



20mph Research Study

Process and Impact Evaluation
Technical Report

November 2018

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Supporting Documents

Headline Report (with Executive Summary)

Technical Appendices:

Rapid Evidence Review
Methodology Description Report
Case Study Description Report
Residents' and drivers' questionnaires - Logistic regression analysis
Analysis of GPS journey speeds in case study areas
Analysis of spot speed data in case study areas
Analysis of safety outcomes in case study areas

1. Introduction

1.1. Introduction

In July 2014, Atkins, AECOM and Professor Mike Maher of University College London, were commissioned by the Department for Transport to evaluate the effectiveness of 20mph signed only speed limits, based on twelve case study schemes in England and various comparator areas with a 30mph limit in place.

The purpose of the research is to:

- strengthen the evidence base regarding the effectiveness of 20mph limits;
- inform future policy development on 20mph speeds and limits at a national and local level;
- identify lessons learned regarding the implementation and monitoring of 20mph signed only speed limits, to guide local authorities considering introducing 20mph limits.

The study comprises a **process evaluation** which looks at why and how case study schemes were delivered, and an **impact evaluation** which examines the effectiveness of schemes in delivering intended changes in attitudes and behaviour of residents and other road users.

The overall aims of the research are:

1. Evaluate the effectiveness of 20mph speed limits in terms of the range of outcomes and impacts;
2. Examine the perceptions and attitudes of different user groups towards 20mph speed limits; and
3. Evaluate the processes and factors which contribute to the effectiveness of 20mph speed limit schemes.

This report presents the detailed findings and conclusions of the evaluation based on a broad range of quantitative and qualitative data sources. Further detail on the methodology, data sources and analysis undertaken is provided in **Supporting Technical Appendices**. A separate **Headline Report** summarises the key messages.

1.2. 20mph limits and zones

There are two distinct types of 20mph schemes:

- 20mph limits – indicated by speed limit signs only; and
- 20mph zones – designed to be ‘self-enforcing’ through the introduction of traffic calming measures (e.g. speed humps and chicanes).

This study is primarily interested in ‘new 20mph limits (signed only)’, introduced in areas previously signed as 30mph and without any pre-existing traffic calming in place. ‘New’ refers to the roads where the speed limit was reduced from 30mph to 20mph following implementation of the main area-wide scheme.

In some case study areas, the limits were introduced on roads with existing traffic calming, enabling a comparison of outcomes associated with the two scheme types – ‘new 20mph limit (signed only)’ and ‘new 20mph limit (existing calming)’ – to be compared.

In addition, some of the case study schemes had small pockets of existing 20mph limits and zones (introduced prior to main area-wide case study scheme), also enabling some comparison of outcomes to be made across different types of 20mph schemes – ‘new 20mph limits’ and ‘older 20mph limits’.

For analysis purposes, the roads in and around the case study areas have been categorised as follows:

Table 1. Categorisation of case study roads for analysis

Name	Traffic Calming	Before Limit	After Limit
New 20mph limit (signed only) – Main focus of this study	No/minimal physical traffic calming	30mph	20mph
New 20mph limit (existing calming)	Substantial pre-existing traffic calming	30mph	20mph
Older 20mph limit (signed only)	No/minimal physical traffic calming	20mph	20mph
Older 20mph limit (with calming)	Substantial pre-existing traffic calming, often combined with 20mph zone sign	20mph	20mph
30mph (no change)	No/minimal physical traffic calming	30mph	30mph
40mph (no change)	No/minimal physical traffic calming	40mph	40mph

1.3. Strengthening existing research

Much of the evidence on the effectiveness of 20mph limits relates to zones implemented in the 1990s / early 2000s (e.g. Webster, D and Mackie, A, 1996; Webster, D and Layfield, R, 2003; Allott and Lomax, 2001). The schemes examined typically covered a few kilometres of road length, where average vehicle speeds were well above 20mph before the speed limit was taken down to 20mph (referred to as before speed), and were implemented to address location-specific safety issues.

These schemes are very different to the 20mph (signed only) limits considered in this study, which are larger area-wide initiatives¹, with lower before speeds (closer to 20mph), and have typically been introduced to deliver an area-wide change rather than address location-specific issues. Existing evidence on these types of 20mph limits (e.g. Wernsperger and Sammer, 1995; Burns, 2001; Fischer, 2010; Atkins, 2010; Pilkington, et. al, 2018) is more limited and tends to be based on data covering short periods following scheme implementation, with variable accounting for background trends in speed, safety and mode use which are unrelated to the change in speed limit.

This study seeks to strengthen the evidence base regarding the effectiveness of 20mph (signed only) limits. Most published research to date has focused on evaluating individual schemes (e.g. Graz in Austria, Portsmouth, Bristol). In contrast, this study combines evidence from 12 case study schemes comprising over 700kms of new 20mph (signed only) limits and uses data from comparable locations where 20mph limits have not been introduced to control for background trends. It brings together a wider range of qualitative and quantitative evidence sources, to provide robust evidence on observed and perceived outcomes following the implementation of 20mph (signed only) limits.

The primary focus is on changes relating to perceptions, driving behaviour, and vehicle speed, along with an early assessment of change in collisions and casualties (between 17 and 44 months post implementation, depending on the case study in question). Detailed statistical analysis has been undertaken to estimate the likely contribution of 20mph limit implementation to observed changes in vehicle speed and road safety.

Evidence on change in mode use is based on self-reported change identified through questionnaire surveys and an investigation of associated factors.

This study has not sought to collect primary data on wider impacts relating to the local economy, the environment (greenhouse gas emissions, air quality, noise) and health. Existing empirical evidence is weak, inconclusive, or complex (particularly regarding air quality) and there remains an evidence gap regarding the impact of 20mph limits on these areas.

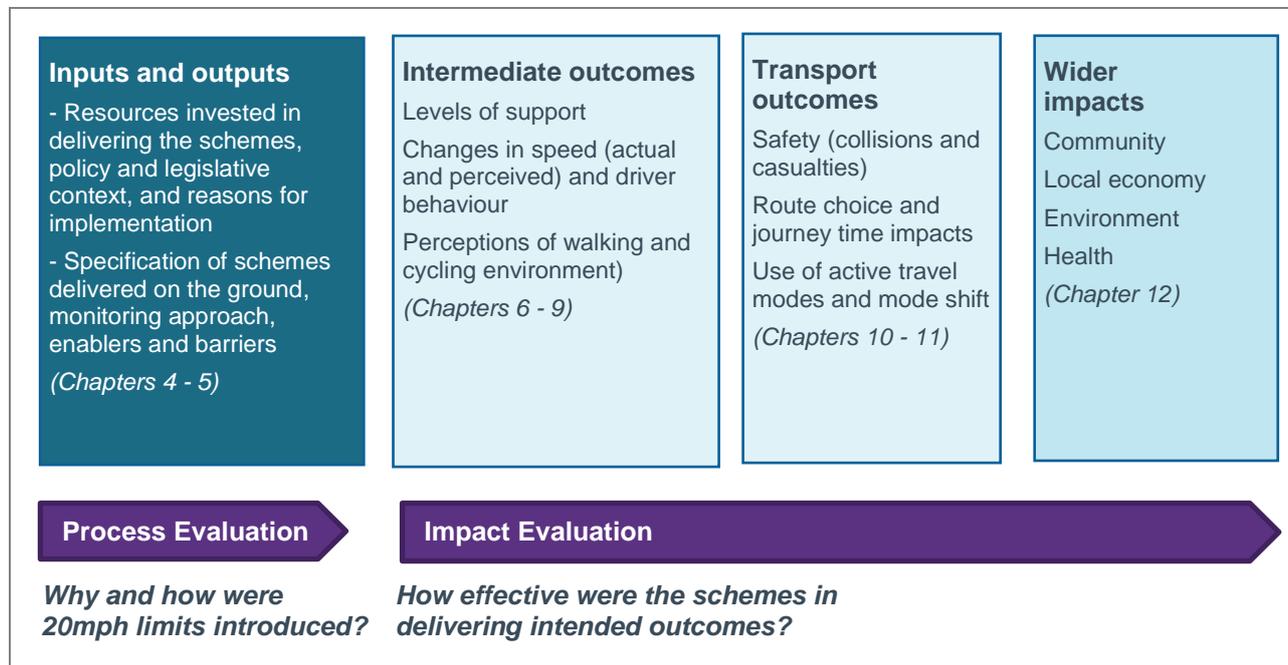
Reference is made to existing evidence throughout this report, to demonstrate how the new case study findings corroborate or challenge previous research.

¹ The two smallest case study areas include 6kms and 14kms of new 20mph limit, Other case study areas are much bigger.

1.4. Structure of report

This report is structured around an input-output-outcome/impact model (called a **theory of change model**) which describes the assumed process by which 20mph speed limits are intended to deliver change, as illustrated in Figure 1.

Figure 1. Structure of report, based on input-output-outcome/impact theory of change model



Further information on the theory of change approach, and how this has informed the data collection and analysis elements of this study is provided in Chapter 3.

An assessment of the extent to which the evidence supports the assumptions set out in theory of change model is made at relevant points in the report.

Theory of Change Hypothesis: Xxxxx.

- ✓ Evidence broadly supports above hypothesis.
- ? Evidence partially supports above hypothesis or is unclear.
- ✗ Evidence broadly rejects above hypothesis.

2. Policy and legislative context

2.1. Key legislation

Before 1991, local authorities were not permitted to set speed limits below 30mph (according to the Road Traffic Regulation Act 1984). Since then, amendments to the Act and Department for Transport Circulars (providing advice to transport professionals and local councils) have allowed reduced speed limits to be applied in appropriate circumstances. The first of these was the DfT's '**Circular Roads 4/90**' (1990), which required highway authorities to apply for consent from the Secretary of State to introduce a 20mph zone as part of a physically calmed 'zone' or on short sections of road with a proven crash record.

In 1999, the Road Traffic Regulation Act 1984 was amended to allow local authorities to designate 20mph speed limits without the prior approval of the Secretary of State. Two distinct types of 20mph speed limit were made possible:

- 20mph limits indicated by speed limit (and repeater) signs only (signed only limits); and
- 20mph zones, designed to be 'self-enforcing' through the introduction of traffic calming measures (e.g. speed humps, chicanes).

Signed only limits were initially applied to individual or small numbers of roads, but increasingly covered larger areas, leading to the introduction of schemes in Portsmouth (2007/08), Bristol (2010), and York (2010), covering larger urban areas.

In 2013, DfT provided revised guidelines on the setting of local speed limits (**DfT Circular 01/2013**). The guidance says that authorities can set 20mph speed limits in areas where local needs and conditions suggest the current speed limit is too high. The guidance encourages traffic authorities to consider introducing more 20 mph limits and zones over time. It states that where there is expected to be a positive effect on road safety and a generally favourable reception from local residents, traffic authorities are able to use their powers to introduce 20mph speed limits or zones on:

- major streets where there are, or could be, significant numbers of journeys on foot, and/or where cycle movements are an important consideration, and this outweighs the disadvantage of longer journey times for motorised traffic; and
- residential streets, where the streets are being used by people on foot and on bicycles, there is community support, and the characteristics of the street are suitable.

It goes on to state (para 85) that: *"Successful 20 mph zones and 20 mph speed limits are generally self-enforcing, i.e. the existing conditions of the road together with measures such as traffic calming [in the case of zones] or signing, publicity and information as part of the scheme, lead to a mean traffic speed compliant with the speed limit. To achieve compliance there should be no expectation on the police to provide additional enforcement beyond their routine activity, unless this has been explicitly agreed."*

The Circular presents research into signed-only 20mph speed limits, suggesting they generally result in slight traffic speed reductions, and are therefore most appropriate for areas where vehicle speeds are already low (e.g. on roads that are very narrow due to engineering or on-street parking). It is noted that if the mean speed is already at or below 24 mph on a road, introducing a 20mph speed limit through signage alone is likely to lead to general compliance with the new speed limit.

The guidance notes that in a few of the roads in the Portsmouth project had average speeds of 25 mph or more and that on these roads the average speed reduction was greater than the reduction on slower roads in the scheme, though insufficient to make the resulting speeds generally compliant with the new 20 mph limits.

In contrast to the previous Local Speed Limit Circular (2006), Circular 01/2013 recommends that local authorities consider 20mph speed limits over larger areas comprising a number of roads where mean speeds at or below 24mph are already achieved over a number of roads.

The Circular also allows the application of 'hybrid' schemes combining 20mph speed limits with 20mph zones; and 20mph speed limits that only apply at certain times of day and are indicated by variable message signs (e.g. outside a school).

Traffic authorities are asked to have regard to this guidance, although it is not mandatory. Traffic authorities retain the responsibility for determining speed limits on their roads.

Network management duty – The Traffic Management Act 2004 places a duty on an authority to secure the expeditious movement of traffic (encompassing all modes, including pedestrians and cyclists) on their network. The duty is essentially about balancing the needs of all road users, and also operates alongside other duties, including those in the area of road safety².

Public health responsibilities – Under the Health and Social Care Act 2012, local authorities took on a number of public health responsibilities in April 2013. This is of relevance, given the strong links between road safety and public health.

Equality responsibilities – The Equality Act 2010 requires local authorities (amongst others) to provide equality of opportunity between people who share a protected characteristic and those who do not. Protected characteristics are: age, race, sex, disability, pregnancy/maternity, religion or belief, gender reassignment, marriage/civil partnership, sexual orientation. Of particular relevance to 20mph limits are children, older persons, those with disabilities, and women, who are more likely to be dependent on walking rather than car use or seen as more vulnerable road users.

Well-being responsibilities – In Wales, the Well-being of Future Generations (Wales) Act 2015 requires public bodies to think more about the long term, work better with people and communities and each other, look to prevent problems and take a more joined-up approach.

2.2. Signing requirements

The DfT Circular, Setting Local Speed Limits (01/2013), states that when introducing a new speed limit, authorities have a duty to put up signage in accordance with the **Traffic Signs Regulations and General Directions, TSRGD (2002); updated in 2011 and 2016**.

Until September 2016, the following regulations applied:

- Terminal signs - 60cm diameter terminal signs were required at the start and end of the limit, with signs placed on either side of the carriageway to form a gateway, and yellow backing boards recommended to provide additional emphasis.
- Repeater signs – The 2002 guidance required 30cm repeater signs to be placed every 100m within the limit, to remind drivers. In the 2011 update to the guidance, this requirement was relaxed to at least one repeater sign with no repeaters required on roads shorter than 200m. In addition, the DfT Circular (01/2013) states that all English authorities are authorised to place a roundel marking as a repeater sign. This removes the need for an upright sign and can help reduce unnecessary clutter.

The regulations were updated by the DfT in September 2016. Under the new legislation, local authorities now have more flexibility to make their own decisions on how many speed limit signs are needed to inform drivers about applicable limits. However, signage must still comply with the Regulations or be specially authorised, be sufficient to encourage compliance, and give reasonable grounds for a case to be upheld in court if a driver were caught speeding.

Three key changes were made of relevance to 20mph signs:

- A minimum of one terminal sign (rather than two) is now required in each direction, located on either the driver's near-side or off-side, as close as possible to the start and end of the 20mph limit.
- The requirement to place repeater signs has been removed.
- Only 20mph limit terminal signs on trunk or principal roads must be directly illuminated at night.

² DfT (2004) Traffic Management Act 2004 Network Management Duty Guidance.

The above changes were made to reduce environmental impact and sign clutter.

Figure 2. Signing requirements for 20mph (signed only) limits

Terminal sign on the entrance to the 20mph limit (60cm diameter) - left, Repeater sign within 20mph limit area (30cm diameter) - right



Roundel on carriageway (as an alternative to repeater signs)



Source: Google Street View Image

It should be noted, however, that all the case study schemes were implemented before the 2016 changes to the regulations.

2.3. Police speed enforcement policy

Police guidelines on speed enforcement are set out in ACPO³ Speed Enforcement Policy Guidelines 2011-2015: Joining Forces for Safer Roads⁴.

General enforcement guidance – The guidelines state that police policy is to provide speed enforcement where:

- a mandatory limit has been introduced;
- there is a need for compliance;
- the speed necessary is clear to all drivers using the road; and
- where some decide to ignore the limit and compliance will result in road safety benefits.

The guidelines also state that *“Enforcement is mainly reactive and should not be seen as a preventative measure to achieve vehicle speeds. Prevention has to rely on public support and compliance by the majority and enforcement of the minority who ignore the law”*.

In undertaking enforcement activity, the police are required to be guided by the principles of proportionality, targeting of enforcement activity, consistency of approach, and transparency.

³ The Association of Chief Police Officers (ACPO) was replaced in 2015 by a new body, the National Police Chiefs' Council.

⁴ The latest version can be found at: <http://library.college.police.uk/docs/appref/ACPO-Speed-Enforcement-Guidance.pdf>.

The document further states that *“Excessively enforcing speed limits that are not clear, that feel like roads with higher limits than in fact they are, and tend to confuse rather than help those drivers that wish to comply, may well lose that public support and confidence the police service needs”*.

Specific 20mph guidance – The guidelines state that 20mph speed limits should *“be part of a package of other measures to manage speed which includes engineering, visible interventions and landscaping standards that respect the needs of all road users and raise the drivers’ awareness of their environment, together with education, driver information, training and publicity”* ... *“It is for local authorities to appropriately sign and if necessary engineer a limit, leaving the police to target the deliberate and persistent offenders, together achieving the very highest level of compliance and safety for other road users”*.

The guidance was updated in 2013 to further clarify the police’s position on enforcement of 20mph limits, as follows:

“Enforcement will be considered in all clearly posted limits, given other priorities, and this will be by:

- 1. Targeted enforcement where there is deliberate offending/disregarding and the limits are clear;*
- 2. Where limits are not clear (that is they don’t feel like / look like the limit or are on in appropriate roads), they will not be routinely enforced (routinely means regular planned attendance where there isn’t intelligence of deliberate offending), only targeted where there is intelligence of obvious deliberate disregard.”*

It goes on to state that *“it is very important that the service doesn’t intentionally give the impression that the police will not enforce the law. As with all crime speed limits the police will use their discretion when to enforce and how that enforcement might take place”*.

Police and Crime Commissioners are now responsible for setting strategic policing priorities for each police force, which will include appropriate enforcement within local policing plans. The approach of neighbourhood policing teams in every community is built around ensuring that local crime and disorder issues and concerns are identified, so that a police force delivers an appropriate policing response. This applies to enforcement of 20mph limits as to any other area of policing.

Enforcement thresholds – The following guidelines have been formulated to provide a proportionate level of prosecution for 20mph speed limit offenders (but do not replace the ability of police officers to use their discretion):

- 24-31mph – Education (i.e. a speed awareness course), if appropriate; otherwise, a fixed penalty notice.
- 31-35mph – Fixed penalty notice.
- >35mph – Summons.

2.4. Roll-out of 20mph (signed only) limits

Over the last few years, a large and growing number of authorities have implemented small-scale and area-wide 20mph limits.

- A survey by Brake in June 2015⁵ estimated that 21% of councils in Great Britain had already introduced widespread signed-only 20mph limits or had made a commitment to do so; and 36% had some limited trials for area-wide 20mph limits in place. However, 43% had no widespread 20mph limits and no plans to introduce them, but might have had some 20mph limits covering a limited area only, such as outside schools.
- In 2016, the Department for Transport asked all local authorities to provide details of the length of road with a permanent 20mph limit (signed-only or with physical calming) in their local authority area. Across

⁵ Brake (2015); *GO20 Towards changing the default urban speed limit to 20mph. Information was requested from all 206 local traffic authorities in Great Britain, of which 122 replied.*

the 39 authorities responding, the length of 20mph road had increased from 1,474kms in 2010 to 4,787kms in 2015, an increase of 225%⁶.

- A review of 20mph limit implementation in London, by 20s Plenty in September 2016⁷, found that:
 - nine inner London boroughs have 20mph limits on all/almost all of their roads (Islington, Camden, City of London, Southwark, Lambeth, Lewisham, Tower Hamlets, Hackney and Haringey);
 - a further five outer London boroughs have a policy to adopt 20mph on residential roads, and a limited number of other roads (e.g. in town centres); and
 - TfL has trialled 20mph on the Transport for London Road Network (TLRN) covering some of London's busiest roads⁸.
- 20s Plenty's website⁹ states that more than half of the largest 40 urban authorities in the UK have a policy of setting 20mph as the default for their streets; and claim that "25% of the UK population live in authorities with a 20mph policy for most urban residential roads".

2.5. Advocacy for wider roll-out of 20mph limits

A number of organisations have called for the wider roll-out of 20mph limits:

- Most recently, the International Transport Forum at the OECD published its report on Speed and Crash Risk (April 2018). This calls for 30km/h (~20mph) speed limits in built up areas where there is a mix of vulnerable road users and motor vehicles. It advocates a 'safe system' of road design and speed limits that can accommodate unavoidable human error without leading to death or serious injury. Research shows that most unprotected road users survive if hit by a vehicle at up to only 30 km/h; and that the risk of being killed is almost five times higher in collisions between a car and a pedestrian at 50 km/h compared to the same type of collisions at 30 km/h (Kröyer et al., 2014). Considering this, there is a strong recommendation to reduce speed in urban areas.

It goes on to state that in many countries, there is a trend into generalising 30 km/h limits in city centres and residential areas. Some countries are considering adopting a 30 km/h default speed limit, with higher limits on main arterial roads. In the Netherlands, following a full review of road classification, 70% of road in urban areas are limited to 30 km/h. Most countries report undertaking regularly communication campaigns to promote lower speeds and better compliance with the speed limits.

- The World Health Organisation (WHO, 2017) recommends 20mph limits as best practice in residential areas. As part of the 4th UN Global Road Safety Week in 2017, WHO focussed on vehicle speed as the major factor in most collisions. Its document on speed management states 'a safe speed on roads with possible conflicts between cars and pedestrians, cyclists or other vulnerable road users is 30kmh/20mph'.
- The Scottish Parliament is considering a Member's Bill to replace the current 30mph national speed limit for street-lit roads with a 20mph default limit¹⁰. A vote will take place on whether the default speed limit in street-lit areas should be lowered from 30 to 20mph after a Green politician's proposal received cross party backing from MSPs. Consultation on the proposed bill attracted 1354 responses, and showed 62% support amongst members of the public, and 81% support amongst organisations¹¹.

⁶ The local authorities with the greatest coverage of 20mph limits were: Sefton (800kms in 2015); Wigan (750kms in 2015); Nottingham (580kms in 2015); Southwark (336kms in 2015); Camden (258kms in 2015).

⁷ 20mph Speed Limits in London, 20s Plenty (Sep 2016).

https://d3n8a8pro7vhm.cloudfront.net/20splentyforus/pages/184/attachments/original/1476092151/London_20mph-Summary-22Sep16.pdf?1476092151

⁸ The recent Mayor's Transport Strategy (2018) states that 20mph limits will continue to be implemented on London's streets, with 20mph considered as part of all new schemes on the Transport for London Road Network. TfL will look to implement 20mph limits on its streets in central London as a priority, with implementation being widened across inner and outer London as soon as is practicably possible. TfL will work with the boroughs to implement lower speed limits on their streets, prioritising designs that are self-enforcing and that do not place an additional burden on policing partners.

⁹ http://www.20splenty.org/20mph_places. Accessed: May 2018.

¹⁰ Proposed Restricted Roads (20mph Limit) (Scotland) Bill. Consultation by Mark Ruskell MSP, Member for Mid Scotland and Fife. May 2017.

¹¹ Proposed Restricted Roads (20mph Limit) (Scotland) Bill. Mark Ruskell MSP. Summary of Consultation Responses. Nov 2017.

