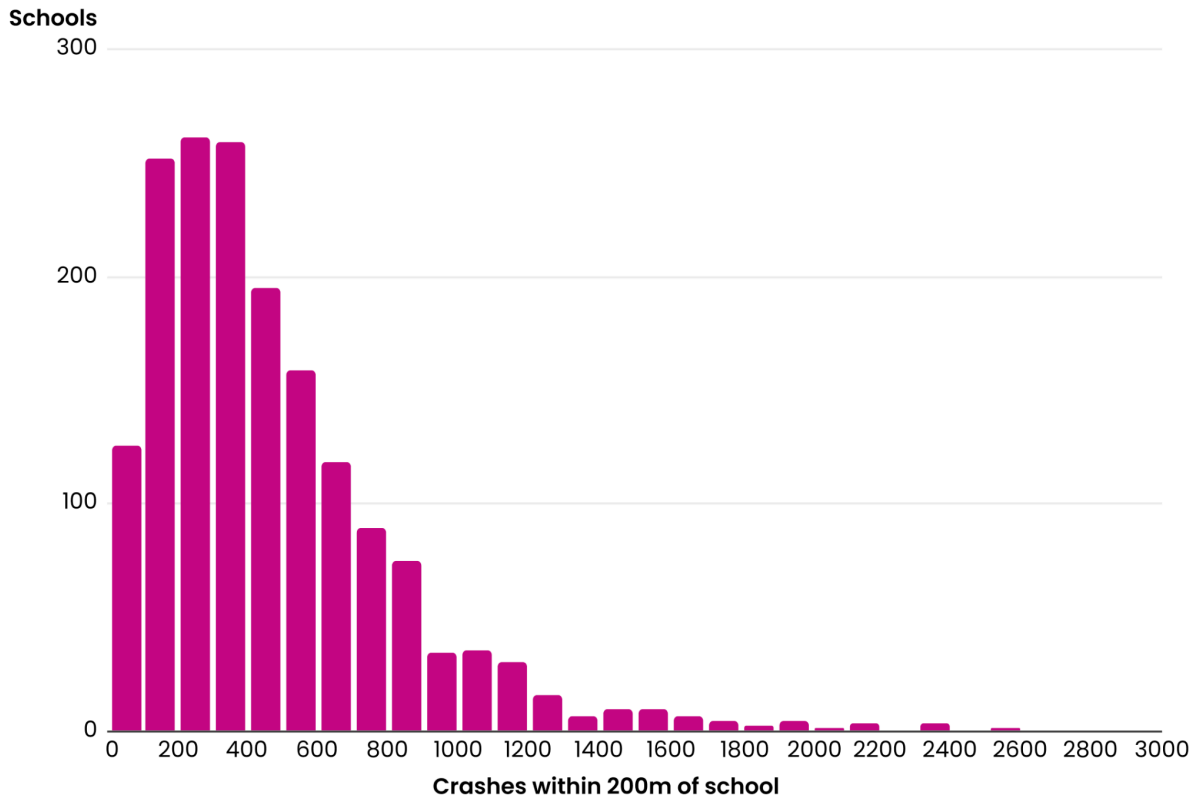

Figure 8: Histogram of the number of crashes within 200m of the school for all NYC schools.

We scored all schools and then focused on those 200 schools which scored highest, as a priority list for Schools Street. Figure 9 shows the number of crashes recorded within 200mt of these 200 schools. 77% of these schools resulted either feasible or highly feasible (68.5% highly feasible) according to manual lookups. When considering our geographical definition of feasibility, 55.5% of all schools again are likely to

have low-to-medium difficulty. It is also important to note that 67 of these schools were already included in the Safe Street program[79], and 9 used to be Open Streets.

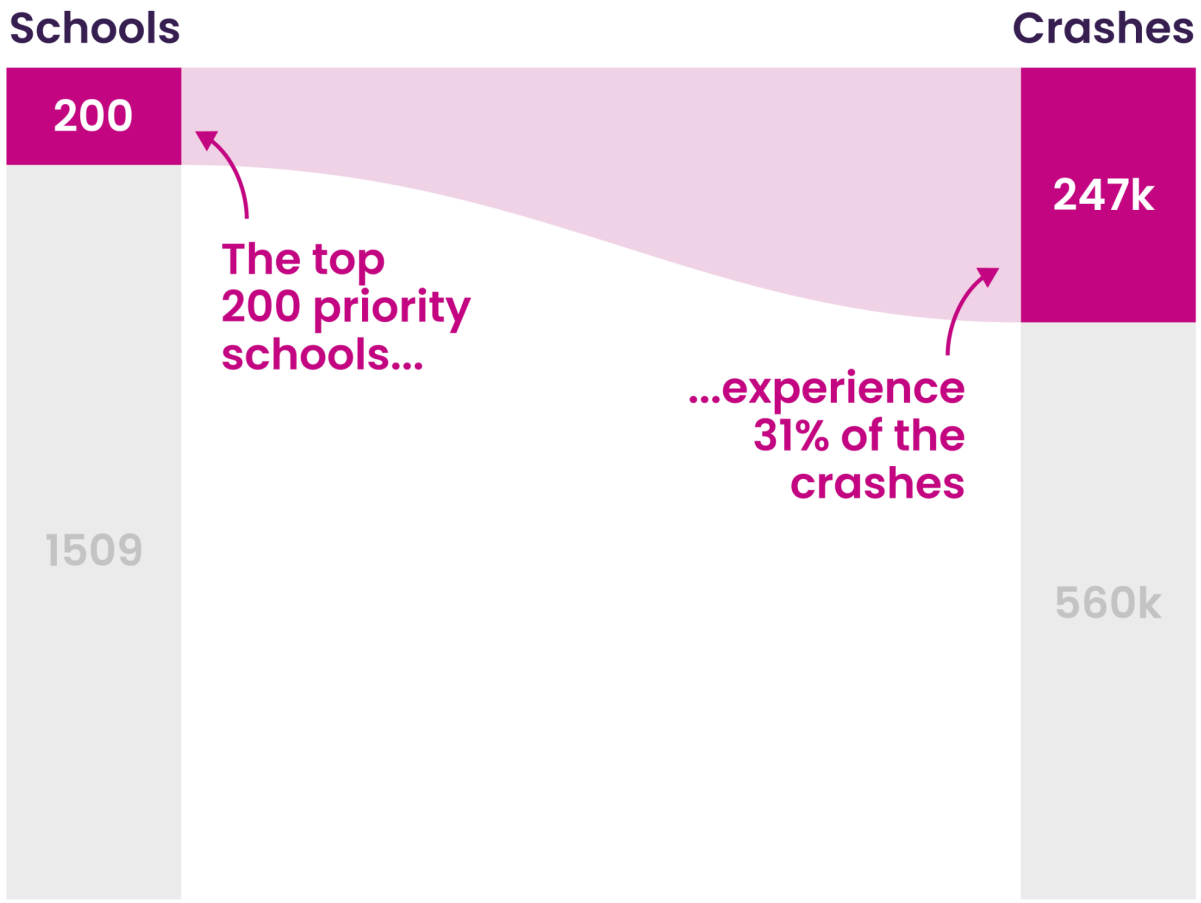

Figure 9: Number of crashes for the 200 top priority schools analyzed

Our final priority list is published in this spreadsheet, including 143 schools that are high priority and likely to be highly or very feasible. The schools are presented in order of priority, with schools already targeted by Slow School Zones interventions highlighted in green.

If all schools in the list were to receive a School Street, 64,321 pupils would benefit from access to additional safe space to play and socialize, and, potentially, to access school by walking or cycling. Adding 140 or more schools to the list of schools targeted will also bring New York in line with the level of intervention taken recently in Paris.