- The National Institute for Health and Care Excellence published guidance in 2010 (NICE, 2010) on unintentional injuries on the road: interventions for under 15s. This recommended that local authorities implement city or town-wide 20 mph limits and zones on appropriate roads, using factors such as traffic volume, speed and function to determine which roads are appropriate.

Further guidance on physical activity: walking and cycling (NICE, 2012) notes the potential role of 20mph zones in helping to restrict vehicle speed as part of a strategy to promote walking and cycling (NICE, 2012).

In 2017, guidance on tackling air pollution (NICE, 2017) advised authorities to consider promoting a smooth driving style by introducing “20 mph limits without physical measures to reduce speeds in urban areas where average speeds are already low (below around 24 mph), to avoid unnecessary accelerations and decelerations”.

- The RAC Foundation (motoring research organisation) supports “the introduction of 20mph limits wherever there is an over-riding road safety case”, but states that “the mobility and productivity needs of road users must also be taken into account”¹².
- PACTS (Parliamentary Advisory Council for Transport Safety) supports lower speed limits in urban areas but stresses that it is important that these deliver real benefits and not the illusion of change^{13,14}.

A number of lobby and interest groups also exist to promote the implementation of 20mph limits; others promote a more cautious approach or are opposed to 20mph limits and zones.

¹² RAC Report on Motoring 2017.

¹³ Response by PACTS to consultation by Mark Ruskell MSP, Green Party, on a Members Bill to change the default speed limit in built up areas across Scotland from 30mph to 20mph (August 2017).

¹⁴ Cycling and Walking Investment Strategy (CWIS) safety review – PACTS response (May 2018).

3. Methodology

3.1. Introduction

This chapter sets out the overall approach to the evaluation. It describes:

- the use of case study schemes as a key source of evidence for the research, supplemented by a Rapid Evidence Review, and interviews with national stakeholders;
- the evaluation framework used to guide the research, including the theory of change model applied to the case study schemes, process and impact evaluation elements, and the use of a contribution analysis approach; and
- the data sources which form the evidence base for the research, and their role in addressing the research questions.

3.2. Case study approach

The overall approach is primarily based on evidence from twelve case studies, comprising a variety of area types (city/metropolitan to small town locations), different road types (e.g. in terms of geometry, land-use and on-street parking), and scale (small-scale and area-wide). These 'core schemes' inform both the process and impact evaluation elements of the research.

A further three case studies cover local authorities that have chosen not to implement a 20mph limit scheme ('no schemes'), and are used to understand the barriers and considerations behind such decisions.

In addition, three comparator areas are used to identify background trends in speeds on 30mph roads with similar characteristics to the 'core schemes'; and regional-based data is used to identify background trends in collisions and casualties on similar 30mph roads. See Sections 3.3, 3.4.7 and 3.4.8 for more detail on the role and selection of these comparator areas.

3.2.1. Case study selection process

Case study schemes were selected based on the following criteria:

- willingness to participate in the research;
- scheme implemented less than three years before the start of the study (in the majority);
- no / minimal presence of zones within the scheme area;
- availability and quality of 'before data' (speed, flow, etc.) and availability or commitment to collect consistent 'after data' (speed, flow, etc.);
- representative of a range of geographical locations, authority types, scheme locations and contexts.

3.2.2. Core schemes

The twelve core schemes cover nine authorities (three metropolitan, two county and four urban unitary), with three authorities providing two case study schemes (either two separate schemes or two contrasting areas of a large area-wide scheme).

The schemes have been categorised as:

- either **predominantly residential areas (including schools)**, or **city centre and adjacent residential areas**; and
- **small scale standalone schemes** comprising a small cluster of self-contained residential roads surrounded by conventional 30mph roads, or **area-wide** covering a larger proportion of the town or city.

This gives the following breakdown:

- predominantly residential and schools – small scale standalone (R-SM) **(two schemes)**;
- predominantly residential and schools – area-wide (R-AW) **(eight schemes)**;
- city or town centre and adjacent residential areas (TC-AW) **(two schemes)**.

Table 2. Summary of case study schemes (twelve core schemes)

Case Study ID	Typology	Area-wide / Standalone	Geography	Authority Type	Implementation Date
Walsall (Rushall) (R-SM1)	Predominantly residential and schools	Small scale standalone scheme	Large city Midlands	Metropolitan unitary authority A	Mar 2014
Winchester (Stanmore) (R-SM2)	Predominantly residential and schools	Small scale standalone scheme	Medium town / city South of England	Large county authority A	Jul 2014
Liverpool (Area7) (R-AW1a)	Predominantly residential and schools (city centre periphery)	Area-wide scheme	Large city North of England	Metropolitan unitary authority B	Apr 2014
Liverpool (Area2) (R-AW1a)	Predominantly residential and schools	Area-wide scheme	Large city North of England	Metropolitan unitary authority B	Jan 2015
Middlesbrough (R-AW2)	Predominantly residential and schools	Area-wide scheme	Large town North of England	Urban unitary authority A	Mar 2012 – Jun 2013
Calderdale (R-AW3)	Predominantly residential and schools	Area-wide scheme	Large urban area North of England	Metropolitan unitary authority C	Jun 2015
Nottingham (Bestwood) (R-AW4)	Predominantly residential and schools	Area-wide scheme	Large city Midlands	Urban unitary authority B	Apr 2014
Brighton (Phase2) (R-AW5)	Predominantly residential and schools	Area-wide scheme	Large town / city South of England	Urban unitary authority C	Jun 2014
R-AW6 Portsmouth	Predominantly residential and schools	Area-wide scheme	Large town / city South of England	Urban unitary authority D	Pre-2010
R-AW7 Chichester	City centre + residential and schools	Area-wide scheme	Small town / city South of England	Large county authority B	Jul 2013
Brighton (Phase1) (TC-AW1)	City centre and adjacent residential areas	Area-wide scheme	Large town / city South of England	Urban unitary authority C	Apr 2013
Winchester City Centre (TC-AW2)	City centre and adjacent residential areas	Small scale standalone scheme	Medium town / city South of England	Large county authority A	Sep 2014

3.2.3. No schemes

The three case studies where schemes have not been implemented for various reasons are summarised below:

Table 3. Summary of ‘no schemes’

Case Study ID	Typology	Area-wide / Standalone	Geography	Authority Type	Implementation Date
No-Scheme1 London Borough	No schemes being considered	-	Large city	London Borough A	Not implemented
No-Scheme2 Metropolitan Borough	Predominantly residential and schools	Small scale standalone scheme	Large city Midlands	Metropolitan unitary authority A	Not implemented
No-Scheme3 County Borough	Predominantly residential and schools	Area-wide scheme	Medium town South of England	Large county authority B	Not implemented

3.2.4. Case study descriptions

A summary of the core case study schemes is provided below and in Appendix B:

Date of implementation – Eleven of the case studies comprise schemes implemented between March 2012 and June 2015. The twelfth scheme was implemented before 2010, allowing longer term impacts to be observed.

Scheme size – The case study schemes have been implemented over a wide range of scales, varying from individual neighbourhoods to area-wide schemes covering large metropolitan cities. The length of new 20mph limit (signed only) varies from 6km in Walsall (Rushall) to 160km in Brighton Phase 2 (one of three phases covering the whole of the city).

Both the small-scale residential schemes were part of a programme of pilot schemes being implemented by the respective authorities to determine the effectiveness of 20mph limits in delivering a range of objectives.

The Liverpool, Middlesbrough, Calderdale, Nottingham, and Brighton case studies are all part of a wider city-based initiative implemented in phases, but are still substantial areas in their own right.

Hours of operation – All schemes operate 24 hours a day, 7 days a week.

Nature of street environment – The case study schemes comprise a mix housing types and ages, carriageway and road widths, and levels of on/off-street parking.

Coverage – The two small-scale residential schemes both comprise a blanket 20mph limit, covering all roads within the scheme area.

The area-wide residential schemes cover most roads within the town / city, but none have a blanket 20mph limit in place. Strategic routes and roads meeting other specific criteria are excluded.

The two city centre schemes both comprise a blanket 20mph limit (including more strategic A and B-class roads with higher traffic flows). Brighton Phase 1 is part of an area-wide scheme which covers the whole of the city of Brighton. Phase 1 covers the core city centre area and the adjacent residential neighbourhoods. Winchester City Centre scheme comprises a blanket 20mph limit across all roads within the historic city wall.

Presence of pre-existing 20mph limits / zones – Almost all of the case studies have some pre-existing 20mph limits or zones in place; often outside schools. In most areas the 20mph zones have been adopted into the 20mph speed limit scheme, with traffic calming measures (such as road humps and chicanes) left in place. However, in Middlesbrough, existing traffic calming measures were removed on two roads following consultation with local residents.

Further information can be found in the Case Study Description Report – Supporting Technical Appendix.

3.3. Evaluation approach

The study approach comprises both process and impact evaluation elements, to fully address the research specification.

The **process evaluation** focuses on scheme delivery, in terms of:

- the rationale for scheme implementation, the objectives, and the resources and processes associated with the development and implementation of schemes (i.e. Inputs);
- the specifications of the schemes (i.e. Outputs); and
- the enablers and barriers which influence the extent to which actual outputs are delivered and match the original specification.

The **impact evaluation** draws on a combination of qualitative and quantitative evidence to monitor direct transport outcomes, such as traffic speeds, flows and casualty rates; as well as the wider impacts relating to environment, health, community, and the local economy. It evaluates the effectiveness of schemes in delivering intended benefits in different contexts.

The evaluation is informed by a **theory of change** (or logic map) which describes the assumed process by which 20mph speed limits are intended to deliver changes in traffic speed and casualty rates, influence travel behaviour and lead to the associated environmental, health, community and economic benefits. The theory of change can be thought of as a set of underlying hypotheses, to be tested through the research, drawing on the available data to determine the extent to which there is evidence to support the intervention logic. It is based on a core input-output-outcome/impact model (which represents the relationship between 20mph speed limit introduction and the change on the ground), along with consideration of enablers and barriers to delivery and the wider context:

- Inputs are resources invested in implementing the schemes;
- Outputs refer to the specification of the schemes implemented on the ground (coverage of roads, signs and roundels, hours of operation, etc.);
- Outcomes are observable changes in perceptions, behaviour and service / network performance, driven by the above outputs;
- Wider impacts refer to the effects which extend beyond the transport sphere (e.g. community, local economy, environment, and health);
- Enablers and barriers are factors which influence the extent to which the actual outputs delivered match the original specifications, in terms of scale, quality, location, timescales; and
- External factors are changes in the wider environment which support or hinder achievement of intended outcomes.

A baseline logic map was produced during the study scoping stage, based on existing published research and interviews with national stakeholders. This mapped the *possible* causal pathways from the implementation of a generic 20mph limit scheme in order to deliver scheme objectives in line with the Department for Transport's Circular 01/2013, and identified evidence gaps.

Feedback on the baseline map, and its applicability to each of the case study typologies, was then sought from local case study stakeholders. Three separate maps were subsequently developed to demonstrate the different causal pathways for the three different scheme types: predominantly residential schemes (small scale); predominantly residential schemes (area-wide); and predominantly city centre schemes (Figures 3-5).

The black text describes stakeholders' understanding of how the schemes were expected to deliver their intended outcomes; while the red text highlights potential negative impacts which are not intended, but which may occur nevertheless. The grey shaded boxes help illustrate the differences between the logic maps.

The logic maps were used to inform the data collection and analysis elements of the study, helping to define questionnaires and topic guides and develop the methodologies for analysing speed and collision/casualty data which addressed the research questions and the requirements of the evaluation.

Comparator analysis – To strengthen the evidence relating to changes in speed and collisions / casualties, data for comparator areas has been used to compare case study trends with background trends on 30mph roads with similar characteristics to the case study areas. This provides a more robust methodology than a simple before and after analysis, and provides evidence on the extent to which case study changes may be attributed to the introduction of 20mph limits. It should be noted that for practical reasons it was only possible to obtain speed data for three comparator areas, each covering a 20km² area. Collision / casualty data is more readily available, enabling a much larger number of comparator areas to be identified covering 8,568km². For context, the case study areas included in the comparator analysis cover a combined area of 110km².

Figure 3. Theory of change – Logic map illustrating intended benefits process for predominantly residential schemes (small scale)

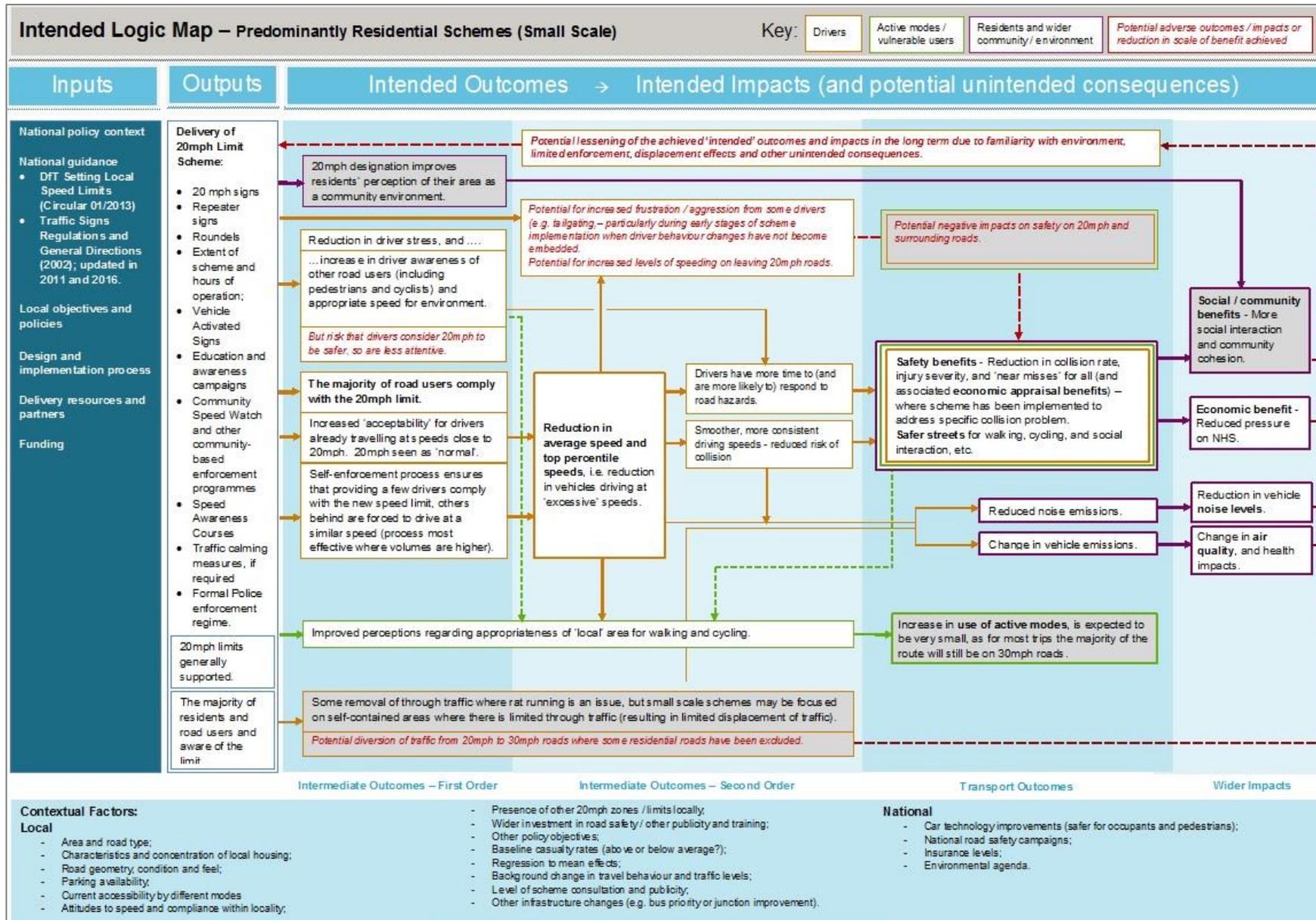


Figure 4. Theory of change – Logic map illustrating intended benefits process for predominantly residential schemes (area wide)

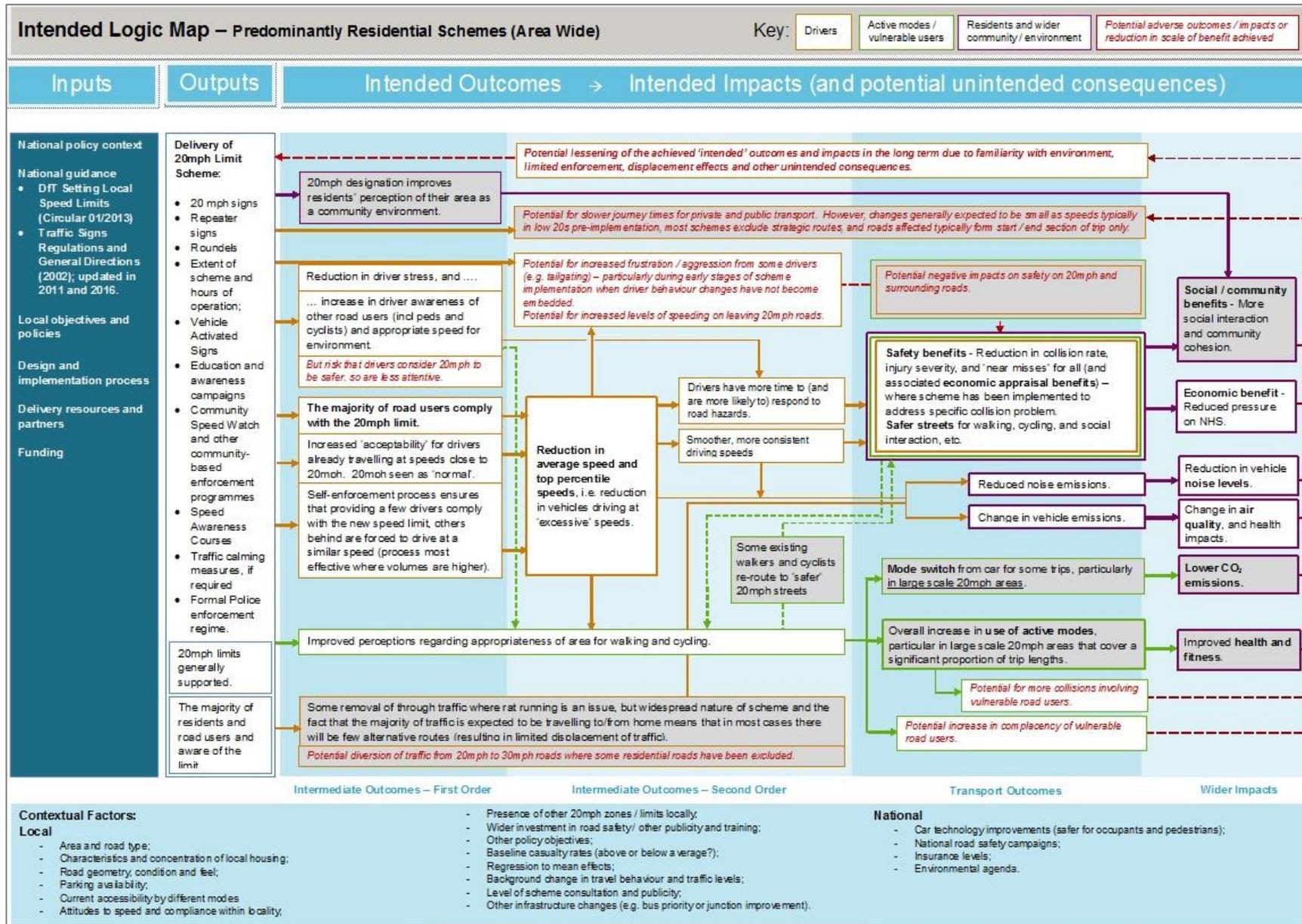
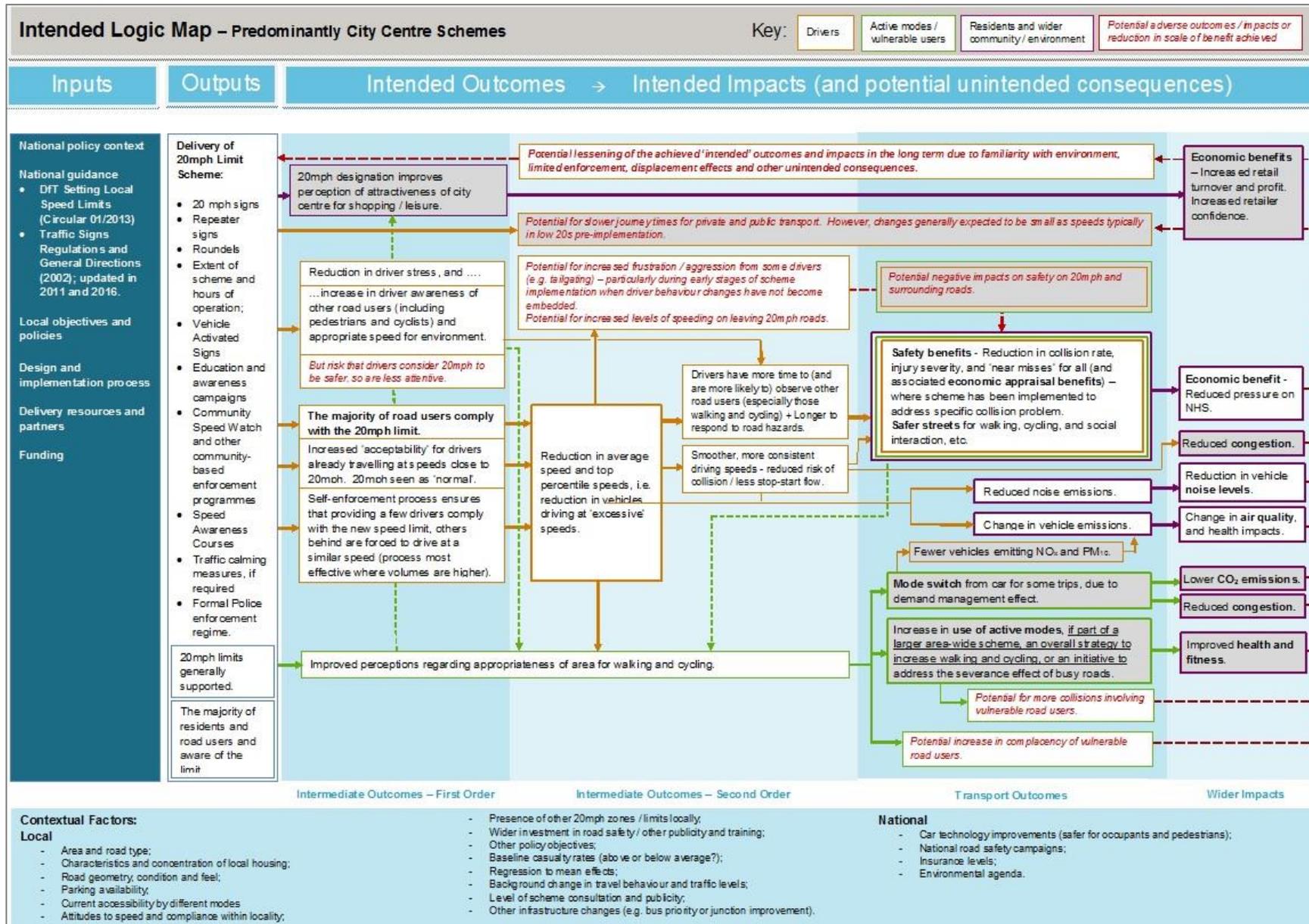


Figure 5. Theory of change – Logic map illustrating intended benefits process for predominantly residential schemes (city centre)



3.4. Evidence sources

3.4.1. Overview

The overall evaluation is based on the following national and case study-based evidence sources:

- a Rapid Evidence Review summarising published research;
- semi-structured interviews with a range of national stakeholders during the scoping stage;
- semi-structured interviews with local case study stakeholders at various stages during the study;
- questionnaire surveys with residents and non-resident drivers/riders in the case study areas;
- nationwide online questionnaire surveys with cyclists and motorcyclists;
- in-depth interviews with 176 drivers participating in the drivers' questionnaire survey;
- nine focus groups with specific user groups in the case study areas;
- area-wide journey speed data from in-car GPS devices (based on over 3 million vehicle kilometres of data for new 20mph limit roads) and instantaneous spot speed data collected by local authorities (covering over 400 monitoring sites); and
- STATS19 collision and casualty data.