[79] DOT

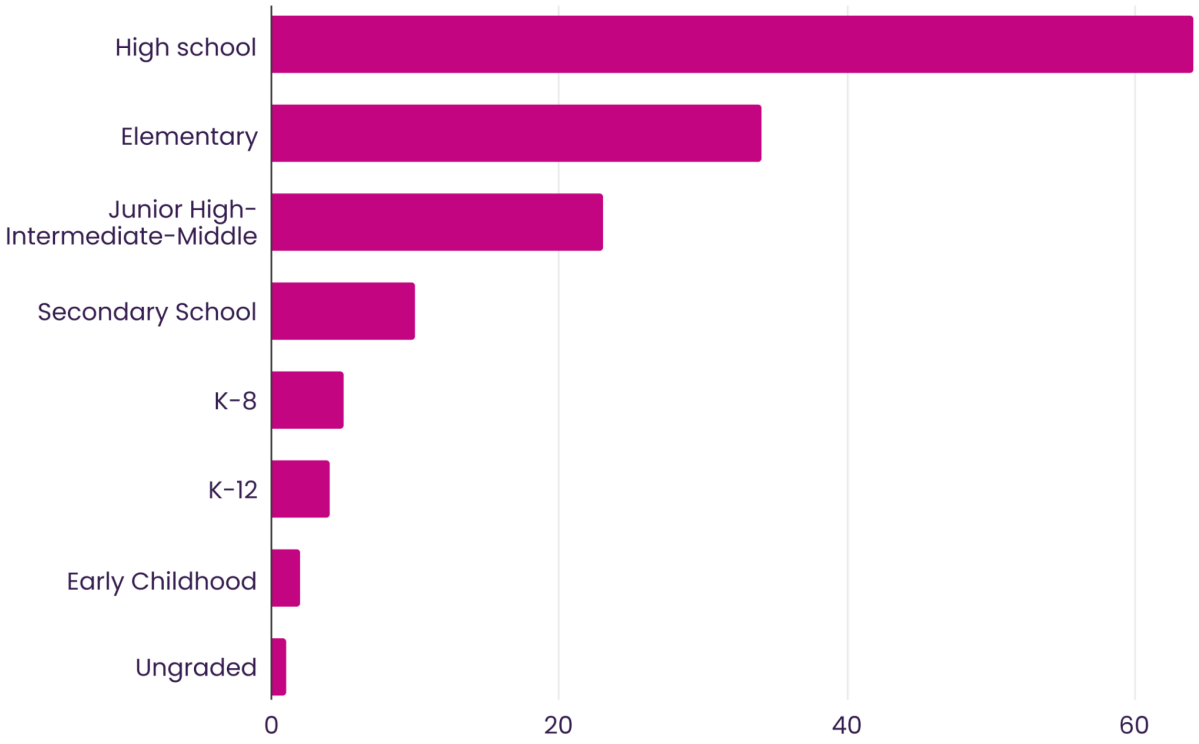

Figure 10: Grades for the 143 priority schools

It is key to notice how the 143 priority schools we identified are overwhelmingly in Manhattan (see Figure 11), with very little presence in other areas and especially Staten Island. The result is linked to the high proportion of crashes in Manhattan compared to other areas, as our priority index is a function, primarily, of road danger.

Although these schools represent an overall priority list for School Streets as a tool to respond to high rates of road danger, overwhelmingly prioritizing certain boroughs and areas can have dangerous repercussions in equity terms. This especially where areas of intervention might coincide primarily with areas where families with higher median income reside (see Figure 12).