3.4.2. Rapid Evidence Review

A rapid evidence review was undertaken during the scoping phase to identify existing evidence in respect to 20mph limits, zones, and advisory schemes; confirm gaps in current understanding; and inform the baseline logic map.

3.4.3. Stakeholder interviews

Semi-structured interviews were undertaken with a range of **national stakeholders** during the scoping stage to clarify the objectives of the research; identify useful evidence sources; and obtain national perspectives on scheme drivers, objectives, and effectiveness:

- Department for Transport (DfT)
- PACTS Parliamentary Advisory Council for Transport Safety, an All-Party Parliamentary Group
- Chartered Institution of Highways and Transportation (CIHT)
- Association of Chief Police Officers (ACPO)
- Public Health England (PHE)
- Road Safety Great Britain (RSGB)
- 20's Plenty for Us
- Alliance of British Drivers (ABD)

Semi-structured interviews with approximately 60 **local case study stakeholders** at various stages during the study to inform the process evaluation; provide qualitative evidence on scheme outcomes and impacts; and review local data collected through direct monitoring:

- Local authority officers (12 core schemes + 3 'no' schemes)
- Local Councillors (9 core schemes + 2 'no' schemes)
- Police (6 core schemes + 1 'no' schemes)
- Primary Care Trust / Public Health Officers (2 core schemes)
- Community engagement representatives (2 core schemes)
- Local bus operators (3 core schemes + 1 'no' scheme)
- Campaign groups (3 cycle campaign groups, 1 climate change group, 1 pro-20mph campaign group, and 1 anti-20mph campaign group).

3.4.4. Questionnaire surveys with residents and non-resident drivers/riders in the case study areas

Household face-to-face interviews were conducted to identify attitudes, perceptions and behaviours amongst **affected residents**. The sample comprised 1,993 residents living on 20mph limit (signed-only) roads – directly affected by the scheme; and 177 residents living on adjoining / connecting streets – likely to be indirectly affected in some way. Both samples included both drivers and non-drivers. The sample areas chosen in each location were homogenous in terms of relative affluence / deprivation, age groups, road width and distance from road to properties, proportion of green space, land use, level of on-street parking,

and signage. No questionnaires were conducted in Portsmouth as this scheme was implemented more than 7 years ago.

For the **(non-resident) drivers'** questionnaire sample, 1,256 face-to-face interviews were conducted with drivers / riders parked at or visiting a number of sites within or just outside each of the sample areas selected for the residents' questionnaires. Again, no questionnaires were conducted in Portsmouth as this scheme was implemented more than 7 years ago. Questionnaire respondents are referred to as 'non-resident drivers' in the rest of the report.

Statistical analysis – To determine whether changes in responses in the before and after periods are statistically significant, 95% confidence intervals have been calculated for the difference in proportions.

In addition, logistic regression analysis was undertaken to gain insight into what factors (represented by so called independent variables) influence the key outcome-related research questions (represented by so called dependent variables), using data collected from the above questionnaires and site visits to the case study areas. In particular, the analysis seeks to understand:

- how outcomes such as level of support, compliance with limit, and change in speed vary amongst different user groups and in different types of areas; and
- to test for association between variables identified as causal factors in the logic maps developed for the three different types of 20mph limit-only schemes (area-wide residential, small scale residential, and city centre).

Separate models were run for residents and drivers/riders. The regression models test for association only, rather than causality. Area-based variables are represented by one value for each case study, so the results may reflect other locational differences, rather than just the variables identified.

3.4.5. Nationwide online questionnaire surveys with cyclists and motorcyclists

An **online cyclists survey** was circulated through Sustrans, via their Twitter account and their LinkedIn profile, targeted at cyclists from across the UK; not just those living in the case study areas. The survey received a total of 1,655 responses, predominantly from regular cyclists.

An **online motorcyclists survey** was circulated through the IAM Road Smart newsletter and sent to an email distribution list of IAM Road Smart motorcyclist members. The questionnaire was open to all IAM Road Smart members, not just those living in the case study areas. The survey received a total of 352 responses, with the majority (54%) riding for leisure purposes and describing themselves as regular or frequent riders. Respondents may not be representative of all motorcyclists.

3.4.6. Qualitative research with user groups

Follow-up **in-depth interviews** were undertaken with 176 drivers participating in the drivers' questionnaire survey, to enrich and support the evidence from the quantitative data.

Nine **focus groups** were conducted with residents to provide additional in-depth evidence on scheme-specific issues and to capture the views of specific user groups (two groups with general residents, two groups with parents, one group with regular cyclists, one group with new cyclists, one group with young drivers, and one group with non-drivers).

3.4.7. Primary speed data

Evidence on actual speed outcomes in the case study areas is based on two data sources:

- GPS area-wide journey speed data provided by TomTom for the 12 case study areas; and
- spot speed data collected by local authorities representing the 12 case study areas, using inductive loops, radar devices or similar technology.

The two data sources measure speed in very different ways. GPS data measures **journey speed**. This is the effective speed of the vehicle on a journey between two points (e.g. from one end of a road to another). It is calculated by dividing the distance between the two points by the total time taken for the vehicle to

complete the journey, including any stopped time. It is therefore influenced by any delays occurring between the two points, such as slowing down to give way to on-coming vehicles, and accelerating / decelerating at junctions. In contrast, spot speed surveys measure the **instantaneous speed** of a vehicle as it passes a specified location.

A summary of the relative strengths and limitations of GPS and spot speed data are summarised in Table 4.

Table 4. Journey speed and spot speed data – strengths and limitations

GPS area-wide journey speed data	Spot speed data
Strengths	Strengths
<ul style="list-style-type: none"> Historically available, in a consistent format. Provides information on speeds across the whole of the network. Very large sample size when aggregated across all case study areas. Data can cover a long time period (e.g. one year before and one year after) - so not biased by seasonality or behaviour on a specific day. 	<ul style="list-style-type: none"> Captures data for every single vehicle passing the detection point. More accurately represents ‘free flow speed’ if located in a suitable location. Allows detailed analysis of behaviour at specific locations. Provides supporting information on traffic flow and mode split. Some equipment also reports speed data by mode. Raw data can be analysed by time of day, day of week, etc.
Limitations	Limitations
<ul style="list-style-type: none"> Only captures vehicles with GPS devices (connected or actively being used). This may result in an affluence or behaviour bias. Based on full segment traversal, so will record lower speeds where vehicles are stopping or slowing down mid-segment (e.g. to post a letter, to pass a parked car or let another vehicle past); and will be affected by acceleration / deceleration at junctions. Records are not kept unless vehicles drive from end to end of segment – data for cul-de-sacs is lost. Low segment samples, compared to spot speeds - maybe just 3% of sample per day. Aggregated days – cannot filter down to specific days in range chosen. 	<ul style="list-style-type: none"> Not historically available. Risk that before and after data are not fully compatible. Provides data for a limited number of locations only. Site locations can be biased towards busier and more important routes, and those where speeding has been reported as an issue or are expected to have low level of 20mph compliance. Data is typically collected for a short period only - can be affected by seasonality issues or biased by behaviour on a specific day. Devices can malfunction resulting in missing or mis-leading data. Data is typically collected for a short period only (normally a maximum of two weeks, but often less).

a) GPS area-wide journey speed data

Description – TomTom stores second-by-second probe data from all TomTom GPS devices where users voluntarily and explicitly agree to share the journey time statistics anonymously. All TomTom navigation systems record their location each second, and this data can be uploaded to TomTom either automatically (in the case of connected devices) or during the installation of periodic software updates when connected to a personal computer. The TomTom database includes data from personal navigation devices (PNDs), embedded in-car devices, fleet management systems and navigation apps on smartphone handsets.

A growing proportion of the data comes from in-car fitted connected devices which are recording all of the time, even when not actively being used for navigation. The rest of the data comes from stand-alone devices, which only record data when actively being used for navigation.

All data received is processed to protect privacy and filter out potentially anomalous results before storing it within a geographic database (known as the Traffic Stats Database) which can be queried online. The

database attaches individual GPS probes to road ‘segments’. Segments are short sections of the road network (typically less than 100m long in urban areas), which represent the lowest level of granularity that data can be spatially disaggregated to.

Before and after timespans – GPS journey speed data from TomTom data was purchased for one year before and one year after the introduction of 20mph limits.

- The before data covers the period **12-24 months before** implementation (i.e. leaving a gap of one year), to avoid any changes in behaviour in the run up to implementation as a result of consultation and education activities, disruption due to works, or phased implementation in the immediate area. However, it is noted that some case study schemes are part of a wider city-based initiative, and implementation activities focused on other parts of the city may have had some influence on behaviour in the case study area during this period (e.g. Liverpool, Nottingham, Brighton).
- The ‘after’ data starts **6 months after** implementation, to allow time for the scheme outcomes to have become established.

There is one exception, Portsmouth, where two ‘after’ years have been analysed (instead of one year before and one year after), to examine how effectiveness varies over time. This scheme was implemented substantially earlier than other case study schemes, enabling long term analysis of outcomes to be undertaken.

Across the 12 case study areas, over 1,100kms of roads and 18 million vehicle kilometres¹⁵ of speed data has been analysed. This comprises 3.1 million vehicle-kilometres on new signed only 20mph roads, 0.6 million vehicle-kilometres on other 20mph roads, and 15.0 million vehicle-kilometres on 30 and 40mph roads surrounding the case study areas.

Table 5. Sample of vehicle kilometres of journey speed data for case study areas

Study Area	Distance (KM)	Before			After		
		New 20mph (signed only)	Other 20mph roads ¹	30mph and 40mph roads	New 20mph (signed only)	Other 20mph roads ¹	30mph and 40mph roads
All case study areas	1,187	1,424,730	297,029	6,521,510	1,697,779	340,223	8,473,359

1. Combines New 20mph limits (existing calming), Older 20mph limits (with calming), and Older 20mph limits (signed only), which were all analysed separately. See Table 1 for definitions.

The ‘after’ sample sizes are higher than the ‘before’ sample sizes, due to the increased number of TomTom users over time. Nevertheless, both datasets represent substantial quantities of observed data.

Analysis metrics – Analysis of GPS data uses the median (denoted as the value lying at the midpoint of a frequency distribution of observed values) to measure average speeds. This helps to dampen the impact of slow moving vehicles (e.g. vehicles slowing to allow an on-coming vehicle to pass). Use of the mean (rather than the median) would result in a much lower estimate of the average speed.

Speed bands and 85th percentile speeds¹⁶ are used to examine the profile of speeds.

Comparator analysis – A key element of the methodology involves undertaking similar analysis in a set of 30mph limit comparator areas, to estimate whether the change in speed in the 20mph limit case study areas

¹⁵ Vehicle kilometres are a measure of traffic volume that considers the total distance travelled by users rather than just the number of users. This is determined by multiplying the number of vehicles on a set of road segments by the corresponding length of the segments.

¹⁶ The 85th percentile speed is the speed that 85 percent of vehicles do not exceed. Only 15 percent of vehicles go faster than this speed, and 85 percent go at or below this speed. It is regularly used in traffic engineering as a standard to set safe speed limits and in the design of roads.

is likely to be due to the introduction of the 20mph limit, or part of a wider trend in speeds affecting both 20mph and 30mph roads.

Three comparator areas were selected¹⁷, with similar average characteristics to three groupings of case studies (Table 6):

Table 6. Case study groupings for speed-based comparator analysis

Group	Description (RUC ¹⁸ and Region)	Case studies included
Group A	Urban City and Town classification - South	<ul style="list-style-type: none"> Winchester (Stanmore) Brighton (Phase 2) Chichester, Brighton (Phase 1) Winchester (City Centre)
Group B	Urban Major and Minor Conurbation classification – Midlands and North	<ul style="list-style-type: none"> Walsall (Rushall) Liverpool (Area 7) Liverpool (Area 2) Calderdale (Phase 1) Nottingham (Bestwood)
Group C	Urban City and Town classification - North	<ul style="list-style-type: none"> Middlesbrough

The above groupings ensure that the three biggest case study areas (Brighton, Liverpool, and Middlesbrough) are all covered by separate comparator areas. In general, Rural-Urban Classification¹⁹ was given more importance than region, as this is more likely to identify factors relevant to vehicle speeds (in terms of geographical characteristics).

It was not possible to purchase separate timespans for each case study area. Instead, data was purchased for up to two sets of timespans (each comprising one year before and one year after) for each comparator area. The case study implementation dates within each group were sufficiently similar to justify this approach.

Statistical analysis was then undertaken to compare the change in median speed observed on 20mph roads for each of the case studies with the change on 30mph roads in the matched comparator areas. The size of each comparator area is approx. 20km² to broadly reflect the size of the largest case study areas.

Selecting and defining the comparator areas – Comparator areas (Table 7) were selected on the basis of the following characteristics, to be as similar as possible to the case study areas:

- region;
- Rural Urban Classification;
- Index of Multiple Deprivation (IMD)²⁰ Income Quintile;
- size and shape of urban area²¹; and
- absence of 20mph area-wide limit in the vicinity of the area.

Road type (in terms of coverage of important strategic roads, important local roads, and minor local roads) has been considered in the analysis stage.

¹⁷ This represented a more cost-effective approach than selecting a separate comparator for each case study area.

¹⁸ The Rural Urban Classification (RUC) system is an Official Statistic used to distinguish rural and urban areas. Categories include Urban Major Conurbation, Urban Minor Conurbation, Urban City and Town, Urban with Significant Rural, Largely Rural, Mainly Rural. Used here as a proxy for geographical characteristics, e.g. population density, land-use, road types, traffic volumes, etc.

¹⁹ The Rural Urban Classification (RUC) system is an Official Statistic used to distinguish rural and urban areas. Categories include Urban Major Conurbation, Urban Minor Conurbation, Urban City and Town, Urban with Significant Rural, Largely Rural, Mainly Rural.

²⁰ The Index of Multiple Deprivation (IMD) is the overall measure of multiple deprivation experienced by people living in an area. It is calculated for all LSOAs in England. LSOAs are then ranked according to their deprivation relative to other areas. The 2015 indices are based on 37 separate indicators, organised across 7 domains of deprivation, when are then combined using weighting to calculate an overall IMD score. The 7 domains of deprivation are: Income Deprivation; Employment Deprivation; Education, Skills and Training Deprivation; Health Deprivation and Disability; Crime; Barriers to Housing and Services; and Living Environment Deprivation. The income element of the IMD data was used in this study to provide a proxy for urban density, road environment and socio-economic characteristics.

²¹ TomTom GPS journey speed data is purchased on a rectangular area basis. A test was therefore carried out to ensure a 20km² rectangle area of built up development could be selected, given the size and shape of the urban area.

Table 7. Selected comparator areas

Category	Comparator area
<p>Comparator A (Urban City and Town classification - South)</p>	<p>Worthing</p> <p>The biggest case study area in Group A is Brighton (population 155,000); so the selection criteria is skewed towards matching the characteristics of the Brighton area.</p> <p>Worthing has a large population (100,000); lends itself well to the selection of a 20km² rectangle; and is known to have rejected proposals for an area-wide 20mph limit following a very high profile and confrontational campaign in 2014. The selected area includes a broad range of residential areas.</p> <p>It is also a seaside location, with some similarities with Brighton in terms of housing type, and attracting visitors (although to a less extent than Brighton).</p> <p>The centre of Worthing is used as a comparator to Brighton City Centre and Winchester City Centre schemes.</p>
<p>Comparator B (Urban Major / Minor Conurbation classification – North and Midlands)</p>	<p>Wolverhampton</p> <p>Group B includes the two Liverpool case studies, Nottingham (Bestwood) and a small case study area in Rushall (all relatively deprived areas); and Calderdale (a more affluent area).</p> <p>The selected comparator area is Wolverhampton, as the area has a clearer distinction between city centre and residential areas, than other options. This enables the city centre area to be discarded to focus on the comparison of residential areas.</p>
<p>Comparator C (Urban City and Town classification - North)</p>	<p>Sunderland</p> <p>Group C includes Middlesbrough (Urban City and Town). Hartlepool and Sunderland were identified as the potential comparators.</p> <p>Both comprise a simple geographical area, with a clear city centre area which would be removed from the TomTom datasets to ensure focus on residential areas. Both have a small number of 20mph zones in place, but accounting for less than 2% of roads. Both have plans for area-wide 20mph limits, but beyond the timescales of our analysis.</p> <p>On balance, Sunderland was selected, as this is a larger city with a population closer to that of Middlesbrough.</p>

Comparator metrics – The comparator data for the selected areas was processed in the same way as the case study data. The following metrics were generated for each comparator area, disaggregated by road type (e.g. important local roads, minor local roads):

- distance of 30mph roads (kms);
- sample of vehicle kilometres observed (vkms);
- median speed, change in median speed;
- 85th percentile speed, change in 85th speed.

The comparator data is based on substantially larger sample sizes than the case study data.

Statistical analysis – A weighted least squares analysis (to take account of the different sample sizes) was then undertaken to examine the change in speeds for case study areas against the comparator areas (representing a difference in difference approach²²).

²² Comparing the change over time in the case study areas to the change over time for the comparator areas (control areas)

The model was specified as follows:

$$\begin{aligned}E(xB_i) &= \mu_i^{(x)} \\E(xA_i) &= \mu_i^{(x)} + d_i + \beta \\E(yB_i) &= \mu_i^{(y)} \\E(yA_i) &= \mu_i^{(y)} + d_i\end{aligned}$$

with weights mx_{B_i} , mx_{A_i} , my_{B_i} and my_{A_i} respectively (based on sample vehicle kilometres). Where, x refers to the case study area and y to the comparator area; B refers to the before period and A to the after period, and i refers to the individual case study areas and corresponding comparator areas.

So:

$$\begin{aligned}E(xB_i) &= \text{Expected speed* in case study area } i \text{ in the before period } B \\E(xA_i) &= \text{Expected speed* in case study area } i \text{ in the after period } A \\E(yB_i) &= \text{Expected speed* in comparator area } i \text{ in the before period } B \\E(yA_i) &= \text{Expected speed* in comparator area } i \text{ in the after period } A \\ \mu_i^{(x)} &= \text{Sample speed* for case study area } i \\ \mu_i^{(y)} &= \text{Sample speed* for comparator area } i \\ d_i &= \text{Background change in speed in the comparator area relevant to case study } i \\ &\quad \text{(which is assumed to apply equally to both the case study and comparator area)} \\ \beta &= \text{Treatment effect (the change in speed as a result of the change in speed limit).}\end{aligned}$$

** Refers to median speed, 85th percentile speed, or 15-85th percentile range, depending on the model in question.*

The crucial parameter is β which is the difference between the change in speed in the case study areas and the change in speed in the corresponding comparator areas, as a result of the change in speed limit.

The statistical analysis was undertaken for all roads (based on an aggregation of the datasets for all three road types), just major strategic roads, just important local roads and just minor local road respectively. Separate tests were undertaken to test the relative change in median speed, 85th percentile speed, and 15-85th percentile range. 95th percent confidence intervals have been calculated to determine the statistical significance of changes observed.

Although the statistical approach uses data for each individual case study area, the result (in terms of a statistically significant change or not) applies to the set of case studies as a whole, and does not identify whether the change in any one particular case study area is significant.

The case study and comparator data was weighted using sample vehicle kilometres to give more emphasis to the larger case study areas. A version of the statistical model was also tested without weights. This treats all of the case studies equally, and is more of a measure of scheme performance rather than driver behaviour.

Some example data is provided below, to illustrate the inputs to the model (Table 8).

Table 8. Example input data for weighted least squares analysis - artificially generated (median speeds and weightings for case study and comparator areas)

Area	Case study areas				Corresponding comparator areas			
	Median speed Before	Median speed After	Vehicle kilometres Before	Vehicle kilometres After	Median speed Before	Median speed After	Vehicle kilometres Before	Vehicle kilometres After
<i>i</i>	<i>x</i> B	<i>x</i> A	<i>m</i> <i>x</i> B	<i>m</i> <i>x</i> A	<i>y</i> B	<i>y</i> A	<i>m</i> <i>y</i> B	<i>m</i> <i>y</i> A
1	26.12	25.37	14.06	14.41	32.06	30.21	18.38	21.92
2	30.14	30.99	11.78	11.57	28.02	31.42	24.35	29.50
3	28.91	30.05	7.84	8.17	29.15	29.82	21.58	26.07
4	25.35	27.13	10.93	13.08	28.49	32.04	21.84	21.59
5	26.83	19.23	5.58	5.43	30.47	28.91	17.28	21.85
6	27.15	22.44	6.38	7.22	31.00	35.67	17.66	20.83
7	25.29	27.80	16.07	14.51	30.78	34.74	22.05	20.21
8	22.55	22.17	5.30	6.02	31.76	31.90	17.42	21.39
9	23.80	25.53	7.57	8.71	30.14	30.50	16.59	15.83
10	31.00	23.39	15.62	18.80	29.57	28.88	22.41	25.25
11	30.01	29.00	13.73	13.26	30.72	29.97	19.31	20.88

b) Spot speed data

Description – Spot speed data refers to data recorded at a specific location or set of locations on the network, using inductive loops on the road (e.g. two rubber tubes laid across the carriageway, linked to a recorder box at the side of the road) or radar devices mounted to street furniture, or similar technology²³.

Approach – Local authority collected spot speed data was provided for 9 of the case study schemes, covering 410 sites (of which 223 were located in Portsmouth). In the case of Nottingham (Bestwood) resource challenges meant that ‘after’ monitoring did not take place, although before and after monitoring was undertaken in other parts of the city. Spot speed surveys were undertaken in the two Liverpool case study areas but were not available within the timescales of this study.

In all locations, before and after speeds and flows were monitored using inductive loops or speed detection radar to measure spot (instantaneous) speed and flow across a sample of locations (varying from 3 to 223). Across the five biggest case study areas, coverage equated to 1 site for every 2.1km of new limit²⁴.

In general, monitoring was undertaken over a 7-day period, 24hrs/day. In Portsmouth, monitoring was undertaken on just one day, but the large number of sites (223) involved improves the robustness of the data if analysed at an aggregate level.

In most cases, before and after surveys were undertaken in neutral months²⁵ when flows are considered to be most representative of the yearly average, but not necessarily in the same month.

Before and after timespans – The timescales for before monitoring vary substantially but before surveys were typically conducted less than 24 months before implementation, with after monitoring taking place between 3 and 12 months post-implementation to allow some time for scheme outcomes to establish. Most authorities undertook one phase of after surveys, but in two cases subsequent monitoring has been undertaken to enable a longer-term analysis of outcomes.

²³ Radar devices are typically less noticeable to drivers than tubes, and as such will give a truer reading for speed.

²⁴ Middlesbrough (25 sites across 97kms of new limit), Brighton Phase 2 (46 sites across 106kms), Portsmouth (223 sites across 341kms), Chichester (35 sites across 67kms), and Brighton Phase 1 (47 sites across 108kms).

²⁵ DfT Guidance on Data Sources and Surveys (Transport Analysis Guidance Unit M1.2) states that surveys should be carried out during a ‘neutral’, or representative, month avoiding main and local holiday periods, local school holidays and half terms, and other abnormal traffic periods. Neutral months are considered to be late March, April, May, June, late September, October, and November.

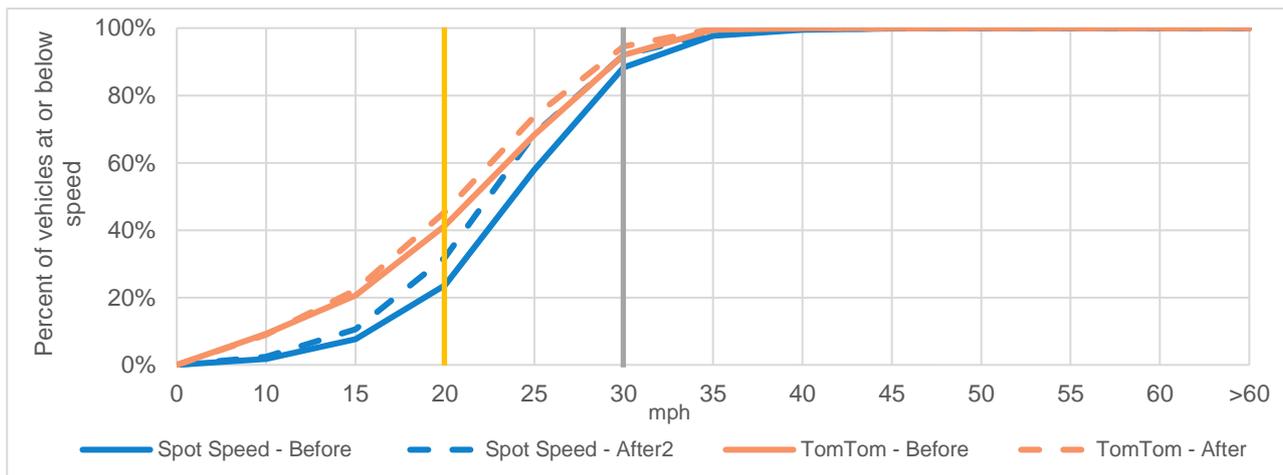
Analysis metrics – For the spot speed data, the mean is used to measure average speeds (rather than the median, which is used for the journey speed data), to reflect the full range of instantaneous speeds. Speed bands and 85th percentile speeds are used to examine the profile of speeds.

In general, the case study authorities were unable to provide comprehensive reporting of analysis undertaken and the findings. For the purpose of this study, it was therefore necessary to re-analyse the raw data. In some cases, authorities were unable to provide the raw data, which limited the analysis which could be undertaken – typically limiting it to an analysis of mean and 85th percentile speeds, and excluding speed profile analysis. A two-tiered approach to analysis was therefore adopted, which involved:

- Examining headline results for a core set of metrics available for the majority of case study areas (mean, 85th percentile, and % driving below 20mph) to examine speed outcomes at a case study and site-specific level.
- Undertaking more detailed speed profile analysis of the raw data for a sample of schemes where robust and comprehensive raw data was provided and covering a range of different scheme types and environments – Walsall (small-scale residential), Brighton Phase 2 (area-wide residential), and Winchester City Centre (city centre). This enabled a comparison to be made between the journey speed and spot speed findings. This shows similar patterns of before and after change, but spot speed surveys generally record higher average and 85th percentile speeds as they measure instantaneous speed at a specific location (Figure 6).

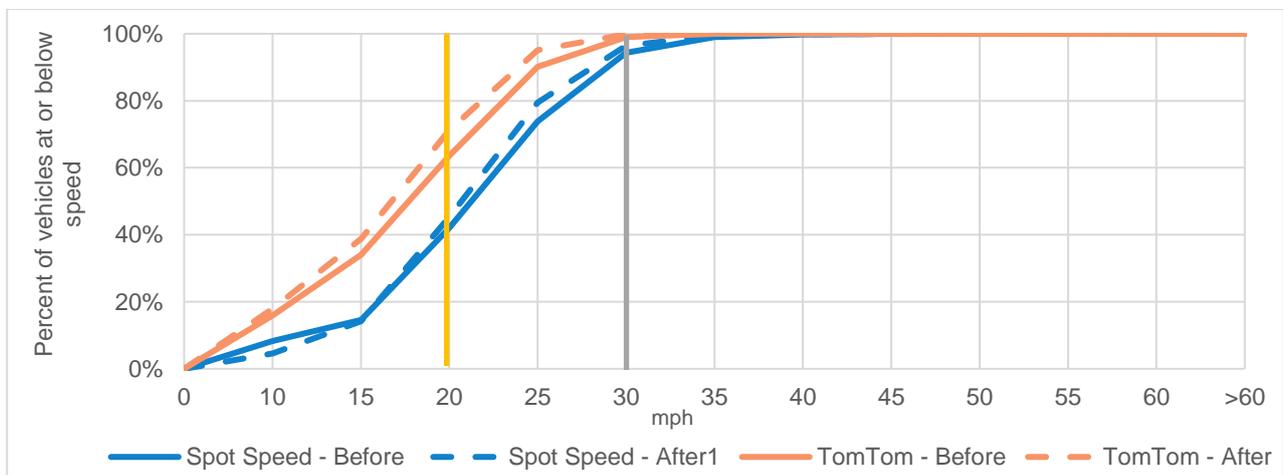
Figure 6. Spot speed vs journey speed data – cumulative speed distribution

Example 1 (Area-wide residential)



TomTom analysis compares 12-24 months before vs. 6-18 months after. Spot speed analysis compares 12 months before implementation (Jun, 7 days) vs. 24 months after (Jun, 7 days). Moderate compatibility with TomTom data spans.

Example 2 (City centre and adjacent residential area)



TomTom analysis compares 12-24 months before vs. 6-18 months after. Spot speed analysis compares 12-30 months before implementation (Apr and Sep, 7 days) vs. 7-8 months after (Apr and May, 7 days). Good compatibility with TomTom data spans.

Interpretation of cumulative distribution graphs – Figure 6 shows the percentage of driver vehicle kilometres (vkms) travelling at or below a specific speed; with 20mph and 30mph speeds highlighted by vertical lines to show the before and after speed limits.

Example 1 shows that prior to the reduction in speed limit (i.e. during the 'before' period, represented by the solid orange and blue lines), approximately 40% of vehicles were travelling at less than 20mph based on TomTom GPS data (and 60% were travelling at faster speeds), while the spot speed data suggests that only about 20% were travelling at less than 20mph (and 80% were travelling at faster speeds). This demonstrates that the spot speed data is recording higher speeds than the GPS journey speed data.

Following the change in speed limit (i.e. during the 'after' period, represented by the dashed orange and blue lines), the proportion of vehicles travelling at or below 20mph increases for both datasets, moving the distribution curve to the left. The larger the shift to the left (and the bigger the gap between the before and after period), the higher percentage of drivers now travelling at lower speeds. The orange curves (representing the TomTom GPS data) is to the left of the blue curve (representing to the spot speed data) across the whole of the speed profile indicating generally lower speeds for the GPS journey speed data. In addition, the dashed curves are consistently to the left of the solid curves indicating slower speeds in the after period across the whole of the speed profile. The same pattern is also evident in Example 2.

3.4.8. Primary collision and casualty data

Evidence on actual safety outcomes is based on the following data sources:

- **STATS 19 data**, provided by the Department for Transport (DfT) for the period Jan 2005 to December 2016. This includes accident, casualty, vehicle and contributor factors data. The 'before' analysis is based on five years of data, and the 'after' analysis uses between 17 and 42 months (between 1.4 and 3.5 years) of data reflecting the different implementation dates for the various case study schemes.
- A **TomTom mapping GIS file** for each 20mph case study scheme, marked up with the pre and post-scheme speed limits, and categorising 20mph roads as new or pre-existing, and with or without traffic calming. The TomTom map product was also used to identify appropriate 30mph roads in comparator areas.

Of the 12 case studies, Portsmouth was implemented substantially earlier than the other case study authorities. Background trends in casualty rates at the time were very different to more recent trends affecting all of the other case studies. Data for Portsmouth was therefore been excluded from the main safety analysis. This is consistent with the approach adopted for the analysis of speed outcomes using GPS data, which treated Portsmouth separately.

STATS19 data – Personal injury collisions (PICs) on public roads that are reported to the police, are recorded using the STATS19 accident reporting form. This data contains details of the incident severity, casualty severity and numbers, and a subjective coding of contributory factors. This information is stored, and available for analysis in two databases maintained by the DfT – an Accident Database and a Contributory Factors Database.

The following data limitations need to be considered when interpreting the findings presented in this report:

Accident Database

- The Accident Database comprises an Accident Table, Casualty Table, and Vehicle Table, detailing the relevant information for each reported collision.
- The dataset only includes collisions where an injury is reported. Damage only incidents are not included in the dataset. This represents a gap in our analysis, as a substantial proportion of collisions in 20mph limit areas are expected to be damage only collisions. No other reliable sources of data on damage only collisions is available.
- Not all personal injury accidents are reported to the police.
- The collision details are not always recorded accurately or consistently by the police, and the level of quality assurance undertaken by local authorities varies hugely. Nevertheless, the error within the data

is likely to be similar for both the before and after periods. Additionally, before publishing their statistics, the DfT carry out substantial cleaning and validation for values that are outside of the expected range and include data from other sources.

- There is an issue around the comparability of the 2016 data, following the introduction of the CRASH reporting system - an online tool designed to provide standardised collection, storage and validation of police casualty data, currently used by around half of police forces. Data entry and validation now becomes the responsibility of the police rather than local authority staff with long standing skills and experience in this field. There is a risk that only the minimum amount of data required by the system may be reported, leaving valuable supplementary data unrecorded.
- In addition, an important innovation pioneered by CRASH is the improved recording of the nature of injuries suffered by victims. However, in the short-term, this may result in substantial deviation between the number of casualties classified as 'serious' by forces that use CRASH, compared with both preceding years, and with forces that do not. Early indications suggest that this has resulted in an increase in the proportion of casualties categorised as 'serious'. **It has therefore not been possible to undertake any meaningful statistical analysis by casualty severity as part of this study.**

Contributory Factors Database

- The DfT also maintains a database of road collision contributory factors data, which provides a subjective coding of factors which may have contributed to the collision. Each collision can be attributed between none and six contributory factors believed to be related to the collision. The contributory factors are for information purposes only and not intended to assign blame.
- Not all collisions are included in the contributory factor data. Only collisions where the police attended the scene and reported at least one contributory factor are included. A total of 77% of all collisions reported to the police in 2015 met these criteria. This proportion, however, is likely to be much lower in 20mph limits, as most injuries are likely to be slight injuries and incidents are less likely to be attended by the police.
- Police officers do not need to carry out a full investigation of the incident before allocating contributory factors. They usually use professional judgement about what they can see at the scene. Some contributory factors, such as exceeding the speed limit, may not be obvious to the officer and are therefore likely to be under-reported.

Given the above caveats, and the small number of collisions involved, contributory factors are used to provide background context only. The findings should be treated as indicative only.

Comparator analysis – A generalised linear model²⁶ of multiplicative form and employing a poisson / negative binomial error structure was used to look at the number of collisions before and after the introduction of 20mph limits and compare the collision rates. The model attempts to take account of other background factors (e.g. background reductions in collision rates, weather, economic trends, etc.) by using comparator areas with similar characteristics to the case study areas to adjust for these impacts in the time periods used.

The model takes the following form:

$$E(y_{it}) = k_i R_{it} \text{ for the } \textit{before} \text{ period; and}$$

$$E(y_{it}) = k_i R_{it} \alpha \text{ for the } \textit{after} \text{ period (with a dummy variable used to represent the after period).}$$

Where:

$$E(y_{it}) = \text{Expected number of collisions in case study area } i \text{ in quarter } t$$

$$R_{it} = \text{Number of collisions in comparator area } i \text{ in quarter } t$$

²⁶ A generalised linear model is a version of an ordinary linear regression model that allows for response variables that have error distribution models other than a normal distribution.

k_i = Coefficient measuring the relative magnitudes of the collisions rates in the study and comparator areas i .

α = The factor by which collision rate is multiplied in the after period.

The crucial parameter is α , which is the factor by which collision rate is multiplied in the after period, and indicates the extent to which the implementation of the lower speed limit has led to a decrease in collisions. If α is less than 100%, then collisions have reduced, and if greater than 100%, then collisions have increased.

Based on purely artificial data, Table 9 illustrates the inputs to the model. Note that the period indicator variable is 1 for the before period and is 2 for after period (the dummy variable).

Table 9. Example input data for generalised linear model - artificially generated

Area i	Quarter t (i.e. 3 month period)	Case study area collisions y_{it}	Comparator area collisions R_{it}	Period (1 = before, 2 = after)
1	1	10	100	1
1	2	8	107	1
1	3	11	124	1
1	4	9	97	2
1	5	13	121	2
2	1	8	65	1
2	2	11	76	1
2	3	6	88	2
2	4	9	56	2
3	1	16	127	1
3	2	12	135	1
3	3	7	98	1
3	4	5	76	2
4	1	20	212	1
4	2	17	189	1
4	3	20	167	1
4	4	13	188	2
4	5	9	156	2
4	6	8	178	2

Fitting a model as described above, would give an output as follows (Table 10):

Table 10. Example input data for generalised linear model - artificially generated

	Estimate	Standard Error	Z Value	Prob (> z)
(Intercept)	-2.26754	0.14827	-15.293	<2e-16 ***
site2	0.28194	0.22193	1.270	0.2039
site3	-0.07494	0.21314	-0.352	0.7251
site4	-0.12780	0.17673	-0.723	0.4696
period2	-0.30038	0.14872	-2.020	0.0434 *

The principal parameter of interest is the one on the last line, labelled 'period2'. This is the estimate of the log of the parameter α . So, the estimate of $\alpha = \exp(-0.30038) = 0.741$. This indicates (in this artificial scenario) the implementation of the lower speed limit has led to a decrease in collisions of around 26%.

A 95% confidence interval on α can be estimated using the standard error and can be calculated as $\alpha = (0.553, 0.991)$. Therefore, the 95% confidence interval in this example is marginally significant at the 5% level (i.e. the confidence interval does not contain the value 1 which would indicate “no change”).

In addition to giving the 95% confidence interval and testing if the estimate of α is significantly different from 1 at any specified significance level (e.g. 5%), we can also state the p value – in this case $p = 4.34\%$. This is the significance level at which the result would be right on the boundary of statistical significance.

The likelihood of being able to detect a change in collisions or casualties with a defined level of probability, depends on the scale of change in the data and the amount of data available (the sample size). The larger the sample size, the greater the likelihood of being able to detect a smaller change. Due to the small number of collisions in each area, the analysis is likely to be more conclusive if all case study areas are considered together. The statistical analysis is therefore primarily reported at an aggregate level, with less emphasis on the change within individual case study areas.

Key strengths of approach are as follows:

- Does not require all schemes to have opened at the same time, and does not require all case studies to have the same amount of before and after data. This means that all data available (to December 2016) can be used.
- Aggregation of areas maximises the sample of data and increases the opportunity to measure an impact if one exists.
- Background trends are picked up by the model using comparator areas to understand the relative impacts.

Selection of comparator areas – A key element of the approach is the identification of a separate comparator area for each case study scheme. The purpose of the comparator is to control for background trends in collisions, and other factors such as environment, road type, weather, economic trends, traffic growth, etc. i.e. anything which could affect driver behaviour and the number of collisions expected in 20mph areas independently of the change in speed limit.

The comparator area should generally comprise a larger number of collisions to provide a clear background trend; but still be representative of the case study area in other characteristics that are likely to impact on safety outcomes (e.g. land use and area type, socio-demographic characteristics, and road type and function). For the purpose of this analysis, the comparator needs to comprise collisions on 30mph roads, with similar characteristics and function to the 20mph roads in the case study areas.

Consequently, a decision was made to use the Urban and Rural Area Definitions developed by central government in 2011, to identify suitable region-based comparator areas for each case study. This approach draws comparator data from a number of settlements within the same region, which are considered ‘similar’ to the case study area (see Table 11).

Table 11. Case study rural urban classifications and size of comparator areas within the same region

Case Study	Case Study size (km ²)	RUC Classification	Region	Comparator Area size ¹
Walsall (Rushall) (R-SM1)	0.5	Urban Major Conurbation	West Midlands	872 km ²
Winchester (Stanmore) (R-SM2)	3.6	Urban City and Town	South East	4,184 km ²
Liverpool (Area 7) (R-AW1a)	15.8	Urban Major Conurbation	North West	1,589 km ²
Liverpool (Area 2) (R-AW1b)	19.3	Urban Major Conurbation	North West	1,589 km ²
Middlesbrough (R-AW2)	18.6	Urban City and Town	North East	737 km ²

Case Study	Case Study size (km ²)	RUC Classification	Region	Comparator Area size ¹
Calderdale (Phase 1) (R-AW3)	4.2	Urban Major Conurbation	Yorkshire and the Humber	830 km ²
Nottingham (Bestwood) (R-AW4)	7.9	Urban Minor Conurbation	East Midlands	359 km ²
Brighton (Phase 2) (R-AW5)	24.9	Urban City and Town	South East	4,184 km ²
Chichester (R-AW6)	7.6	Urban City and Town	South East	4,184 km ²
Brighton (Phase 1) (TC-AW1)	7.0	Urban City and Town	South East	4,184 km ²
Winchester (City Centre) (TC-AW2)	1.0	Urban City and Town	South East	4,184 km ²

1. The comparator areas exclude all other case study areas within the region.

Analysis undertaken shows that the comparator areas selected provide good guidance in terms of collision trends (for seasonal variation and long-term drift in the mean collision rate), when compared with the case study areas.

The analysis also considered whether the fit of the model could be improved by undertaking a weighted analysis, where the collision data for the respective lengths of the three road classes²⁷ in comparator areas were weighted to represent the relative proportions in the case study areas. The results showed little difference between the weighted and unweighted analyses, with both models showing good fit.

Before and after timespans – A key strength of the approach, is the ability to make use of all data available for each case study, however, limited or extensive.

The 'before' data covers 5 years and leaves a gap of one year prior to implementation of the 20 mph limits in the case study areas, to avoid any changes in behaviour in the run up to implementation.

The 'after' data covers between 17 and 44 months, depending on the case study in question. No post implementation gap has been left, in order to maximise the amount of data available.

Table 12. Before and after data spans for case study schemes

Case Study	Scheme Implementation Date	Before period (5 years before, with 1 year buffer)	After period (no buffer)	Number of months of after data
Walsall (Rushall) (R-SM1)	Mar 2014	01 Apr 2007 – 31 Mar 2013	01 Apr 2014 – 31 Dec 2016	33 months (2-3 years)
Winchester (Stanmore) (R-SM2)	Jul 2014	01 Aug 2007 – 31 Jul 2013	01 Aug 2013 – 31 Dec 2016	29 months (2-3 years)
Liverpool (Area 7) (R-AW1a)	Apr 2014	01 May 2007 – 30 Apr 2013	01 May 2013 – 31 Dec 2016	32 months (2-3 years)
Liverpool (Area 2) (R-AW1b)	Jan 2015	01 Feb 2008 – 31 Jan 2014	01 Feb 2015 – 31 Dec 2016	23 months (1-2 years)
Middlesbrough (Phase 1, Phase 2) (R-AW2)	Mar 2012 – Jun 2012; Mar 2013 – Jun 2013	01 Jul 2005 – 30 Jun 2011	01 Jul 2013 – 31 Dec 2016	42 months (>3 years)
Calderdale (Phase 1) (R-AW3)	Jul 2015	01 Aug 2008 – 31 Jul 2014	01 Aug 2015 – 31 Dec 2016	17 months (1-2 years)

²⁷ Roads in the TomTom base map were categorised as Major strategic roads (FRC 1-3), important local roads (FRC 4-5), and minor local roads (FRC 6-7).

Case Study	Scheme Implementation Date	Before period (5 years before, with 1 year buffer)	After period (no buffer)	Number of months of after data
Nottingham (Bestwood) (R-AW4)	Apr 2014	01 May 2007 – 30 Apr 2013	01 May 2014 – 31 Dec 2016	32 months (2-3 years)
Brighton (Phase 2) (R-AW5)	Jun 2014	01 May 2007 – 30 Jun 2013	01 Jul 2014 – 31 Dec 2016	30 months (2-3 years)
Chichester (R-AW7)	Jul 2013	01 Aug 2006 – 31 July 2012	01 Aug 13 – 31 Dec 2016	41 months (>3 years)
Brighton Phase 1 (TC-AW1)	Apr 2013	01 May 2006 – 30 Apr 2012	01 May 2013 – 31 Dec 2016	44 months (>3 years)
Winchester (City Centre) (TC-AW2)	Sep 2014	01 Oct 2007 – 30 Sep 2013	01 Oct 2014 – 31 Dec 2016	27 months (2-3 years)

Regression to the mean (RTM) – RTM arises in traffic safety studies through the site-selection process. If sites are selected for treatment on the basis of a high accident frequency in the preceding (typically) three years, then a before/after comparison will almost inevitably lead to an exaggerated estimate of the effect of the treatment. The magnitude of this bias can be appreciable (and easily be on a par with the magnitude of the treatment effect itself), as previously studies have demonstrated²⁸.

One approach to avoid RTM is to collect historical accident STATS19 data for the sites from a number of years before the scheme implementation, and use this as the baseline period to compare with the after data. As the case study schemes are intended to deliver area-wide benefits, and are not wholly safety driven, we do not consider RTM to be a problem for this study. Nevertheless, the use of five years of before data will mitigate against any effect which might exist.

3.4.9. Use of multiple data sources

The evidence base for the research comprises a mix of quantitative and qualitative sources, allowing us to:

- triangulate evidence and identify a range of viewpoints and alternative explanations;
- test for consistency and divergence in the emerging findings;
- undertake in-depth investigation to identify causes behind conflicting evidence and explanations; and
- identify a best fit answer based on a range of evidence available.

In general, greater weight has been given to quantifiable data sources (questionnaire results and primary data relating to speed and safety) in terms of the key messages emerging from the research, as this data provides greater certainty about the strength and scale of the outcome. However, the qualitative sources (stakeholder interviews, in-depth driver interviews, and focus groups) play a valuable role in explaining the context and exploring the associated issues relating to the quantifiable outcomes, and capturing the outcomes relating to specific user groups.

A clear distinction is made between perceived and actual outcomes, which often differ. Both are valid, but in different contexts. For example, perceived reduction in speed is more important in terms of walking and cycling levels, while actual speed is of key importance in terms of injury severity as a result of a road collision.

3.4.10. Statistical reliability

The evidence presented in this report needs to be considered in the context of its statistical reliability. The term “significant” is only used in this report when referring to **statistical significance** (i.e. the likelihood that a relationship between two or more variables is caused by something other than chance). In addition, **the report only refers to changes which are statistically significant, unless otherwise stated.**

Questionnaire surveys – The questionnaire results are based on a sample of the population in the case study areas (or nationally in the case of cyclists and motorcyclists), and should not be taken as a precise

²⁸ For example, see Appendix H of the DfT 4-year evaluation report on speed cameras: <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/pgr/roadsafety/speedmanagement/nscp/nscp/thenationalsafetycameraprogr4597>).

indication of the actual figures for that population. The reported figures are estimates, within a small margin of error, of the actual figures. The margin of error varies with sample size – the larger the sample is, the lower the error will be. It also varies with the proportions answering: the margin of error is smaller for a 90% or 10% result than for a 50% result.

In order to illustrate the use of varying sample sizes and their effect on the statistical significance of results, the table below outlines the degree of statistical error broadly associated with example sample sizes of 500 and 1,000, and the actual sample sizes for the various questionnaires undertaken.