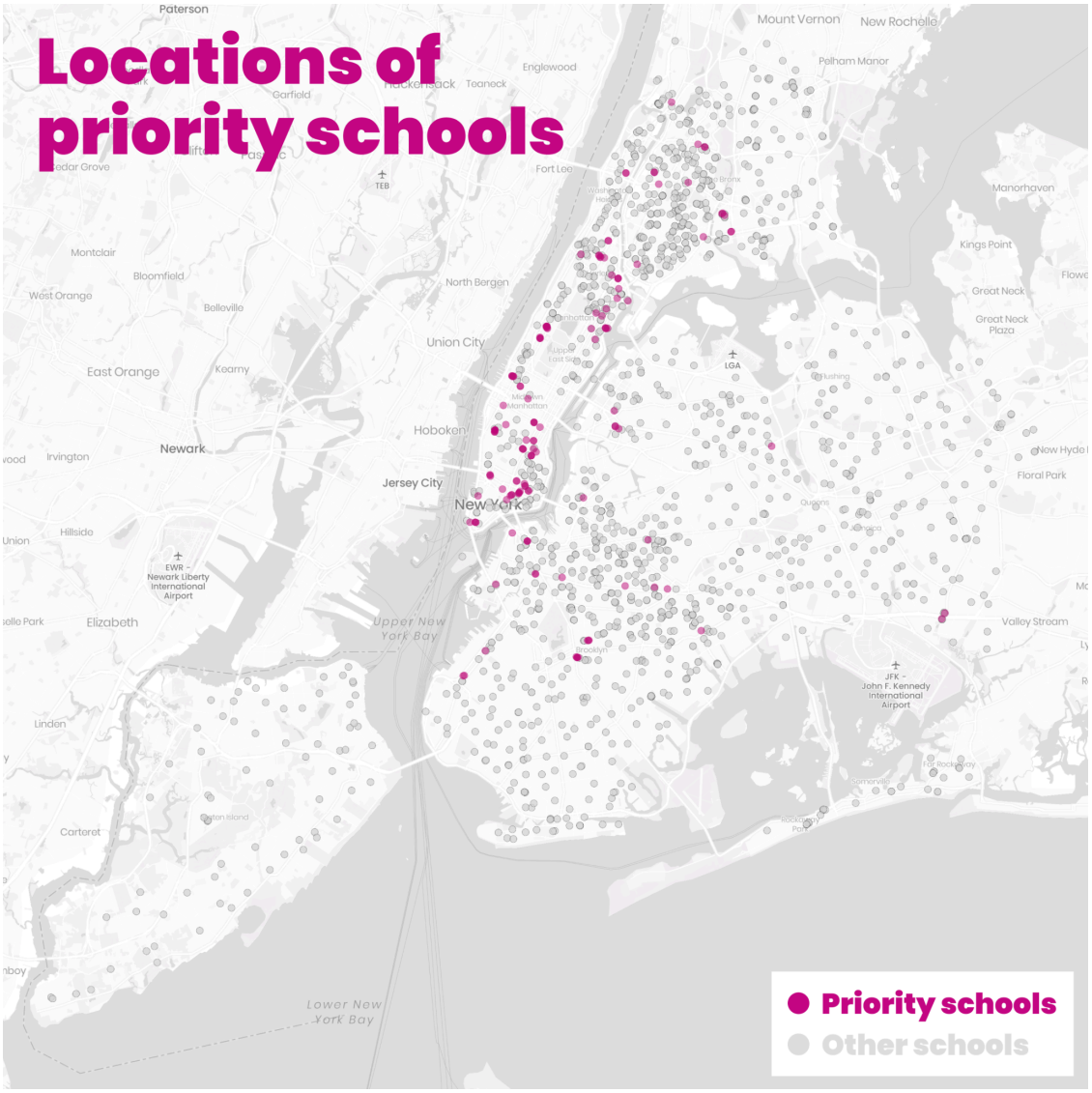

Figure 11: Locations of priority schools in NYC.

As we discussed earlier, it is important that city-wide interventions account also for their effectiveness across different socio-demographic indicators, targeting in particular those areas where children are more likely to have limited access to green space, space for play and leisure. Further analysis should consider in more detail these implications, for example by considering the distribution of existing and planned School Streets across different socio-demographic indicators, as done in the case of London School Streets.[80]

[80] Thomas, A, et al (2022)