Table 13. Statistical error associated with questionnaire sample sizes (at 95% confidence level)

Sample size	50% giving the same response	40% or 60% giving the same response	30% or 70% giving the same response	20% or 80% giving the same response	10% or 90% giving the same response
500 (example)	± 2.6%	± 3.5%	± 4.0%	± 4.3%	± 4.4%
1000 (example)	± 1.9%	± 2.5%	± 2.8%	± 3.0%	± 3.1%
1993 (residents' questionnaire)	± 1.3%	± 1.8%	± 2.0%	± 2.2%	± 2.2%
1256 (non-resident drivers' questionnaire)	± 1.7%	± 2.2%	± 2.5%	± 2.7%	± 2.8%
1655 (cyclists' survey)	± 1.4%	± 1.9%	± 2.2%	± 2.4%	± 2.4%
352 (motorcyclists' survey)	± 3.1%	± 4.2%	± 4.8%	± 5.1%	± 5.2%

A sample size of 1000 ensures a maximum margin of error for a given proportion response rate of ±3.1%. In other words, if the proportion of the sample supporting 20mph limits is 50%, then there is a 95% likelihood that the true proportion within the total population is within ±3.1% (46.9% to 53.1%). The margin of error reduces to ±1.9% if the sample proportion reduces to 10% or increases to 90%. It increases if the sample is reduced (as a result of disaggregation of results), to a maximum of ±4.4% if the sample size reduces to 500, for example.

Information on sample sizes is provided through the report. ***In general, questionnaire / survey findings are based on sample sizes exceeding 1000, often much bigger. Sample sizes are smaller when the findings are disaggregated by scheme typology, non-drivers (residents' questionnaire), and cycling related topics (residents' questionnaire), or based on the motorcyclists' survey, but in all cases the sample size exceeds 100.***

To determine whether changes in responses in the before and after periods are statistically significant, 95% confidence intervals have been calculated for the difference in proportions.

Speed and safety data – As described above, a weighted least squares statistical model has been used to determine whether the change in speed in case study areas is significantly different to the change observed in comparator areas; and a generalised linear statistical model has been used to undertake similar analysis for collision and casualty data.

4. Why were 20mph limits introduced?

4.1. Introduction

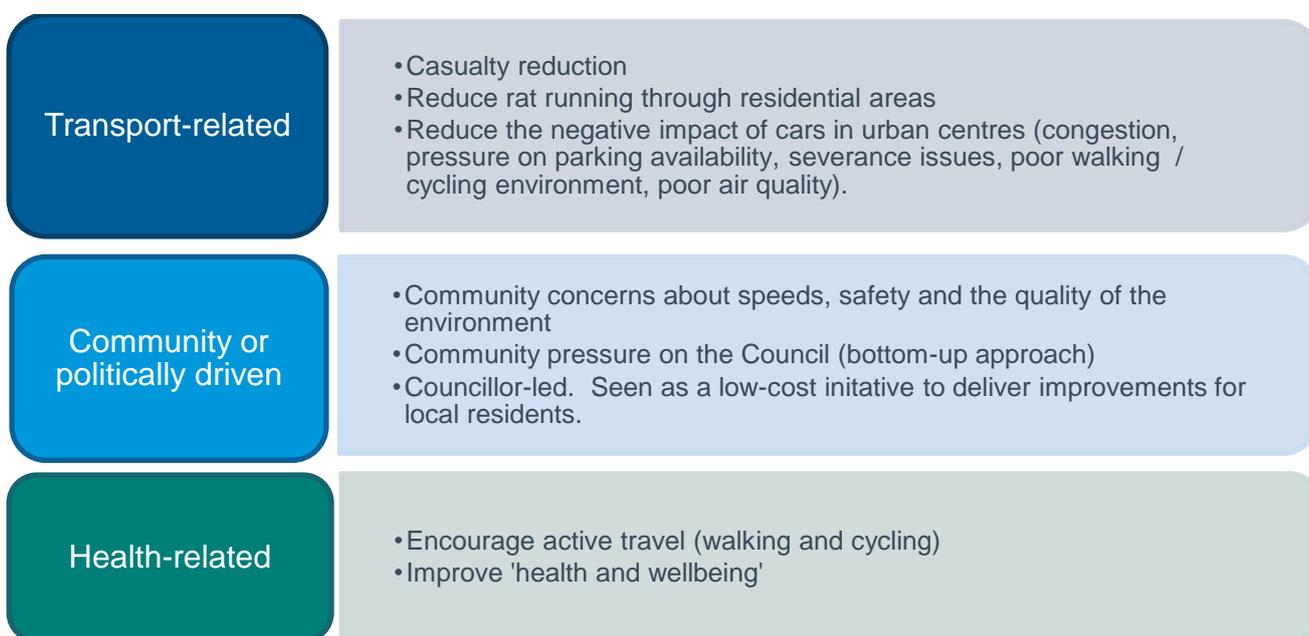
This chapter sets out the rationale for delivering 20mph (signed only) limits covering:

- the motivations and objectives for implementing 20mph limit (signed only) schemes; and
- how they are expected to achieve the intended outcomes.

4.2. Motivations and objectives for implementing 20mph limits

The key motivations behind schemes can be categorised as transport-related, community or political, and health-related; with most schemes driven by a combination of these factors (listed in Figure 7).

Figure 7. Key motivations for implementing 20mph limit (signed only) schemes



Transport motivators – A number of schemes have been driven by a historically poor safety record or a wish to maintain momentum in recent efforts to **reduce casualties**; with 20mph limits being seen as an effective means of addressing the dispersed and random nature of many collisions (four case study schemes). However, **accident reduction is not a key driver behind many of the case study schemes**.

In some cases, the 20mph limits represent an evolution of existing safety or sustainable travel initiatives, providing a lower cost means of rolling out interventions in a faster and broader manner, particularly at a time of substantial revenue cuts.

Community / political motivators – In the majority of cases (eight case study schemes), local councillors and/or the local community have been strong drivers behind scheme implementation, with councillors responding to community concerns about speeds, safety and the quality of the environment in their local areas.

In some cases, the drive has been very much community led, in the form of petitions and the involvement of local campaign groups. In other cases, councillors have taken the lead, seeing 20mph limits as a low-cost initiative which enables them to demonstrate they are addressing community concerns.

Health motivators – Most of the case studies include objectives relating to health and well-being. In Liverpool, the Primary Care Trust acted as a key promoter and made a substantial contribution to the cost of the scheme, having recognised the potential for a reduction in hospital admissions as a result of residents

adopting healthier lifestyles and fewer road casualties. Public Health also played a key role in Calderdale, funding the community engagement strategy.

Case study examples – Scheme motivators (Box A)
<p>Middlesbrough - In 2010, the Council had achieved all three of their headline ten-year casualty reduction targets set by the previous government. Given this success, they faced the challenge of ensuring this momentum continued over the coming years. A reduction in capital and revenue resources meant the widespread introduction of physical traffic calming as a means of tackling excessive speeds and casualty rates was not possible. The Council therefore decided to introduce an area wide 20mph scheme.</p> <p>Brighton - The key motivators behind the city-wide 20mph scheme were:</p> <ul style="list-style-type: none"> • a poor safety record in the city which had not been addressed for some time; • demands from members of the public about speeds and casualty levels, including residents’ petitions for 20mph schemes (particularly near schools); and, • political recognition of the need to improve safety in the city (particularly in terms of severity), supported by a political mandate to deliver a 20mph scheme based on a commitment to deliver a 20mph scheme in the local party manifesto. <p>In addition, the city already had some 20mph zones in place, and had already started to look at implementing small clusters of 20mph limit schemes around schools. Interest in an area-wide 20mph scheme appears to be related to the introduction of an area-wide scheme in a nearby authority.</p> <p>Winchester City Centre - The key motivators behind the city centre 20mph scheme were:</p> <ul style="list-style-type: none"> • to meet a commitment in the Town Centre Access Plan to 'reduce the negative impact of vehicle movements in the town centre and residential areas'; • requests for a 20mph speed limit from the local community (residents and the Town Forum); • political drive from councillors, and a need address the high levels of traffic in the historic city centre and the associated consequences.

Scheme objectives – In general, 20mph schemes provide an opportunity to address a wide range of policy areas in what is perceived to be a low-cost manner – “20mph schemes tick lots of boxes”. The majority of schemes therefore have a range of objectives which span road safety, promotion of active travel modes, perceived quality of the environment, health and well-being, and community benefits. The most common objectives are focused around community and health themes.

Table 14. Case study scheme objectives

Type of objectives	Number of case studies	Transport-related	Community-related	Health-related
Reduce casualty numbers and severity	9	✓		
Reduce average or excessive speeds / Formalise the speed at which the majority are already travelling	9	✓		
Improve community perceptions of safety and speed, and dominance of the car	11	✓	✓	
Encourage use of active travel modes	12	✓	✓	✓
Improve noise / air quality	3		✓	
Improve health and well-being	10			✓
Other - Reduce negative impacts of cars in city centres	2	✓	✓	
Other – Improve community cohesion	1		✓	
Other – Address concerns about HGV speed limits	1	✓		
Other – Support regeneration and improve the public realm	1		✓	

4.3. How did stakeholders expect schemes to achieve their outcomes?

The logical processes by which local stakeholders expected 20mph schemes to achieve their outcomes is set out in the logic maps in Section 3.3 (Figures 3-5).

Local stakeholders expected speed reduction and compliance to be achieved through a self-enforcement process, whereby, the majority of drivers adhere to the limit because they perceive 20mph to be an appropriate speed for the road environment and conditions. This then encourages or enforces other drivers to adopt a similar speed. They considered that providing a sufficient number of drivers actively comply, the approach should be effective in reducing average speeds and preventing excessive speeds, particularly where volumes of traffic are sufficiently high for this to happen.

Stakeholders hoped that over time driver behaviours and attitudes will change and compliance with 20mph limits will become the norm. However, many stakeholders were sceptical about the likely scale of change, as many drivers were already travelling close to 20mph and proactive enforcement activity was expected to be limited.

Stakeholders then expected a reduction in casualty numbers and severity to be achieved through a reduction in vehicle speeds (particularly those travelling fastest) and increased driver awareness of those walking and cycling. Walking and cycling was expected to increase as residents perceived the street environment to be safer due to vehicles moving more slowly. The benefits for walking and cycling were expected to be greater in larger schemes where pedestrians / cyclists are able to undertake a higher proportion of trip length on 20mph roads.

These changes were expected to reduce the proportion of trips made by private vehicle, smooth the flow of traffic (reducing stop-start driving), and reduce congestion; particularly in city centre and other congested areas.

In general, the widespread nature of area-wide schemes and the fact that the majority of traffic is expected to be travelling to/from home (in the case of residential schemes) or the city centre (in the case of two of the schemes) means that in most cases there are likely to be few alternative routes. As a result, the stakeholders did not expect schemes to lead to widespread displacement of traffic.

Noise benefits were expected to come from a reduction in average and excessive vehicle speeds, but there was uncertainty amongst local policy makers about whether lower speeds alone would improve air quality.

Health benefits were expected to come from fewer road casualties and an increase in active travel. Safer and more attractive local environments were expected to encourage more social interaction. Shopping and leisure activity were also expected to increase, especially where a scheme forms part of transport, public realm and other development initiatives to promote a city centre or commercial area.

Stakeholders generally anticipated that any adverse impacts would be minimal. The potential for slower journey times for some private and public transport journeys was acknowledged, but expected to be small as speeds were already in the low 20s on many roads, most schemes exclude strategic routes, and the roads affected were typically at the start or the end of most journeys (not affecting the main part of the trip). Bus and taxi operators were most concerned about this issue; and this was one reason why one of the case study schemes was not implemented (see Section 5.11.2 below).

4.4. Lessons and considerations for decision-makers

Clarity around strategic case, objectives and outcomes - Only a small proportion of case study schemes were specifically identified in the local authority's Local Transport Plans and related strategies. In addition, scheme objectives were often not clearly documented, with most authorities setting out the intended outcomes in a more descriptive manner on their website. Local authority officers often did not have a clear understanding of the relationship between lowering the speed limit and impacts associated with congestion, air quality and active travel (i.e. how exactly these outcomes might occur, in what contexts, and the scale of likely change), reflecting the limited research evidence available at the time.

Appropriate consideration and articulation of the strategic rationale for the scheme, the objectives to be delivered, and intended outcomes is a key requirement for ensuring any intervention is effective and delivers maximum value. In the case of 20mph limits, such an approach is important in terms of:

- understanding the extent to which schemes can contribute to policies relating to transport, health, environment, local economy and local communities;
- identifying opportunities to link the scheme with related transport and wider policy initiatives, as part of an integrated strategy to address broader policy objectives;
- identifying and ensuring buy-in from appropriate partners (including funding);
- establishing a common understanding of scheme benefits and what success looks like; and
- ensuring the right outcomes are monitored to determine whether the scheme has been successful.

This study substantially strengthens the evidence base that policy makers are able to draw on, but empirical evidence regarding wider impacts is weak (relating to the local economy, the environment and health) is weak, inconclusive, or complex, and there remains an evidence gap regarding the impact of 20mph limits on these areas.

5. How were schemes delivered and monitored?

5.1. Introduction

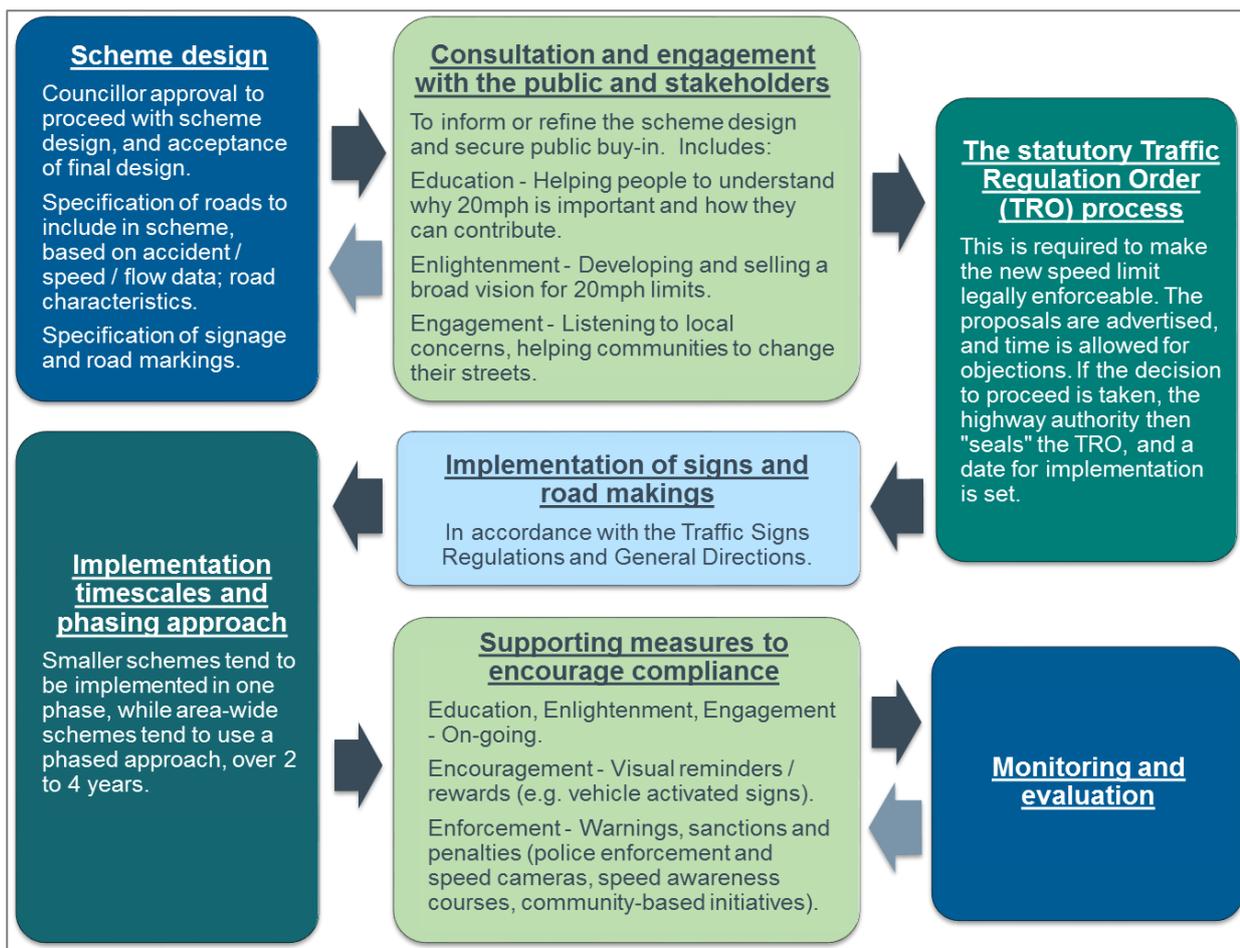
This chapter examines the scheme delivery process, looking at:

- how the 20mph limits were designed, implemented and monitored, delivery partners, and costs and funding sources;
- enablers and barriers affecting the process;
- levels of awareness amongst residents and drivers; and
- lessons and considerations for decision-makers.

5.2. Overview

The delivery process varied across the case studies but comprised a number of key stages including: scheme design and specification; engagement and consultation; statutory Traffic Regulation Order (TRO) process; implementation of the limit; supporting measures to encourage compliance; and monitoring and evaluation.

Figure 8. Delivery process for case study schemes



The categorisation of consultation and supporting measures to encourage compliance into Education, Enlightenment, Engagement, Encouragement, and Enforcement interventions (the 5 Es) is based on research undertaken by Toy, S (2012) on some of the early 20mph schemes implemented in the UK and Europe.

5.3. Scheme design and specification

Key elements of the scheme design process include location of the scheme boundary, specification of roads to include/exclude, and positioning of signs and road markings.

5.3.1. Location of scheme boundary

The smaller case study schemes use obvious urban features to identify the scheme boundary (strategic routes, rail lines, areas of green space, watercourses, etc.) to provide a clear distinction between roads with 20mph speed limits and those without. In the case of the Winchester City Centre scheme, the boundary has been kept tight around the city centre, coinciding with the historic city wall and also including the historical residential streets of Hyde, to encourage drivers to acknowledge a change in environment as they enter the 20mph limit and adopt a different driving style.

5.3.2. Specification of roads to include/exclude

Case study authorities used a range of criteria to determine which roads to include / exclude, including road purpose, traffic flow, existing speeds, accident history, presence of schools and high levels of pedestrian activity (e.g. commercial areas and community facilities), road environment and geometry, and public opinion. Data was collected through desktop research and surveys, supported in some cases by physical audits and professional input from local authority officers and the police, and consultation feedback.

All of the area-wide residential schemes exclude some roads, typically strategic routes (A and B roads), but in some cases also key bus routes, distributor roads, streets with non-residential frontages, and wider roads where compliance is expected to be low. This creates a different look and feel on roads with and without 20mph limits.

The two city centre schemes both comprise a blanket 20mph limit, which includes more strategic A and B-class roads with higher traffic flows.

In two case studies, consultation was central to the initial scheme design process and residents were asked if they wanted their streets included. The intention was to garner strong local support to increase the likelihood of self-enforcement. However, the exclusion of some roads can lead to inconsistency and potential confusion, with some roads remaining at 30mph and others changing to a 20mph limit, despite having similar characteristics.

Some authorities (e.g. Portsmouth) have kept in streets which were considered to be less suited to a 20mph limit, in order to avoid isolated 30mph roads and to provide consistency in signage and road user perceptions. This includes streets with higher average before speeds. Others have excluded streets with average speeds of more than 24mph or with known speeding issues. This reflects Circular 01/2013, which does not advise against, but suggests that where average speeds exceed 24mph the introduction of signage only is unlikely to lead to 20mph compliance.

Case study examples – Scheme design (Box B)

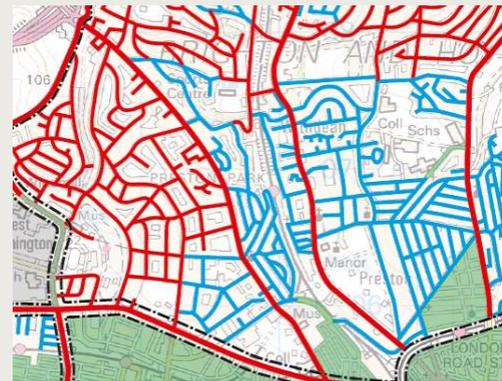
Winchester Stanmore – This scheme is part of a programme of nine pilot schemes spread across 10 districts within the county, intended to create a better environment and quality of life in residential neighbourhoods. The pilot areas were identified following assessment of 45 locations against the following criteria:

- Confined residential area (Y/N)
- Evidence of concerns or community support (Y/N)
- Character of the area (low speeds) (Y/N)
- Size of area (S,M,L) and number of entry points
- 20mph limit likely to require enforcement (Y/N/Part)
- Engineering measures likely to be required (Y/N/Part)
- Urban residential 30mph (Y/N)
- Indicative cost (H,M,L)
- Outcome of assessment (red/amber/green)

Consultation was then carried out, to determine whether the shortlisted areas were supportive.

Case study examples – Scheme design (Box C)

Brighton Phase 2 – Pre-implementation surveys were undertaken to determine the flows, speeds, casualties and the character of every single road in the city, to assess the appropriateness of a 20mph speed limit. Main roads and key arterial routes were generally excluded. This process was followed by a consultation exercise across the city to gauge overall level of support, followed by a second round of consultation where residents were asked whether they wanted their street / area to be included. Responses were analysed and some roads were left out.

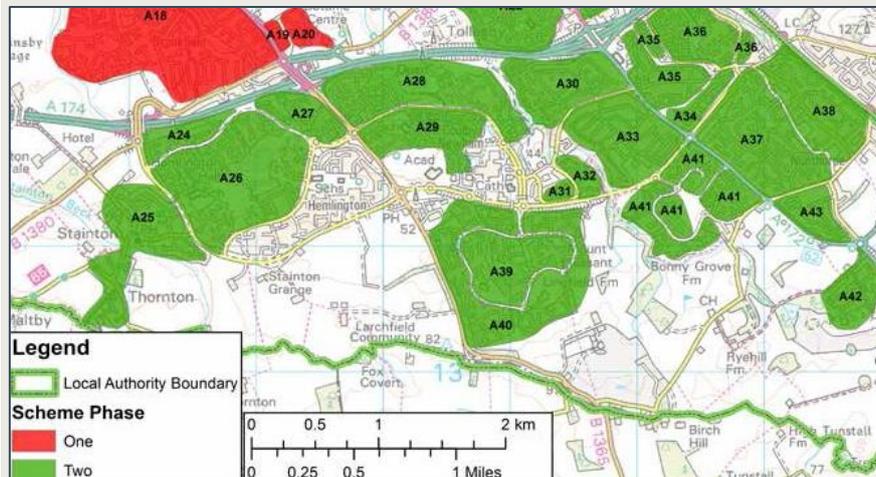


Blue = Roads reduced to 20mph speed limit;
 Red = Roads to retain existing speed limit.

Middlesbrough – For this scheme, the characteristics of all streets in the town were assessed, and clusters of streets to be covered by a 20mph limit were identified using the following criteria:

Characteristics of streets included within 20 mph speed limit	Characteristics of streets excluded from 20 mph speed limit
<ul style="list-style-type: none"> On-street frontages that do not have a strategic function. Have an existing speed limit of 30 mph. Average traffic speeds are 24 mph or less. 	<ul style="list-style-type: none"> Fronted by non-residential users. Residential streets with no direct frontage. Strategic Routes. Wide roads that are likely to encourage higher average speeds. Streets with speeding problems. Have an existing speed limit of 40 mph or above.

Within the green and red areas shown below, a blanket 20mph limit applies to provide consistency in the driving environment.



The overall level of support for introducing a 20mph limit in the various areas was determined by a vote at the end of local parish/community council meetings, with members of the public invited to attend.

5.3.3. Signs and road markings

Approach – Decisions on the type and location of signs are generally a desktop exercise based on the professional view of the officers involved, and / or a detailed on-street audit of every road. However, in some cases, the public have been involved in the decision about the type of signs to be used, and / or have participated in a walk-talk-build approach to determine where signs should be located.

Most case study authorities adopted a similar approach to signing (see Case Study Description Report – Supporting Technical Appendix), comprising post-mounted signs at the entrance to the limit area, and smaller post-mounted repeater signs within the area (at varying intervals). Some authorities use ‘20’

roundels on the carriageway, either at the entrances to the limit area (to increase awareness of the change in speed limit), or within the limit area at junctions or mid-way along streets (to remind drivers of the limit). Some schemes use red background or High Friction Surfacing (HFS) to increase visibility of the roundels.

A few schemes use '20' roundels instead of post-mounted repeater signs – to reduce sign clutter, lessen the environmental impact (particularly in historic areas), and to reduce implementation and maintenance costs.

Case study example – Signs and road markings (Box D)

*In **Winchester City Centre**, the historic nature and designated conservation status of the city centre presented a number of challenges. The narrow pavement widths dictated where signage could be placed, and the need to dig up pavements to install new signs proved a greater issue than anticipated due to the historical architecture found below. However, relaxation of signage requirements by the Department for Transport (in 2013) allowed roundels to be used as repeaters rather than traditional signs. This was an important factor in getting buy-in from local residents, who were already concerned about sign-clutter.*



Image taken from Google StreetView

Most schemes broadly reflect the requirements of the signing regulations of the time (TSRGD, see Chapter 2.2), but typically with some relaxations. For example, the requirement (at the time) for terminal signs on either side of the carriageway has not always been adhered to.

A number of authorities found that additional signing or changes to sign location were required, post implementation, to address issues around lack of awareness or visibility.

Case study examples – Signs and road markings (Box E)

Portsmouth – *The presence of on-street parking obstructed the visibility of some of the signs and limited the number of suitable locations for installation. During the early stages of the scheme, officer support was established to work with the Police and install any additional signage as necessary.*

Liverpool – *Following implementation, drivers and riders were stopped by the police for exceeding 20mph. A number stated they were not aware of the new limit and reported that signs were not large or prominent enough. The Council therefore increased the size of the signs to 600mm on roads over a set width and decreased the distance between repeater signs in areas where signage had not yet been implemented. The Council sought to keep street clutter to a minimum, but some residents felt the scheme had increased street clutter slightly.*

Nottingham – *The Council provided additional signage in the vicinity of a school to raise driver awareness, following concerns raised by the local councillor. Before the widespread implementation of 20mph limits, the existing 20mph zone was considered to be sufficiently visible to encourage drivers to react to the reduced limit. However, the introduction of a 20mph limit across the area was felt to have reduced the effectiveness of the 20mph zone and reduced driver awareness of the likelihood of children in the area.*

Cost saving approaches adopted by case study authorities include fixing signs to existing street furniture; repurposing old and unused posts from 20mph zone initiatives; and using stronger bolts to prevent removal.

Adequacy of signage – Just over half of all residents (55%²⁹) and non-resident drivers (56%) perceived the signage to be adequate in their local scheme, but around a third (34%) of both groups disagreed.

Levels of satisfaction varied substantial across locations and user group, from 42% to 82% (Table 15).

²⁹ 60% amongst drivers only.

Table 15. Perceived adequacy of signage vs. independent assessment of frequency and visibility of signing

Case study area	% of respondents perceiving signage to be sufficient		Independent assessment of frequency and visibility of signing ³⁰
	Residents	Non-resident drivers	
Calderdale	82%	79%	Moderate
Liverpool Area 2	65%	59%	Low-Moderate
Winchester Stanmore	62%	59%	Moderate
Brighton Phase 2	59%	61%	Low-Moderate
Nottingham	48%*	45%*	Moderate
Liverpool Area 7	47%*	61%	Low-Moderate
Brighton Phase 1	43%*	68%	Low-Moderate
Walsall	38%*	53%	Moderate
Middlesbrough	50%	46%*	Low-Moderate
Winchester City Centre	57%	45%*	High
Chichester	63%	42%*	High

Residents questionnaire (sample size varies from 110 to 214); and non-resident drivers questionnaire (sample size varies from 110 to 132).

Significant differences compared to Calderdale results marked with asterix (*). Percentages in grey are not significantly different to Calderdale.

However, residents / drivers' perceptions about signage adequacy do not reflect the independent assessment of frequency and visibility of signing undertaken by the study team. For example, in Winchester City Centre and Chichester a relatively low proportion of non-resident drivers (45% and 42% respectively) perceived signage to be sufficient, but in both cases the frequency and visibility of signing was categorised as 'high' as a result of the independent review. Entrances to the new 20 mph limit are marked by post-mounted signs (sometimes accompanied by '20' roundels marked on the carriageway on red backgrounds), and within the area 20mph roundels are located at frequent intervals. This suggests that other interventions (e.g. awareness campaigns) are also required to ensure road users are fully aware that a 20mph limit applies.

A common request amongst those who felt that the signage in their areas to be inadequate, was for larger, more frequent, and better positioned signage when entering a 20mph limit and on roads with on-going speeding problems.

Vehicle activated signs were generally felt to be more effective, because they are introduced for short periods only and moved around every few weeks.

Poster style signs based on children's drawings (Figure 9) were generally perceived to be effective as they appeal to people's emotions and draw attention to nearby schools and/or local children. However, they do not have the same legal status as the statutory signs so may be ignored, and can contain too much information which can lead to distraction. In addition, it was felt that over use of these types of signs could reduce their effectiveness.

However, a number of participants felt that, regardless of the level and types of signage, drivers switch off after a while and no longer 'see' the signs.

"We've got a lot of signs, but no one takes any notice"... "There is enough signage. People either stop seeing it, or are oblivious or ignore it"... "You could put a sign on every lamppost, people will still be oblivious to it"

³⁰ See Case Study Description Report.

Figure 9. Examples of customised local signs



5.3.4. Changes made to schemes post-implementation

None of the schemes has changed substantially since implementation. In one example, an authority added a road after community pressure following a child fatality, even though speed was not the cause of death.

5.4. Consultation and engagement

Consultation was a key aspect of all case study schemes to help determine initial scheme design; refine the design and secure public buy-in; and/or as part of the formal Speed Limit / Traffic Regulation Order process.

All authorities in the case studies gathered views from the public, stakeholders and community groups including schools, residents' associations, etc. Generally, authorities took a similar approach by displaying information publicly and online; using questionnaires to gauge support and opinion; holding public meetings (led by Council officers, the police and other delivery partners); and raising awareness through dedicated websites and the press. One authority employed an officer from Sustrans to work directly with residents to change attitudes towards walking and cycling; and another commissioned a public engagement company to support the council in developing, organising and hosting engagement, awareness and enforcement activities.

The quality of the consultation material was generally well received. Although only 29% of residents responding to the questionnaire could recall receiving information, the majority said that it was useful (77%) and thought the aims and objectives were well-presented (70%).

Case study examples – Consultation and engagement approaches (Box F)

Liverpool - The Council adopted a 'consultation first' approach to scheme design and delivery, which sought to put the people of the city at the heart of the campaign. A public engagement company was commissioned to develop a public engagement plan for local residents. This included high visibility engagement activities designed to raise awareness of the 20mph policy, build support for the initiative and encourage a culture of self-enforcement. Only once these events had been delivered and relationships built with the communities did the legal process of Traffic Regulation Orders follow.

At the outset, the council started a process of formal consultation with key stakeholders such as councillors and Merseyside Police.





At the same time, the Council set about identifying local influencers who could 'own' the 20mph campaign at a local level, who would understand where opportunities may exist to deliver promotion events, and who could quickly connect with the public. These included local councillors, key staff from local community hubs and grass root organisations, and local celebrities. Working with these groups, they established a series of events and activities which highlighted the campaign's purpose. These activities sought to develop a sense of community ownership of the 20mph scheme before the new limits were put in place.

The Council also worked closely with lead partners and citywide stakeholders to present the campaign as one which had a broad public sector base of support. This involved aligning engagement activities with those of the council, the emergency services, schools, health providers and road safety organisations.

In addition, a number of high visibility co-production engagement activities were developed with community organisations, schools and public services, based on their own ideas. Examples include:

- a mock trial of a speeding driver with the lower house of the School's Parliament, involving the Council and police;
- a debate with learner drivers, involving the Council and the police;
- an activity with young people and the public to develop a large artwork; and
- Kids Court – an activity which took a previously successful scheme developed the police and integrated a programme of engagement with a local school and community.

Various marketing and communication activities were undertaken, including substantial coverage in the local media and a feature on the BBC.

Social media was widely used, with updates provided via Facebook and Twitter, and via a blog on the Council website.

These activities were all integrated under a common brand and logo, which was widely promoted. For example, local businesses and organisations were encouraged to display the campaign logo on company vehicles. This included the Royal Mail and the local contractor responsible for implementing the scheme.



Images taken from: www.the20effect.com

Post implementation – The Council continued to run the campaign post implementation to reinforce messages about the speed compliance and the benefits of 20mph limits.

A Roadside Education Programme, supported by the police and local schools, was introduced whereby drivers travelling in excess of the speed limit were invited to take part in various education activities, rather than taking points on their licence. These included a roadside education bus, where they could go inside and watch a video explaining the differences of travelling at 20mph rather than 30mph; and a 'Kids Court', where a court situation was played out with children from local schools interrogating the offender. The Council would like to have continued these interventions but are currently unable to due to resource constraints.

However, regular updates are provided on social media, regarding the latest 20mph news and events. This includes interviews with taxi drivers about why they support the 20mph limit, news about local businesses actively supporting the limit, interviews with business and community leaders about their daily commute on foot and by cycle, and information about cycle routes throughout the city.

Portsmouth – In Portsmouth, the consultation approach focused on use of local / national media and community involvement. This proactive approach received positive feedback from the public, and minimal complaints about a lack of information. In summary, the process included:

- Consultations with Neighbourhood Forums and residents' associations;
- Publishing statutory advertisements and articles in the local paper;
- Recording television and radio interviews locally and nationally;
- News flashes on the council website and intranet site;
- Including the FAQ website link in the Traffic Regulation Order (TRO);
- Exhibition of plans and posters in all schools and public buildings;
- Engagement with local schools; and
- Distributing plans and leaflets at the council offices.

Community engagement involved close liaison with the local schools. Each child was sent home with a publicity leaflet showing which roads in their sector would be affected, responses to Frequently Asked Questions (FAQs), and contact details. This was supported by large posters placed in school halls. Posters and leaflets were also placed in doctors' surgeries, libraries, and shopping centres, etc. At the same time, the scheme received considerable publicity in the local press and the local radio based on interviews with councillors. A dedicated phone line was set up to answer queries on the scheme.

Other consultees included the Police, Fire & Rescue Service, Central Ambulance Control, utility companies, public transport operators, Freight Transport Association, Road Haulage Association, the Royal Mail, and the Cycle Forum.

See Case Study Description Report – Supporting Technical Appendix for further information on consultation approaches adopted.

5.5. Speed Limit / Traffic Regulation Order (TRO) process

Under Section 84 of the Road Traffic Regulation Act 1984, local highway authorities are required to implement a Traffic Regulation Order (TRO) to make a new 20mph speed limit legally enforceable.

Statutory consultees, relevant stakeholders and the public are consulted and the TRO must be published in local newspapers and throughout the community. In the case of permanent orders, at least 21 days must be given for consideration of proposals and formal objections. Objections are considered, and a decision to proceed or not is taken. Where an authority implements an order regardless of objections, an application to review the decision can be made to the High Court.

The TRO is enforceable from the date it is signed. New signs and road markings must be implemented by this date. A TRO can be delivered within 6-8 weeks, but objections can lead to lengthy delays. Early community engagement generally helps to minimise objections. If subsequent changes are made to the scheme a new TRO is required, but removing roads will not trigger this process.

None of the implemented case study schemes reported to have received substantial objections, possibly due to the comprehensive approach to consultation that most appeared to adopt.

A number of case study authorities combined the TRO statutory consultation with the wider public consultation, to streamline the council decision-making process. Another authority included all non-A and B roads in the statutory consultation process, and subsequently refined the list in light of residents' objections. This avoided the risk of having to include additional roads at a later date, and re-do the TRO.

5.6. Implementation timescales and phasing approach

Smaller case study schemes tended to be implemented in one short phase, while large-scale schemes were phased over two to four years. There were a number of benefits to this latter approach, including implementing lessons learnt, gauging public reaction and spreading the funding and resources. However, it can lead to prolonged timescales between consultation / engagement and implementation, which can cause public confusion and uncertainty. In one case study area, the length of the gap meant that the community engagement team had to re-visit the area to remind residents what was happening and why. In other case studies, the sub-areas were kept relatively small allowing scheme to be rolled out quickly on a continuous basis.

Roll-out varied. Some authorities prioritised areas with the highest accident rates, while others started where resistance from the public and council members was expected to be lowest. In one case, the Council implemented the city centre area last, as they anticipated this to be the most controversial phase. However, officers reported that early implementation of the city centre area would have raised awareness of 20mph scheme more quickly.

5.7. Supporting measures to encourage compliance

Research undertaken by Toy, S (2012) on some of the early 20mph schemes to be implemented in the UK and Europe categorises supporting measures into the '5 Es' (Figure 10).

Figure 10. Supporting measures to encourage compliance (the 5 Es)

Education	<ul style="list-style-type: none"> • Helping people to understand why 20 is important and how they can change their driving habits
Enlightenment	<ul style="list-style-type: none"> • Developing a broad vision for 20mph and selling the vision to win over residents, visitors, employees and employers
Engagement	<ul style="list-style-type: none"> • Listening to local concerns, helping communities to change their streets
Encouragement	<ul style="list-style-type: none"> • Visual reminders and rewards for keeping to the limit and driving considerably (e.g. vehicle activated signs in 'problem' locations)
Enforcement	<ul style="list-style-type: none"> • Warnings, sanctions and penalties for breaking the limit or for anti-social driving (Police enforcement and speed cameras, speed awareness courses, community-based initiatives)

Evidence from the case studies shows that authorities have adopted a range of approaches to encourage self-enforcement of 20mph limits, covering the 5Es highlighted above (see also Case Study Description Report – Supporting Technical Appendix).

5.7.1. Education, enlightenment, and engagement

These interventions commence during the scheme design stage (see Section 5.4); but in around half of the case studies, they have continued post implementation to reinforce messages about why 20mph is important and how they can change their behaviour. Liverpool has been particularly active in this context with its on-going community engagement campaign. In West Sussex, a Sustrans officer was employed to work directly with residents in Chichester to influence driver behaviour and change attitudes towards walking and cycling (Box G).

Case study example – Post implementation engagement activity in Chichester (Box G)

Chichester – Following implementation of the 20mph limit across the city, sustainable transport charity Sustrans spent just under a year working in partnership with West Sussex County Council to deliver a behaviour change project in Chichester around the subject of 20mph. The aim was to improve social attitudes towards 20mph with the added benefit of leading to a reduction in traffic speeds. This was done through a programme of community engagement, education, and social media and marketing. Recognising the importance of linking in with proactive members of the community, recruiting and engaging with 20mph champions was a high priority. The key messages of the project were all positive around how much more pleasant the local environment would be and what the residents could do because of the 20mph being introduced, rather than negative messages around road safety.



Schools – The 20mph project ran alongside the Bike It Programme which has been available to schools in the local area since July 2013. This created some direct links into schools that were already engaged with Sustrans, and produced a gateway into local community work too through parents, staff and local residents.

Interventions included road safety and speed awareness lessons, teaching materials, and branded merchandise / safety equipment.

Wider community engagement – *Sustrans worked alongside community groups to promote the 20mph message and to help local residents become advocates for the project. A number of areas were highlighted by the traffic surveys as still having non-compliance with the lower speed limit, and so these were selected as focus areas. Community engagement was used to enthuse local residents to take ownership of where they lived and encourage lower speeds to improve their living environment.*

Street design and street closures – *There was an interest in how improving the local area would affect traffic speed and the resident's likelihood to use outside space for walking, cycling and playing. The Council worked with the 20mph project to improve an underpass which was discouraging local residents from walking and cycling. In addition, the community worked with the 20mph project to rejuvenate a play area in Charles Avenue, where parents said they did not feel confident letting their children play due to the higher speed traffic and the unmaintained state of the play area. This in turn could have contributed to the increase in speed, as the drivers didn't see children playing in the local area.*

A key part of the project was about creating a legacy that residents could continue on after the project had finished. Sustrans worked to develop Temporary Play Street Orders (TPSO) allowing temporary closures of streets for play activities, and to give the local community something to lead on. See Box Z for further information.

Hedgehog March – *One of the most successful elements was the Hedgehog March. Primary school children created and decorated cardboard hedgehogs displaying 20mph safety messages. The hedgehogs were then placed in the windows of local businesses. Over a three week period, the hedgehogs moved every few days to a new location nearer to the city centre, eventually congregating at the Council Offices, coinciding with a parade through the city centre by 110 primary school pupils with 20mph flags, for a presentation, talks and radio interviews. During the march, the 20mph twitter and Facebook accounts were used to post videos and photos of the locations of the hedgehogs so that local families could follow their progress. The project proved an effective way of engaging with local businesses, to spread the 20mph message but also to engage more thoroughly with social media to a wider audience.*

Working with over 450 children meant that the total audience was much larger with many children talking to their parents and families about the associated lessons.

Multi-agency collaboration – *At the start of the project there was a feeling of isolation from other activities, departments and organisations within Chichester. However, it soon became apparent that there were lots of different organisations that were all carrying out work in very similar areas, many of which could be tapped into. The most successful link was with the Chichester "Community Operations" Team, who already have established links with the local area and knowledge of the issues, and meant that the 20mph project could jump straight into areas of Chichester which were proving hard to get a foot hold in.*

5.7.2. Encouragement

In addition to standard post-mounted signs and carriageway markings, five of the case study authorities use vehicle activated signs as a visual reminder to encourage compliance. These activate if an approaching vehicle is detected to be exceeding a pre-set speed threshold. The speed limit, the speed of the passing vehicle, and/or a warning message illuminate on the sign to remind the driver/rider to slow down. The signs are normally installed on a temporary basis and rotated around 'problem' sites, but permanent signs have been installed where problems are expected to persist.

One local authority is considering implementing vehicle activated signs which use automatic number plate recognition (ANPR) technology to display the vehicle registration number of speeding vehicles, along with a warning to drivers telling them to slow down. Information could be provided to the police to enable them to target enforcement activity at repeat offenders. ANPR cameras have been successfully trialled on the strategic network (A and B roads), but would represent a costly solution in 20mph areas.

5.7.3. Enforcement

Warnings, sanctions and penalties for exceeding the limit include:

- formal enforcement by the police, with offending drivers issued a fixed penalty notice (with a fine and penalty points), invited to attend a speed awareness course (if available), or summoned to appear in Court;

- use of fixed speed cameras;
- community speed watch programmes supported by members of the public; and
- other community-based initiatives.

Police enforcement – Evidence provided by the case study authorities suggests the level of enforcement has been low across all of the case studies. In most cases the police adopt the same approach to enforcement of 20mph limits as they do for 30mph roads. This typically means that they may respond to complaints about repeat offenders, but do not undertake a more routine and untargeted approach to enforcement. This reflects Association of Chief Police Officers (ACPO) guidelines on speed enforcement (see Section 2.3), expectations that 20mph limit-only schemes are expected to be self-enforcing (in accordance with Circular 01/13), and resource constraints (financial and staffing) within the police service.

Case study example – Police enforcement (Box H)

Calderdale – One example of a more proactive approach to enforcement is Operation Hawmill, which was launched in 2016 to focus on tackling offences most likely to contribute to a fatal road traffic collision (drink/drug use, speeding, using a mobile phone whilst driving and not wearing a seatbelt). The operation runs twice a week and targets nuisance motorists and dangerous drivers in areas where most complaints are received (including the Siddal and Southowram 20mph case study areas).

Updates on police activity in an area are posted on the 20mph 'Love Our Streets' Facebook page so that residents get up to date information on the action that the police are taking about speeding and anti-social driving. Between 01/06/2017 and 31/01/2018 34 tickets were issued for speeding in 20mph areas.

For 2018, £20k has been allocated by the police and match funded by Calderdale Council. The initiative supported by the Calderdale Road Safety Partnership will see all partners working closely to address the issues and look to further improve road safety across the district.

Fixed speed cameras – In general, fixed speed cameras have not been used in the case study areas. This is partly due to the cost of buying and maintaining the equipment; but also because they are seen as being most appropriate for enforcing limits in casualty-led scenarios. Most of the 20mph limits in the case study schemes have low casualty rates, and the use of fixed speed cameras is expected to be contentious.

Average speed enforcement (ASE) cameras work using automatic number plate recognition (ANPR) technology are now permitted in 20mph areas, but there are currently very few in operation on 20mph roads nationally (Jenoptik, 2017).

Speed awareness courses – In three case study areas, local speed awareness courses have been developed, which operate on a local basis only. However, lack of funding and resources to deliver these courses has affected their on-going availability.

A National Speed Awareness Course for 20mph Zones and Limits (NSAC 20) is currently being piloted and could fill this gap if rolled out more widely.

National Speed Awareness Course for 20mph Zones and Limits (NSAC 20)

In January 2014, the National Driver Offender Retraining Scheme (NDORS) introduced the National Speed Awareness Course for 20mph Zones and Limits (NSAC 20) for police forces in England, Wales and Northern Ireland to adopt if they wish. The course is class room based and lasts for three hours. It enables the police to target the newness, unawareness and unintentional behaviour that can be reasonably associated with the enforcement of 20mph limits or zones.

During 2014, there were 1,380 drivers who attended the National Speed awareness course, increasing to 34,471 in 2017. This course is currently being run as an interim course for between two and three years, and is being fully evaluated.

Community-based initiatives – Community Speed Watch (CSW) or similar interventions have been used by at least three of the case study authorities and considered by at least two others. CSW is a locally driven initiative where active members of the community join together with the support of the police to monitor speeds of vehicles using speed detection devices. Vehicles exceeding the speed limit are referred to the police with the aim of educating drivers to reduce their speeds. Volunteers receive appropriate training, and are supported by neighbourhood policing team (NPT) staff. Offenders can be sent a warning letter, a fixed

penalty notice or invited to attend a speed awareness course. Speed detection equipment is sometimes funded by the police, but in other cases local communities are required to provide the necessary funding. A police officer is required to accompany volunteers at the roadside, and also issue letters.

Lack of staff and financial resources to manage the intervention and provide the necessary equipment are identified as barriers in a number of case studies, and has prevented the intervention going ahead in two cases.

Case study examples – Community Speed Watch initiatives (Box I)

Portsmouth – There are three police-supported schemes in Portsmouth. Three resident volunteers are required to run each event: one to operate the equipment; one to record speeds; and one to verify speeds. Afterwards, a resident has to take the data to the police station and upload it to a database. Furthermore, the police has to be notified when a session is going to be run as residents can't go out on an ad-hoc basis, at short notice. Resident support in the three areas has been poor, and the number of sessions held has therefore been low. Nevertheless, when they have been run, they have been well received by local residents. Some of the more successful schemes in the city have been run by the Safer Neighbourhood Teams.

Nottingham – Here the police have sought to reduce resource requirements by asking volunteers to visit the police station to write and send letters. Automatic warning signs have also been used to encourage motorists to slow down, and action is only taken against repeat offenders, excessive speeds or unsafe driving. In most cases the warning signs encourage compliance and limit administration.