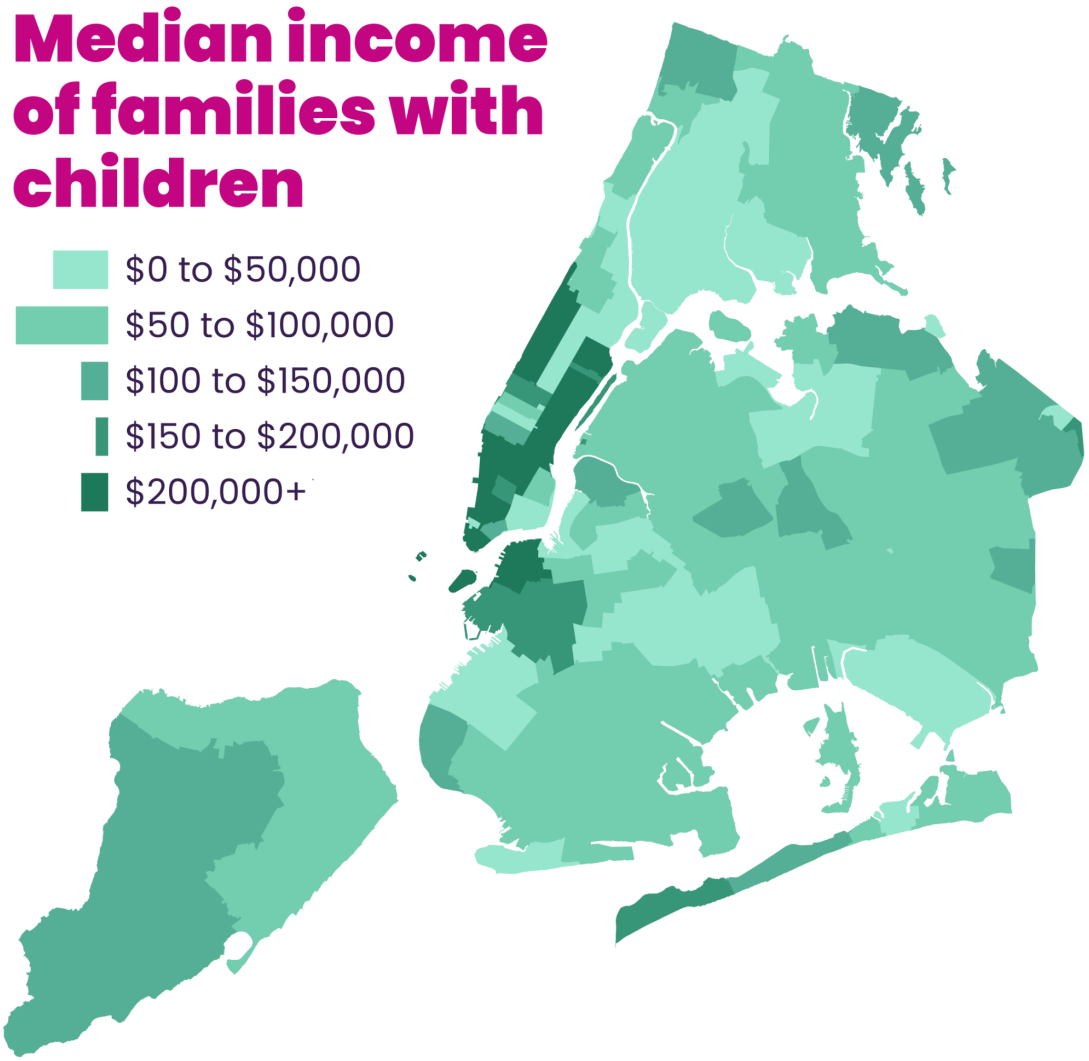

Figure 12: Median income of Families with Children in NYC. Source: Citizens' Committee for Children of New York

Due to its limited scope, the study presents some limitations that should be taken into account, especially in light of equity considerations made before. Particularly, we have yet to be able to provide an in-depth analysis of the distribution of priority schools across different income quintiles or different racial and ethnic groups which would be an essential way of completing our study. To compensate for this gap and, as a way of refining our priority score, we reproduce, together with the NYC-wide priority list, five borough-based priority lists that present the schools that scored highest per borough as a tool for policymakers to target evenly across different areas

and demographics of New York City.[81] For each borough, we selected a number of schools proportional to the borough's population (and number of schools). The borough-based priority schools are visible in Figure 13 and can be explored in more detail in this online interactive map, and the details can be found in this spreadsheet.

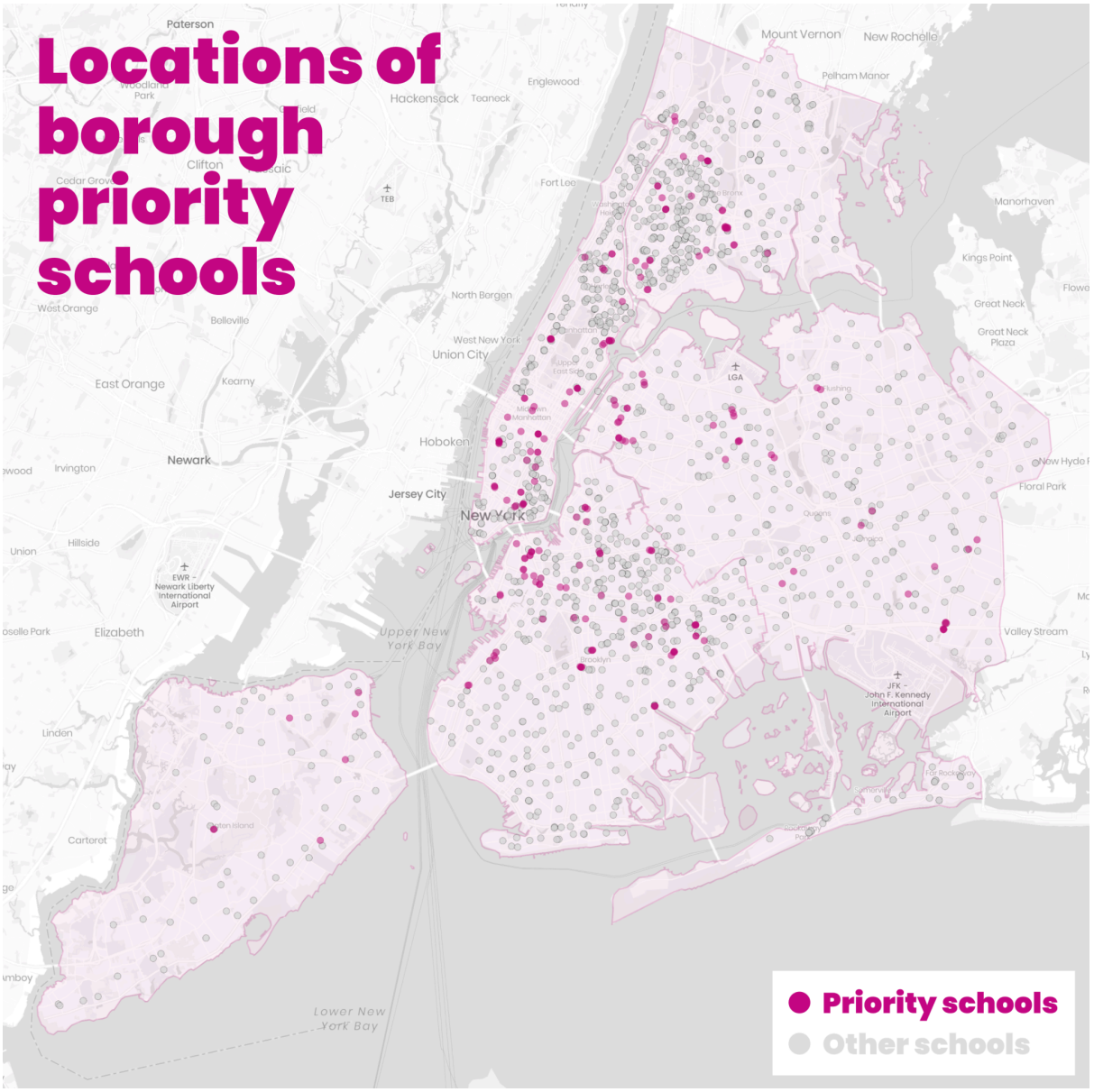

Figure 13: Locations of priority schools per borough in NYC.

[81] Please note, due to time limitations, these five additional lists have not been manually checked for existing interventions, potential school closures or potential infeasibility due to proximity to fire departments or similar.