Tiered approach to encouraging compliance – Most of the case studies adopt a range of measures to encourage compliance, which involve gradually increasing the level of intervention where speeding problems persist. Where compliance issues continue to persist, installation of physical traffic calming measures have been identified as a last resort by some authorities.

Case study examples – Tiered enforcement approach (Box J)

In **Middlesbrough**, it is recognised that changing driver's attitudes and behaviours is not going to happen overnight. The Council uses speed detection radar (installed on street furniture for a week) to monitor speeds on streets with high average speed pre-implementation and those identified by the public as having speed issues. Appropriate speed enforcement measures are then introduced on 'problem streets'.

- Level 1 – If average speed data indicates that speeds are an issue on a particular street, additional signing and markings are installed.
- Level 2 – If further speed surveys show there is still an issue with speed, vehicle activated signs are temporarily installed (typically for a month) to reinforce the 20 mph limit.
- Level 3 – If these temporary signs fail to have the required impact on reducing speeds, consideration is given to undertaking Community Speed Watch, with offenders receiving advisory/warning letters from the police rather than fines and penalty points.
- Level 4 – If all of the above measures are unsuccessful, the Council will consult with stakeholders in the local area/streets of concern to determine levels of support for reverting the 20 mph speed limit back to 30 mph or introducing physical traffic calming measures. At the time of interview, there had been no instances of this level being reached, however, one road had been subject to continuous speed issues and the Council were considering installing permeant speed activated signs, which would be joint funded by the parish council.

These activities, alongside working with local schools, are intended to help to reinforce the message that driving at 20mph in residential areas is fast enough.

In **Portsmouth**, three speed detection radar are used to monitor speeds over a two-week period, in locations where residents have raised concerns about speeding. Since July 2013, when the units were purchased, data has been collected at more than 80 locations. Where more than 70% of vehicles are found to be travelling at >24mph, various options are considered to reinforce the 20mph limit. These include:

- Additional white '20' roundels on the road – to provide psychological traffic calming.
- Temporary vehicle activated signs for up to a month. These can achieve quite substantial reductions, for short periods, but locations need to be revisited to maintain benefits. However, due to the volume

of requests, the council has a policy of not returning to the same locations within three years unless there is a safety concern raised by the police or a fatality occurs.

- *Community Speed Watch.*
- *Education and Enforcement Days where speeding continues to be a problem - although pressure on police resources means that the Roads Policing Unit is no longer able to support this initiative, and the Neighbourhood Police Teams have been unable to resource instead.*
- *Physical traffic calming – as end resort only. This can be controversial, as local residents were often found to be against traffic calming during the initial consultation phase. It is also very expensive, typically costing £80k per street. The council currently implements physical calming on one or two streets a year.*

5.8. Monitoring

Case study authorities all recognised the importance of monitoring outcomes, but were required to tailor their approach to the funding and resource availability. They primarily focused on monitoring changes in speed, flow and collisions.

Before and after **speeds** and **flows** were monitored using inductive loops or speed detection radar to measure spot (instantaneous) speed and flow across a sample of locations³¹. See Section 3.4.7 for further information.

Where vehicle activated signs have been employed this provides a further source of evidence, but for a limited number of locations only and on the basis that the presence of the signs may skew driver behaviour.

A few case study authorities have undertaken additional post-implementation surveys to monitor roads where speeding is reported to be an issue. In Portsmouth, complaints about speeding are still the most common complaint received by the Council from the public, eight years after implementation. The Council therefore have an on-going programme to monitor speeds on roads where complaints have been received by the public, and roads with the highest speeds are shortlisted for further treatment. Similarly, in Middlesbrough, the scheme attracted a lot of public and media interest, and additional post-implementation surveys were undertaken to address concerns raised.

Monitoring of **collisions** is based on validated STATS19 data provided by the Department for Transport, or local datasets.

Post implementation **questionnaire surveys** were undertaken in two case study areas (Portsmouth and Chichester³²) focusing on attitudes, perceived changes in driving behaviour, and self-reported change in walking and cycling activity.

None of the case study areas undertook before and after **pedestrian and cycle counts** (although after counts were undertaken in Brighton Phase 2 area). This was partly due to cost, but also concerns about the likely robustness of the data and difficulties of attributing any change to 20mph speed limits.

5.9. Key delivery partners

The design and delivery of the case study schemes was local authority-led in all cases. This was generally the highway authority, however, in one case the County Council delegated the process to the second tier City Council, due to lack of appropriate staff resources.

In most cases the local authority was supported by other partners, including the police, and in a small number of case studies, the Public Health Department or Primary Care Trust. Local authority officers also worked with schools and other public sector organisations, pressure groups, community groups, and local businesses as part of wider community education and awareness initiatives.

³¹ The one exception was Nottingham (Bestwood) where resource challenges meant that 'after' monitoring did not take place, although before and after monitoring was undertaken in other parts of the city.

³² A similar survey was undertaken in Calderdale, but did not cover the case study area.

Table 16. Key delivery partners and roles

Key partners	Roles
Councillors	<ul style="list-style-type: none"> • Approval for officers to proceed with scheme design • Promoting the case for / against the need for a 20mph limit in response to issues raised by the local community • Attending public meetings and exhibitions and supporting consultation and information-sharing activities • Scrutiny of options, approval of final scheme design and sign-off of TRO.
Police	<ul style="list-style-type: none"> • Advice on roads to include / exclude • Attending public meetings and exhibitions and supporting consultation and information-sharing activities • Formal and targeted enforcement, in line with the approach for 30mph limits (all case studies) • Working with the council to deliver roadside speed education and speed awareness courses for speed limit offenders
Fire & Rescue Service	<ul style="list-style-type: none"> • Working with the council to deliver community engagement, roadside speed education and speed awareness courses for speed limit offenders
Primary Care Trusts, Health Partnerships	<ul style="list-style-type: none"> • Part funding of scheme • Promotion of active travel benefits of scheme

5.10. Costs and funding sources

Funding sources – The majority of schemes were funded from local authority transport budgets – generally the Local Transport Plan fund, but also the Local Sustainable Transport Fund. Two schemes also had substantial contributions from the health sector. In one case the local authority’s Public Health Department funded 40% of the scheme cost via ring-fenced Public Health funding, and in another the local Primary Care Trust funded 40% of the scheme cost (focused on the public engagement element). A further scheme was funded using planning obligations from local developers³³.

Scheme costs – The cost of the schemes ranged from £10,000 to £1.7 million, with larger schemes generally having higher implementation costs (see Table A-1).

Case study authorities were asked to provide details on areas of spend, and the proportion spent pre-, during, and post-implementation. Detailed costs were provided for six of the case study schemes, but in a range of formats and levels of details. Many authorities struggled to provide precise costs for the case study areas, particularly for area-wide schemes where implementation phases overlapped; and were also unable to quantify the amount of staff time spent on the scheme.

The most costly elements were:

- staff costs (mentioned by two case studies), and;
- costs associated with signs and carriageway markings, including sign production, road painting, and labour costs (mentioned by four case studies).

Costs for signs and carriageway markings were provided by both of the small-scale residential schemes, equating to £1600 per kilometre for each scheme. Both were categorised as ‘moderate’ in terms of frequency and visibility of signing (see Case Study Description Report – Supporting Technical Appendix). Information provided for some of the larger area-wide schemes suggest a substantially lower unit cost, but it is unclear whether labour costs are included.

³³ Planning obligations, also known as Section 106 agreements (based on that section of The 1990 Town & Country Planning Act) are private agreements made between local authorities and developers and can be attached to a planning permission to make acceptable development which would otherwise be unacceptable in planning terms.

Consultation and engagement activities prior to implementation, were also identified as a key cost. Estimates of £250,000 and £300,000 were given for some of the larger area-wide schemes, with costs relating to the whole city rather than just the area covered by the case studies.

Case study examples – Scheme costs (Box K)

Walsall (small-scale residential scheme) – This scheme comprises 5.8km of new 20mph limit. Total spend was £21,500, excluding staff costs. Overall:

- 13% (£2,750) was incurred pre-implementation (data collection; consultation; TRO process);
- 45% (£9,590) during implementation (signs and lines / markings); and,
- 43% (£9,180) post-implementation (awareness activities; vehicle activated signs and speed awareness course; and monitoring).

The gateway signing / lining (including high friction surfacing) was the highest cost element during the implementation phase. Consideration was given to illuminating the gateway signs, but was rejected due to the high capital cost and on-going maintenance costs.

Post-implementation, most of the cost (~£7,000) relates to the use of vehicle activated signs and the development and implementation of a speed awareness course. This was a shared cost with the police. Post-implementation engagement and awareness activities were funded from the road safety budget (~£1,000), with the remainder (~£13,400) coming from the LTP allocation.

Nottingham (large area-wide scheme) - This scheme comprises over 500km of new 20mph limit across the city. Total spend was £1.7million. Overall:

- 44% (£740,000) was incurred pre-implementation (data collection, £50,000; detailed design, £210,000; consultation and engagement, £300,000; TRO process, £180,000);
- 56% (£950,000) during implementation (signs and lines / markings, £250,000; removal of redundant signs; electrical work; labour; etc.); and,
- 1% (£10,000) post-implementation (awareness activities).

The cost was higher than expected due to a number of reasons:

- the final scope for the scheme was not known until the initial consultation was completed;
- the cost of removing redundant signage on street and resigning junctions (as part of a commitment to remove sign clutter), and the associated electrical costs, were more than anticipated;
- increases in unit rate construction costs.

The scheme was primarily funded through the Local Sustainable Transport Fund.

Detailed cost information was provided for three area-wide residential schemes. In each case, the majority of costs were incurred before and during implementation, accounting for between 80% and 99% of total spend. In general, budgets for on-going monitoring and engagement activities were not clearly identified and sourced at the outset, and were ultimately affected by council budget cuts. Planned monitoring and engagement activities therefore had to be substantially reduced.

Feedback from officers in Portsmouth, the first of the case study schemes to be delivered, is that there has been a substantial number of complaints about on-going speeding issues, since the 20mph limit. This is still the most common type of complaint which the council's Transport Road Safety Team receive from the public, and a substantial amount of officer time is required to respond to issues raised. In addition, the council have purchased three speed detection radar units, which are used to monitor speeds on roads where complaints have been received. Since 2013, data has been collected for over 80 roads.

5.11. Enablers and barriers to delivery

Local authority stakeholders (mainly council officers) were asked to identify and rank enablers and barriers which affected the extent to which schemes were delivered to the anticipated quality, programme, and cost, and were accepted by the public.

Figure 11. Enablers and barriers affecting scheme delivery

Enablers	Barriers
<ul style="list-style-type: none"> • Early engagement and buy-in from other stakeholders, including cross-party support from councillors (8,3)** • Clear articulation of scheme rationale, objectives, and outcomes (6,0) • Tailoring the scheme to local circumstances (4,2) • Pro-scheme campaign group (3, 1) • Complementary initiatives (3,0) • Phased but efficient implementation of large area-wide schemes (2,0) • Guidance and policy documents from other policy areas (1,0) 	<ul style="list-style-type: none"> • Limited funding and staffing resources (9,4)** • Scheme opposition (8,1) • Confusion about the enforcement role of the police amongst the public and in the media (8,1) • Political change (3,1) • Lack of / confusing evidence regarding the benefits of 20mph limits (2,0) • Issues relating to government leadership and guidance, needed to justify schemes (1,0) • Practical delivery issues (4,0)

** Most frequently mentioned barrier and enabler.

Numbers in brackets represent the number of case studies mentioning barrier / enabler, and number identifying this as the most important barrier / enabler. Information on ranking was obtained for 10 of the 12 case studies.

5.11.1. Enablers to delivery

Early engagement and buy-in from stakeholders, including cross-party support from local councillors – This was the most frequently mentioned enabler (8 schemes), and identified as the most important factor for three of the schemes. This helps to minimise objections from the local community and businesses (crucially at TRO stage), secure support in scheme delivery from potential partners, enables the scheme to be delivered quickly, and increases public acceptance of the new limit.

This chapter has already highlighted how councillors, Public Health representatives, the Police, and Fire and Rescue supported the delivery process in terms of funding contributions, providing inputs into the scheme design process, attendance and facilitation of consultation events, participation in awareness / education activities, and support for wider enforcement activities. The Liverpool case study provides a particularly good example of a high profile public awareness and education campaign, involving schools and local community groups; and use of social and conventional media. Both the Liverpool and Chichester case studies demonstrate the value of identifying local influencers (residential and community leaders) to ‘champion’ the 20mph limits.

Cross-party support from councillors is also important in terms of smoothing delivery. In one case, the identification of the scheme in the local party manifesto provided a powerful mandate for delivery.

Clear articulation of scheme rationale, objectives, and outcomes, supported by a robust evidence base / tailoring the scheme to local circumstances – A number of authorities highlighted the benefits of upfront planning and research, to encourage buy-in and respond to questions from stakeholders and the public. The reasons for implementing a 20mph limit scheme and the benefits expected need to be clearly articulated to the public.

Tailoring the scheme to local circumstances - Getting the scheme design right for the area is also crucial in securing public support. This includes locating signs where they are clearly visible, appropriate frequency of repeater signs and size of carriageway roundels, appropriate decisions about roads to include / exclude, and integration with other local initiatives and campaigns relating to transport and other policy areas.

A vocal and active pro-scheme campaign group – To reinforce consultation and engagement activities of the local authority and other key stakeholders. This was a key enabler in three schemes, and the most important factor in one scheme.

Case study example – Active pro-scheme campaign group (Box O)

***Chichester** – Strong community and councillor support, led by a vocal and proactive campaign group were the critical success factors in Chichester. The scheme was developed in response to a campaign by ‘20s*

Plenty for Chichester' and ChiCycle, a pressure group which aims to improve cycling infrastructure and encourage cycling in the city. The campaigners were able to dedicate sufficient time to run a very effective campaign, which resulted in support from over 2,916 members of the community, with many letters of support received from schools, resident associations, health organisations and churches. In addition, the scheme complemented the Council's focus at the time on promoting walking and cycling, and coincided with the coalition party's 'big society' ideology which gave the campaign further momentum and provided the Council with an opportunity to demonstrate its ability to work with the local community. This combination of factors led to the successful implementation of the scheme.

Other initiatives focused on safety, active travel, health and well-being, and the environment (complementary initiatives) – One scheme benefitted from school travel plans being updated at the same time, which enabled consultation to be integrated and helped reinforce messages about safety, active travel and associated benefits. Another authority felt the implementation of complementary initiatives such as cycle lanes and safer routes to schools helped support the decision to introduce an area-wide 20mph limit scheme.

Phased but efficient implementation of large area-wide schemes – To help spread resources and costs, apply lessons learned and demonstrate early successes to the public. However, prolonged timescales between consultation / engagement and implementation can cause public confusion and uncertainty, and increase costs if engagement activities need to be repeated. See Section 5.6 for further information.

Guidance and policy documents from other policy areas – To demonstrate the role 20mph limits can play in delivering wider benefits. One authority specifically referred to guidance published by NICE (National Institute for Health and Care Excellence) on the potential role of 20mph limits in improving health (NICE, 2012).

5.11.2. Barriers and challenges to scheme delivery

Funding and staffing resources – The most frequently mentioned barrier was 'limited funding and staffing resources', for design, delivery and post implementation activities (engagement, enforcement-related interventions, and monitoring). This was identified as the most important barrier for four of the case studies.

Several case study areas reported that council funding cuts had reduced the availability and skillset of staff to design and deliver schemes, resulting in slower delivery than intended. One authority had to scale down its programme of pilot schemes due to insufficient funding. Several officers mentioned that more funding and resources pre-implementation would have enabled more public engagement to be undertaken to ensure residents understood why the schemes were being introduced and to reduce public opposition.

A particular challenge for authorities is that the scope of the scheme (in terms of roads included / excluded) can be difficult to finalise before consultation has been completed, leading to uncertainty about costs relating to the TRO process, signs and markings, and any removal of existing signs. Furthermore, strong opposition can substantially increase the costs associated with engagement activity and the TRO process.

Lack of funding for post-implementation activities appears to have had more of an impact. One authority had to substantially reduce its intended programme of post-implementation education and awareness activity; and were unable to maintain the high profile achieved during the pre-implementation period. Others were able to allocate only minimal funding to post-implementation activities.

Identifying funding and suitable police resources for Community Speed Watch interventions has been a particular challenge, resulting in only limited roll out of these initiatives across the case studies.

At least half of authorities reported that funding cuts meant they had to scale down post-scheme monitoring. One authority had to abandon post-scheme monitoring altogether in the case study area, although they did undertake before and after monitoring in other parts of the city. Others struggled to find resources to properly analyse and report on the data collected; resulting in uncertainty about the effectiveness of the scheme.

The design and implementation of 20mph limit schemes is typically led by transport planners, often road safety officers or highway engineers. However, one authority cited a need for more staff with behavioural change skills to deliver educational campaigns and influence public attitudes.

Scheme opposition / active anti-scheme groups – In general, public opposition to schemes was low. However, in a few areas, anti-lobby groups hampered efforts to secure public support, prolonged delivery and increased pressure on staff resources. Concerns focused on the impact of the scheme on journey times, issues of sign clutter, and whether the scheme represented good use of council money. In one authority, the taxi trade opposed the scheme publicly and loudly, due to concerns that the changes would negatively affect their journey times, and consequently their trade. In another authority, many of the residents were ‘pro-car’ and were initially against the scheme, putting pressure on the council to provide evidence to demonstrate the benefits and counter their arguments.

In the case of one of the ‘no schemes’ a strong, well-organised anti-campaign resulted in the proposed scheme not going ahead. The Council concerned was not able to provide evidence to clearly demonstrate the scheme rationale, objectives and outcomes, and ultimately were not able to secure buy-in from key stakeholders. The scheme in question was proposed to local councillors by a section of the local community, following the favourable outcome of a 20mph consultation exercise for a nearby town. It was a community-led rather than transport-driven scheme designed to address a specific or strategic transport need. A strong anti-lobby emerged, which had the backing of local businesses (including the local bus operator) and were able to dedicate more time and resources to the campaign than the pro-scheme groups. See text box below for further information.

No scheme example – Active anti-scheme campaign (Box L)

The proposed scheme would have involved a town-wide 20 mph speed limit for residential roads, excluding A and B roads, and some local distributor roads. Streets known to have existing speed limits in excess of 24mph were excluded from the initial scheme design, unless they were surrounded by streets with speeds of less than 24mph.

The scheme was proposed to local councillors by a section of the local community, following the favourable outcome of a 20mph consultation exercise for a nearby town. In line with the council’s policy to only pursue 20mph schemes where there is evidence of strong interest from the local community, local Councillors agreed to progress with a town-wide consultation exercise to determine the level of public support. Opinions were divided within the town with both pro- and anti-scheme lobby groups emerging.

The pro-group promoted the scheme as an effective way of making roads safer for children, older people, those with disabilities, pedestrians, and cyclists; promoting use of active travel modes; and delivering quality of life and community benefits. However, the anti-campaign challenged the perception that the scheme would deliver road safety benefits, and accused the pro-group of ignoring hard evidence.

Following a three-month consultation period, 69% of respondents voted against the scheme – based on a 25% turnout – and the proposal was rejected. The vote, however, was tied for under 18s, and varied greatly across the town. Suggested reasons for the no vote are summarised below:

- *The anti-campaign was very well organised, with backing from the local bus operator and other local businesses. They took each of the pro-campaign’s claims, and countered them vociferously with local evidence.*
- *The local bus company carried advertising from the ‘anti’ campaign on its buses. Two operators in the local area stated that even a small reduction in speed over just a part of the overall route, would make many bus timetables impossible to operate, requiring them to review their routes and withdraw bus services from most routes with 20mph limits.*
- *The town suffers from severe congestion at certain times of the day, and the scheme was seen as exacerbating the situation.*
- *The street layout comprises a grid structure, with many roads used as through routes.*
- *The consultation material provided no information on the potential benefits of the scheme, but did suggest that bus services may be negatively affected.*

In general, those campaigning against the scheme felt there were more effective ways of encouraging mode shift and improving road safety. For example, redesigning dangerous junctions; re-phasing traffic lights, at crossroads in particular; better enforcement of existing limits; introducing traffic calming on a case-by-case basis; segregated cycle ways; and ensuring that bus companies can run a frequent, reliable timetable for those who wish to use public transport.

In the case of another ‘no scheme’ there was strong opposition from local councillors, despite the Council having successfully implemented five of six small-scale residential ‘pilot’ 20mph schemes, and majority public support for the scheme amongst those responding to the consultation.

No scheme example – Opposition from local councillors (Box M)

The proposed scheme covered a small residential area which suffers from speeding issues on through routes used as a 'short cut' by traffic accessing the nearby motorway junction. There have been a number of attempts to implement traffic calming schemes in the area, but this approach has not been supported by local residents.

The proposed 20mph limit scheme was stopped following opposition from local councillors. The precise reasons are unclear, but the following factors appear to be relevant:

- *unfavourable timescales in relation to the local elections, and political concerns about implementing a scheme in the area;*
- *a lack of understanding about what a 20mph signed-only scheme entails, and possible concerns that it could lead to traffic calming in future; and*
- *concerns from the councillor that the response rate to the public consultation questionnaire was low (29%) – despite being higher than for the other pilot schemes; and interpretation of 'non-responses' as objections rather than indications of support (contrary to the Council's general consultation approach).*

Confusion about the enforcement role of the police amongst the public and in the media – ACPO Speed Enforcement Policy Guidelines (2011-2015) (see Section 2.3) state that enforcement should be mainly reactive and should not be seen as a preventative measure to achieve vehicle speeds. It emphasises the need for 20mph limits to be self-enforcing, leaving the police to target the deliberate and persistent offenders.

Stakeholders in eight case study areas commented that the guidelines had been misinterpreted by the media and other groups, with reports that the police would not be undertaking any enforcement activity on the new 20mph limit roads. This hampered efforts to secure public support and required local authorities and the police to clarify that the enforcement approach would be similar to that on 30mph roads. What the police say locally about enforcement can be important in how schemes are perceived.

Political change – As with all schemes, political change and the involvement of new councillors can cause programme delay, due to a need to re-justify schemes and take new views into account.

Lack of / confusing evidence regarding the benefits of 20mph limits – As highlighted in Chapter 1, existing evidence on 20mph (signed only) limits is limited and tends to be based on short periods of after data, with variable accounting for background trends. There is a particular gap regarding empirical evidence relating wider impacts associated with the local economy, the environment, and health. The relationship between speed reduction and air quality is particularly complex, and remains an area of uncertainty. This makes it difficult for local authorities to clearly justify the scheme and demonstrate the benefits to the public and other stakeholders.

One authority identified the need for health benefits to be more clearly linked to 20mph (signed only) limits, and evidence to show how schemes can be part of a package of wider interventions to improve health and fitness.

In the case of one of the 'no schemes' the Council's current policy is not to implement any area-wide 20mph limits, as it feels there is insufficient evidence available to enable it to provide a clear articulation of the rationale, objectives, and outcomes (see text box below). A 20mph limit is not expected to be effective in addressing the specific road casualty problem within the authority, and the evidence regarding active travel, health, community and environmental benefits is felt to be insufficient to forecast local outcomes. The council is also concerned about the cost of undertaking sufficient enforcement to ensure compliance.

No scheme example – Lack of evidence (Box N)

The primary reasons behind the council's current policy are:

- ***Lack of definitive proof of positive or negative impacts*** - *The Council has taken the lead on a number of initiatives in the past, but on this occasion, is waiting for further evidence before considering adopting a more proactive 20mph limit policy. A previous trial scheme on one road within the borough was inconclusive and was removed after 18 months.*

- **Evidence that vehicle speeds are not a major cause of road collisions** - Most collisions occur on the borough's strategic and principal roads. In three years, only 12% occurred on local roads, and of these, 64% occurred at junctions. In the absence of clear evidence on the effectiveness of 20mph limits, the borough is continuing with a data-led approach to tackling road safety which involves identifying solutions for locations where accidents occur.
- **Expensive and unpopular enforcement** is expected to be required to ensure compliance.