Appendix 1: School Streets feasibility analysis

Step 1

For all 1709 schools in NYC, we did geographical lookups on GIS of the following characteristics:

- Nearest road width
- Crow-flies distance to the nearest main road
- Number of bus stops within 100m
- Number of POIs within 100m judged to be plausibly relevant to School Street feasibility or to involve constant essential traffic[82]

Relevant POIs have been identified doing manual checks of those included in the POIs dataset (see section Datasets Used). Given the unclear definition in the dataset, we only included those subcategories that were of clear definition and relevance to the study. Specifically, we selected, for the variable FACI_DOM we included all values 1-7, and of those, all those whose variable FACI_T had value 3; 5-10. The sites of interest because of potential high demand destinations included (FACI_DOM; FACI_T): (1-7; 3) community, museums, theaters and cinemas, art and day centers; (1-7; 5) care centers, health facilities and shelters; (1, 3, 4, 5; 7) commercial buildings including malls, markets, hotels, restaurants and cafes; (2, 3, 4, 5; 7) and other industrial facilities including waste centers and navy buildings; (1-5; 8) government offices, civic courts, post offices; (7;8) DSNY garages; (1-7;9) churches and faith centers; (1-7; 10) hospitals and medical

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centers. Transport facilities (1-7;6) included: bus depots and terminals, transit hubs, ferry landings, subway yards, airport infrastructures, heliports, marina and yacht clubs, piers, and bush terminals.

Step 2

We used the above geographic characteristics to stratify schools into a three-level 'School Street difficulty score'. The formula was developed on the basis of Possible's previous study on School Streets in London and readapted to NYC available datasets. The formula is as follows. Each school starts with 0 points

- +2 points if nearest road is more than 30ft wide (max +2 points)
- +1 point if another road more than 30ft wide is within 100mt (max +1 point)
- +1 point for number of bus stops within 100mt, capped at 3 points (max +3 points)
- +1 point for any other point of interest within 100mt that may be relevant to school street feasibility or that may involve constant essential traffic (max +2 points)

The distribution of schools obtained is as follows:

Value	Count	Percent
0	136	7.96%
1	391	22.88%
2	670	39.20%
3	318	18.61%
4	121	7.08%
5	52	3.04%

6	16	0.94%
7	5	0.29%

We divided the schools in three groups on the basis of their difficulty score as: Group 1 - Low difficulty score (0 points); Group 2 - mid difficulty score (1-2 points); Group 3 - high difficulty score (3-8 points).

The distribution of categories is:

- 136 schools with low difficulty score (7.96%) = group one
- 1,061 schools with mid difficulty score (62.08%) = group two
- 512 schools with high difficulty score (29.96%) = group three

Step 3

We took a random sample of 10% schools with each of the three groups found above (14 in group 1 - low diff; 106 in Group 2 - mid diff; 52 in Group 3 - high diff = 172 schools). We firstly considered if they were already part of a School Street program. We found that only 3 were already School Streets, 11 near an open street.

We manually looked up on Google Street View the random sample of schools to make an ad-hoc judgment as to School Street feasibility. In order to enhance our analytical ability compared to the synthetic geographical checks, we considered feasibility also in terms of other elements difficult to measure through GIS. Using the negative and positive criteria below we categorized the schools in the random sample as 'unlikely to be possible, 'may be possible', or 'likely to be possible'.

Negative (decreases feasibility)

- Proximity to main street (more than X lanes)
- Proximity to truck or bus routes

- Street extremely steep
- Next to a key POI
- Next to police or fire department

Positive (Increases feasibility)

- Multiple schools on the block
- Proximity to a park

The results are shown in Table 2, Rows 1-3. The Table shows the resulting distribution of the school street feasibility categories (manual looks up) according to the difficulty score (synthetic model).

Step 4

In this step we wanted to focus on the % of schools' feasibility scores across all groups.

To do so, we multiplied the total number of schools with each difficulty score with the probabilities computed in Step 3, to estimate the proportion of schools in each feasibility category. We then summed across the different difficulty scores to estimate the total proportion of all schools in each feasibility category. The results are shown in Table 2, Row 4.

Table 2: Distribution of School Street feasibility scores

Difficulty	Likely feasible	May be feasible	Unlikely feasible
Group 1 - Low	7.1%	78.6%	14.3%
Group 2 - Med	16.0%	45.3%	38.7%
Group 3 - High	11.5%	55.8%	32.7%
% across all schools	14.0%	51.1%	34.9%

This first analysis showed that over half of schools (65%) are considered feasible or may be feasible, whilst 35% score as unlikely feasible.

We also noticed a quite substantial difference between the results of the numerical and manual checks in terms of different understandings of feasibility.

This difference is likely due to the following reasons:

- The difficulty score did not account for truck routes (whilst manual lookups did)
- The POI used in the difficulty score did not identify all police and fire departments which were instead considered in the manual checks
- The difficulty score did not account for 'political feasibility', e.g. proximity to an existing open street or park, or another school
- The different sample size across the three groups

To refine the scoring and deliver policy-relevant outcomes, we defined a second score, a priority score.

Appendix 2: School Streets priority analysis

The feasibility score showed that most schools in NYC are likely or mostly feasible to be able to receive a School Street, while 33% of schools being considered both highly difficult and unlikely feasible in both scoring systems.

We therefore generated a second score, a priority score, where we considered which schools should be in the priority list for receiving a School Street.

The score assigned took into account of:

- number of crashes within 200m of the school
- number of other schools within 100m of the school
- if the width of the nearest road is less than or equal to 30m

The first two variables were normalized and the third variable was binarized. Because we believe the number of traffic crashes is the most important variable, we gave it a weight factor 2 whilst the rest had a weight factor 1. The lowest quintile scored up to 2.0969, the last between 4.8959 and 17.7473.

We then compared the 200 schools that scored highest (all in the fifth quintile) with the ones already considered as part of the 'Safe Street program' and the 'School Street program'. We found that out of the first 200 schools in the priority list, 67 were already included in the Safe Street program, and 9 used to be Open Streets.

Finally, we proceeded with manual lookups of 200 of the high priority schools and considered for each of them feasibility and priority.

When manually considering again feasibility in manual checks for feasibility (Values between 1 – low to 3 – high), 68.5% schools out of the 200 in the fifth quintile were highly feasible, and 77% were either feasible or highly feasible.

Table 3: Feasibility scores for top 200 school streets

Value	Count	Percent
1	46	23.00%
2	17	8.50%
3	137	68.50%

When considering the feasibility of the top 200 schools (only geographical, see Step 2 Appendix 1), we found that 55.5% of those were in the low to mid difficulty score (score 0-2).

Table 4: Feasibility scores for top 200 school streets

Value	Count	Percent
0	12	6.00%
1	42	21.00%
2	57	28.50%
3	47	23.50%
4	26	13.00%
5	11	5.50%
6	3	1.50%
7	2	1.00%

Appendix 3: Datasets

To perform our analysis, we used the following datasets:

- To determine the locations of the schools the School Point Locations datasets (version updated the 24th of April 2019) 2019 provided by the NYC Department of Education.
- To determine the width of nearest roads we used the NYC Street Centerline dataset (version updated on the 12th of October 2022) provided by the Office of Technology and Innovation.
- The location of the bus stops has been determined using the datapoints for 'bus stops shelters' (version updated the 7th of September 2022) provided by the NYC Department of Transportation.
- Points of Interest have been identified using the Points of Interest dataset (version updated on the 12th of October 2022) provided by the Office of Technology and Innovation. We considered only those POIs classified (according to the variable FACILITY_T) as:
    - Cultural Facility
    - Social Services
    - Transportation Facility
    - Commercial
    - Government Facility (non-public safety)
    - Religious Institution
    - Health Services
- Motor vehicle crashes near schools have been identified using the Motor Vehicle Collisions - Crashes dataset (version updated on the 12th of December 2022) provided by the Police Department (NYPD).
- Existing Slow School Zones have been identified utilizing the list published by the DOT.

Datasets Limitations

The school dataset has been last updated in 2019, meaning that some schools are currently closed; moreover, the dataset has some repeated values we have not been able to remove. For example, when performing manual checks for priority, we found that 15 out of the 200 schools in the list were closed. When performing manual checks for feasibility, we found that 6 out of the 172 schools were repeated in the dataset. We removed the closed schools from the priority list, but we have not been able to exclude all the repeated values from the feasibility analysis.

The selection of POIs is imprecise given the unclear classification in the datasets.