Other reasons include:

- The evidence available suggests that 20 mph limits lead to a small reduction in average speeds and casualties, but the Council felt there was limited evidence of the impact on maximum speeds.
- Mixed evidence on the impact on vehicle emissions, use of sustainable modes and local amenity value.
- Concerns about the impact of the additional signs on the streetscape.

Issues relating to government leadership and guidance – One authority reported that the lack of national road safety targets for collisions and casualties³⁴ presented challenges in terms of justifying the scheme and providing a context for the outcomes. A focus on targets for killed and seriously injured, rather than all casualties or those involving vulnerable road users can create similar difficulties. Two authorities identified the need for a well-publicised national campaign on the benefits of 20mph limits, to help reinforce messages about driving at an appropriate speed in residential areas (for example, as part of DfT's *Think!* road safety speed campaign).

Practical delivery issues – Time consuming and resource intensive nature of advertising the TRO; delays associated with a change of contractor and challenging winter weather conditions which stopped work to install signposts; and length of time to procure and install signs and road markings.

Wider evidence on barriers to delivery

In 2015, a report commissioned by Brake (road safety charity) identified three main reasons for not implementing widespread 20mph limits. Firstly, councils typically expect average speeds to reduce by 1-2 mph hour, and are unclear whether this change is enough to deliver tangible benefits. Secondly, many councils are facing substantial reductions in government funding affecting both capital and maintenance budgets, and some perceive a more targeted road safety approach or investment in other sustainable transport measures to represent better value for money. Thirdly, some authorities interpret Circular 01/2013 as advising against introducing signed-only 20mph limits on roads with an average speed above 24mph.

While some councils are thought to interpret government guidance in a flexible manner to meet their requirements, others forego wholesale adoption in favour of using 20mph limits on specific roads with safety issues. In other cases, 20mph limits have been abandoned after short pilots showed a limited impact on reducing accidents.

(Brake, 2015; GO 20 – Towards changing the default urban speed limit to 20mph)

5.12. Levels of awareness amongst residents and drivers

Overview – Residents living on 20mph limit streets were asked whether or not they agreed with the statement '*The majority of residents are aware that a 20mph limit applies*'. The majority of residents (73%) agreed that people living on their street were aware that a 20mph limit applied; however, a surprising 11% disagreed, suggesting that awareness at the time of the survey was not perceived to be universal.

Although not representative, it is worth noting that the majority of participants in the non-driver focus group were not aware their road had a 20mph limit, prior to being invited to participate.

Need for traffic calming measures to raise awareness – Survey respondents were split on whether traffic calming measures should be introduced to increase awareness of the 20mph limit. Around two-fifths of residents (44%) and drivers (40%) agreed that traffic calming measures should be introduced; but similar proportions of residents (40%) and drivers (48%) were against this. Perhaps not surprisingly, there was a

³⁴ The 2011 Strategic Framework for Road Safety (relevant at the time of the stakeholder interviews) laid out the coalition's approach to road safety, following a decentralised agenda. This included the removal of national casualty reduction targets, and an emphasis on local authorities making full use of existing powers and flexibilities to improve road safety. This approach has been carried through to the subsequent 2015 British Road Safety Statement (Working Together to Build a Safer Road System).

small net level of agreement amongst residents (+4%), and a small net level of disagreement amongst non-resident drivers (+8%) – reflecting the potential benefits / dis-benefits associated with each group.

Understanding of scheme rationale – Focus group participants were asked ‘do you know why the scheme was implemented?’. Most participants mentioned issues around improving safety, with reducing congestion and improving air quality also seen as key drivers by some - broadly reflecting the scheme objectives set by the relevant local authorities. However, there was little reference to health and well-being, and encouraging use of active travel modes. Some participants questioned whether the limits were needed, as the areas concerned were perceived to have a low level of collisions. See [Section 6.3.2](#) for perceived benefits identified by residents.

5.13. Lessons and considerations for local decision-makers

The findings of the process evaluation have identified a number of lessons and considerations for decision makers.

Integrated approach – 20mph schemes have the potential to deliver a wide range of benefits, and in the longer term, health, environmental and community benefits could be greater than the more obvious road safety benefits. This provides an opportunity to work and engage with a range of policy and interest groups; and the most effective schemes are likely to be those which are based on a broad integrated policy agenda (involving health, environment, urban planning, emergency services, education, community representatives, etc.). Longer-term 20mph schemes which are supported by complementary transport, health, environment and community policy and interventions are likely to deliver greater benefits.

A scheme driven by traffic engineers may be seen as anti-driver, while one involving multiple agencies and policy agendas is more likely to achieve community support. The involvement of Public Health, for example, can give recognition and credibility to the long-term health benefits of schemes, which the public may find more persuasive than a simple focus on speed reduction. In London, lower speeds are at the heart of Transport for London’s Healthy Streets Approach, which has been integrated into all Mayoral policy and strategy documents (see text below).

Integrating engagement activities with interventions in other policy areas can help to maximise exposure and reinforce messages about safety, active travel and associated benefits. A multi-agency approach can also help leverage in funding and resources, including expertise in behaviour change.

Involving the police as part of an integrated team helps put the role of formal enforcement activity into context. It demonstrates that enforcement is part of a package of measures to encourage compliance, based largely on education and awareness to secure public support.

Integration of Healthy Streets Approach into London policy

Overview – Transport for London has adopted a ‘Healthy Streets Approach’ to improve air quality, reduce congestion and help make London’s diverse communities greener, healthier and more attractive places to live, work, play and do business³⁵. It seeks to put people and their health at the centre of our decision making, helping everyone to use cars less and to walk, cycle and use public transport more.

The Healthy Streets Approach provides a framework of policies and strategies for achieving this. Because 80 per cent of Londoners’ travel time is spent on London’s streets – including bus and tram trips and journeys to and from Tube and rail stations – this can only be done by creating streets that feel pleasant, safe and attractive. Streets where noise, air pollution, accessibility and lack of seating and shelter are barriers that prevent people – particularly the most vulnerable people – from getting out and about.

The purpose of the Healthy Streets Approach is not to provide an idealised vision for a model street. It is a long-term plan for improving Londoners’ and visitors’ experiences of using the streets, helping everyone to be more active and enjoy the associated health benefits.

To deliver the Healthy Streets Approach, changes are required at three main levels of policy making and delivery:

- At a street level, direct investment in walking, cycling and public transport infrastructure is seen as vital to providing a safer, easier, cleaner and more appealing environment for everyone to

³⁵ Healthy Streets for London: Prioritising walking, cycling and public transport to create a healthy city (TfL, Feb 2017)

enjoy. An important measure of success will be positive changes to the character and use of the city's streets.

- At a network level, streets and rail systems need to be designed and managed so that more active travel becomes part of every journey.
- And, in terms of the future, as London continues to grow, active travel needs to be designed into the fabric of new developments and regeneration projects.



Healthy Street Indicators – Work at the street, network and strategic level is all aimed at improving the experience of travelling through and spending time on London's streets, using ten evidence-based indicators of what makes streets attractive places.

Slower speeds are at the heart of the approach³⁶:

“If we could reduce the speed of vehicles, then the street would feel safer, more relaxed, less noisy and easier to cross. A street with slower moving traffic is likely to attract more people to walk, cycle and spend time in it. Reducing speeds may involve physical traffic calming but also requires changing the way the street feels and how it is used, to encourage people to drive with more care. This can all help encourage people to feel more comfortable playing, socialising, exercising and resting in the street environment.”

Partnership working – TfL is working with partners across the public, private and community sectors, to deliver Healthy Streets, including London boroughs, developers and land owners, businesses, education and community partners. Vital to the success of Healthy Streets is the continuing work with the Metropolitan Police Service, who provide on-street law enforcement and education.

Related strategies – The Healthy Streets Approach will be embedded across the full range of Mayoral policy and strategy documents to ensure it is delivered effectively across the city.

The Mayor set out his new vision for Healthy Streets in ‘A City for All Londoners’ and each of his statutory strategies will reflect how his vision will be delivered. The London Plan, the Mayor’s Transport Strategy and the Health Inequalities Strategy lead the way, but the Environment, Culture, Housing, Police and Crime, and Economic Development strategies all have roles to play in delivering the Healthy Streets Approach. A new Health Action Plan will provide a more detailed plan for the delivery of the health aims.

Mayor Transport Strategy³⁷ – ‘Healthy Streets and healthy people’ is one of three key themes at the heart of the new Mayor Transport Strategy. The strategy involves allocating more road space to the most efficient travel choices – installing new cycle lanes, giving buses more priority and providing more space for pedestrians. Over time, reallocating space will create streets that function better not only for people who are walking, cycling and using public transport, but also for taxis and essential delivery, servicing and car journeys.

A Vision Zero approach (Policy 3) seeks to eliminate all road traffic deaths by reducing the dominance of motor vehicles on our streets. As part of the approach (Proposal 9) 20mph limits will continue to be implemented on London’s streets, with 20mph considered as part of all new schemes on the Transport for London Road Network. TfL will look to implement 20mph limits on its streets in central London as a priority, with implementation being widened across inner and outer London as soon as is practicably possible. TfL

³⁶ TfL (2017); Guide to the Healthy Streets Indicators: Delivering the Healthy Streets Approach.

³⁷ Mayor of London (2018); Mayor’s Transport Strategy.

will work with the boroughs to implement lower speed limits on their streets, prioritising designs that are self-enforcing and that do not place an additional burden on policing partners.

Investment – TfL's five year Business Plan, brings together all street spending into a new £2.1bn Healthy Streets portfolio to ensure that, with borough partners, all street investment is directed towards delivering against the Healthy Streets Indicators. This new approach to investment will be overseen by a Healthy Streets Portfolio Board, bringing together decision-makers from across our organisation, as well as from City Hall.

At a case study level, there is an expectation in Calderdale that all new residential developments will be 20mph, and each will be assessed based on the speed limits of connecting roads, safety considerations and transportation policies. The council will work to incorporate a vision of healthy streets into all new developments.

At a transport level, authorities should consider 20mph limits as part of a wider initiative to improve road safety, promote walking and cycling and reduce congestion, and improve air quality. Furthermore, implementing a 20mph limit can create opportunities for other interventions (e.g. Box P).

Case study example – Quiet routes in Portsmouth (Box P)

Portsmouth – Portsmouth have developed a network of quiet routes, making use of quieter 20mph roads and cycle paths, more suited to less confident cyclists. Coloured stickers on lamp-posts mark out the routes and tell users when to get off their bike, when to use a crossing and which way to go.

There are five routes between the north and south of the city and five between the east and west, serving key destinations including the seafront and leisure attractions; as well as schools, colleges, shops and workplaces.

Tailoring the scheme design to local circumstances – It is important that the scheme design (in terms of the scheme boundary, roads included / excluded, and positioning of signs and road markings) reflects local circumstances, objectives and aspirations, if the scheme is to be supported by the local community.

Urban features and road characteristics can be used to create a different look and feel in 20mph areas. However, when designing schemes consideration also needs to be given to providing continuity in speed limits (i.e. avoiding frequent changes from 20mph to 30mph), local community aspirations, and likelihood of compliance through self-enforcement. The appropriate balance will depend on the specific objectives of the scheme and supporting interventions, including the relative weight given to reducing collisions / casualties, encouraging active travel, and delivering wider policy objectives relating to health, environment, local economy and local communities. The impact of road type and character on speed compliance is examined further in Chapter 7.

Signage requirements – The Traffic Signs Regulations and General Directions (TSRGD) was updated in 2016³⁸ (see Chapter 2.2), giving local authorities more flexibility to make their own decisions on how many signs and road markings are needed to inform drivers about 20mph limits. This provides scope to substantially reduce sign clutter and implementation / maintenance costs. However, signage must still comply with the Regulations or be specially authorised, be sufficient to encourage compliance and give reasonable grounds for a case to be upheld in court if a driver were caught speeding.

The experience of some case study authorities is that additional signing has been required post implementation to ensure drivers are sufficiently aware of the limit. A cautious approach should therefore be taken to adopting a minimal signing strategy, at least in the short to medium term.

The Scottish Parliament is considering a Member's Bill to replace the current 30mph national speed limit for street-lit roads with a 20mph default limit³⁹. If successful, the promoters of the Bill expect that over time this would substantially reduce the need for signage, in the same way as there are currently limited signs and road markings to indicate the default 30mph limit. They also expect that over time the signing requirements

³⁸ After the case studies considered in this study were implemented.

³⁹ Proposed Restricted Roads (20mph Limit) (Scotland) Bill. Consultation by Mark Ruskell MSP, Member for Mid Scotland and Fife. May 2017.

in city-wide schemes could reduce, through increased driver awareness and acceptance, particularly where a more blanket approach has been adopted.

The importance of effective consultation – Case study authorities emphasised the importance of effective consultation (pre-implementation), in terms of establishing local support, ensuring smooth delivery (particularly regarding the TRO process), and encouraging changes in driving behaviour.

Critically, many of the consultation approaches were designed to put the community at the heart of the process, with local residents encouraged to take responsibility for their local environment and drive change. This can be achieved through various approaches, including:

- focusing on wider community benefits (safety, quality of life, health, etc.) rather than speed reduction;
- adoption of a common brand and logo, which stakeholders and the local community can promote;
- questionnaires to affected households – Most case study authorities undertook questionnaire surveys to obtain information on travel patterns and mode use, views on local speed-related issues, and support for 20mph limits, but the questionnaires were as much about getting the public involved as obtaining information;
- the use of local ‘influencers’ or champions who own the campaign at a local level and are able to quickly connect with the public;
- activities with local schools (as a means of engaging with parents, and changing attitudes and behaviour through child-parent influence); and,
- use of social media to encourage dialogue and debate within the local community.

However, engaging with the community in a comprehensive manner is difficult, and interventions are quickly forgotten post implementation. Evidence from the residents’ questionnaires shows that only 29% could recall receiving any information about the schemes, and only 12% said they were aware of the consultation activities. The results show a clear lack of awareness or recall (i.e. they may not have read the consultation material, may not have noticed it, or may have forgotten about it).

Awareness and education campaigns should continue after the scheme has been implemented, to encourage on-going compliance.

Engagement with young drivers – Within the case studies investigated there appears to have been relatively little focus placed on engagement with young drivers; although in Liverpool, the Council and Police took part in 20mph debates with Further Education students (pre-drivers). However, this is the age at which driver habits and attitudes are formed, which may last into later life. In contrast to more experienced drivers, young drivers have not established their driving style in the context of a default 30mph limit and do not need to change long established driving habits. A specific focus on young drivers, nationally or locally, is therefore likely to be beneficial.

Appropriate skillset – The scheme design process for the case study authorities appears to have been led by transport planning teams, particularly road safety officers and traffic engineers. Consideration should be given to employing a wider set of skills to encourage integration with wider policy areas. This might include urban planners to encourage integration with public realm policy (focusing on the look and feel of 20mph roads); and health, education, environment and community representatives to enable engagement activities to be aligned and messages reinforced. Public engagement and behaviour change skills are of key importance, and represent areas where conventional transport planners may lack appropriate knowledge and training, and where specialist input is likely to be beneficial.

Public expectations need to be managed – A number of authorities commented that the delivery process had enabled the Council to demonstrate its ability to work with the local community and respond to residents’ concerns; and also had a positive impact in terms of creating a community spirit. However, they were also aware that it had raised expectations amongst the public regarding the Council’s ability to respond to other community issues, or take further action if speeds remain high.

Substantial revenue costs – Capital cost may be low, compared with other schemes, but revenue costs associated with pre- and post-implementation engagement, enforcement activities, and monitoring can be substantial. A number of case study authorities had to considerably cut back on these activities, as budgets had not been properly identified and/or sourced at the outset.

Monitoring – Post implementation monitoring is important in terms of identifying whether the objectives have been met, assessing the need for further intervention where there is concern, and to demonstrate the benefits of investment where there is success.

Sufficient resources should be budgeted for at the outset, to undertake, analyse, and report on the surveys. There may be a need for additional monitoring post-implementation, to respond to concerns from the public and councillors.

The monitoring approach should be tailored to the specific scheme objectives, proportionate to the scale of the scheme, and undertaken in a robust manner which provides confidence in the results and the extent to which they are likely to be due to the new 20mph limit. There should be clarity on the purpose of monitoring and how the results will be used (e.g. to justify spend to decision-makers, modify the scheme design, inform decisions about future policy, or identify need for further intervention).

A logic map approach, articulating the process by which the scheme is expected to deliver outcomes and wider impacts, can help identify the monitoring priorities. For example, where speed reduction is a key objective then data on observed speeds will be important; but where the scheme is focused on improving the attractiveness of the area for walking and cycling, then attitudinal surveys are arguably more informative.

Consideration also needs to be given to the context within which the scheme has been implemented, including the potential contribution of other policy initiatives and background trends (particularly in terms of speeds, collisions / casualties, and use of other modes).

The findings of the analysis should be clearly reported, and available for scrutiny by policy makers in the authority concerned and elsewhere. In general, the case study authorities were unable to provide a formal report setting out the findings of the monitoring data (within the timescales of this study). Some provided analysis spreadsheets, while others referred the study team to local authority papers prepared for Council executive/cabinet meetings, which provide a high-level summary of the results. In general, however, documentation of any monitoring and analysis was limited. So, while the authorities generally collected a substantial amount of monitoring data, there is a question about whether the data has been used effectively.

Table 17 outlines issues for consideration relating to monitoring of transport outcomes.

Table 17. Monitoring of specific outcomes (issues for consideration)

Issues for consideration
<p>Speed and flow</p> <p>Changes in speed can be monitored using spot speed surveys to measure instantaneous speed at a sample of locations, or in-vehicle GPS devices to monitor journey speeds on a particular route or area-wide basis.</p> <p>Spot speed surveys represent a more straight-forward approach (from a commissioning and analysis perspective) which authorities will be familiar with; and can provide a robust approach for capturing the speed of every vehicle passing the detection point, along with information about total flow and vehicle type. The specific locations chosen will influence the findings, and may distort results if there is a focus on monitoring ‘problem’ streets. The impact of the 20mph limit may be diluted by including roads where the average before speed was already less than 20mph; or by averaging average speeds if the data is not flow-weighted.</p> <p>In contrast, in-vehicle GPS data can provide a better picture of how an area as a whole is performing, and how journey times are affected. It can be obtained retrospectively, but does not provide information on total flow which may be required if the scheme is expected to result in substantial re-routing of traffic or to monitor background changes in congestion. Use of GPS data is likely to be most viable for monitoring across large areas where economies of scale can be achieved in terms of the cost of purchasing and analysing the data.</p> <p>In both cases, any change needs to be compared against the background trend in speeds and flow. This is particularly challenging given the lack of data available for local 30mph roads. In this study, GPS journey speed data has been obtained for a limited sample of comparator areas with similar geographic, socio-economic and road characteristics. Other studies (e.g. Pilkington, P et al., 2018) have compared change in 20mph areas with the change observed on roads elsewhere in the city which have retained a 30mph limit. However, these are typically through routes with different characteristics to the majority of 20mph roads. Since 2011, the Department for Transport (DfT) has published average speeds in free flowing conditions on 30mph roads in Great Britain, but for a limited sample only (29 sites). All of these approaches have their limitations.</p>

Issues for consideration
<p>Safety</p> <p>STATS19 data is published by the DfT on an annual basis and includes accident, casualty, vehicle and contributory factor data. Key limitations of the dataset relating to completeness, accuracy and consistency have already been set out in Section 3.4.8.</p> <p>Of particular relevance is the change in the classification of ‘serious’ injuries following the introduction of the CRASH reporting system in 2016. This means that it will be difficult to undertake any meaningful statistical analysis by casualty severity over the next few years.</p> <p>In order to avoid regression to the mean (RTM) influences, before data should cover a number of years before implementation (for example, at least three years). Given the relatively small number of collisions occurring on residential roads and the likely fluctuation between years, several years data will generally be required to provide meaningful results. Early reporting of results may be misleading.</p> <p>Again, any change needs to be compared against background trends in collisions using data for 30mph roads in comparator areas with similar geographic, socio-economic and road characteristics.</p>
<p>Cycling and walking activity</p> <p>The challenges of collecting robust cycling and walking data are well documented (e.g. PTEG’s LSTF Monitoring and Evaluation Guidance, 2012). Volumes of cycling and walking are much lower than for motorised traffic and usage patterns are more varied and seasonal.</p> <p>Various technologies can be used to establish a network of automatic continuous counters (inductive loops, pneumatic tube counters, piezoelectric counters, radar detectors), with relative strengths, weaknesses and costs; but are best suited to monitoring usage on segregated cycling routes. Where counters are placed on the main carriageway, consideration should be given to alternative routes used by cyclists.</p> <p>Automatic methods for monitoring pedestrian activity are more limited (video imaging, infra-red sensors, piezoelectric pressure mats), and are not well-suited to low level, dispersed trips typical of 20mph limit areas.</p> <p>Manual surveys provide an alternative approach, and have the potential to provide more accurate estimates for both walking and cycling levels. They should be undertaken for a 12-hour period and where possible for at least 2-3 days in a given week. However, given the low level, dispersed nature of trips, a large number of sites may be required to provide a reliable picture of overall levels of activity.</p> <p>Other methods include travel behaviour surveys including travel diaries; satisfaction surveys (focus groups); surveys of physical activity; and citizens’ panel surveys.</p>
<p>Perceptions</p> <p>Changes in perceptions and attitudes can best be monitored through questionnaire surveys (which can also cover changes in travel behaviour), and more qualitative approaches such as focus groups.</p>

A detailed examination of the monitoring, analysis, and reporting approaches adopted by the case study authorities regarding spot speed data identified a number of lessons which are summarised in the text box below.

Case study lessons – Monitoring spot speeds
<p>Siting of monitoring equipment – Spot speed surveys only capture speeds in one specific location, so monitoring equipment should be sited in a location where vehicles are likely to be driving at a typical speed for the road, generally in free flow conditions. Speed readings will be lower if the equipment needs to be placed near a junction, at a bend, near parked cars, etc.</p> <p>Monitoring locations – The results will be influenced by the types of roads surveys are undertaken on. There may be policy reasons for focusing on roads where speeding has been reported as an issue or are expected to have a low level of 20mph compliance; but these roads may not be representative of the wider 20mph implementation.</p> <p>Duration – Extending the monitoring period to at least two weeks allows two sets of data to be collected for each day of the week, and reduces the impact of any unusual circumstances (e.g. inclement weather). DfT’s Transport Analysis Guidance (WebTAG) advises two weeks for undertaking flow counts.</p> <p>Data quality – The data collected should be consistent across survey sites and both the before and after periods, and should be fit for purpose:</p>

- Speed bin categories should be appropriate for 20mph roads, i.e. capable of monitoring percentage compliance, and the proportion travelling at speeds of interest in the context of 20mph implementation (e.g. 20-24mph, >24mph). These categories will be different to those typically used on higher speed limit roads.
- Before and after data should be collected during comparable months (to minimise for seasonality impacts on flow and speeds), and on the same days of the week.
- Ideally, before data should be collected a sufficient period of time before implementation, to ensure that driver behaviour is not affected by consultation activities, education and awareness initiatives, disruption due to installation of signing and lining, or implementation in nearby areas. After surveys should be delayed (e.g. for 6-12 months) to allow scheme outcomes to establish.
- The raw data should be quality checked to ensure that it is fit for purpose, and is not influenced by gaps which bias the overall results.

Use of historic data can reduce the cost of monitoring, but can also reduce the robustness of the evidence if the data is collected at different times of the year, or at different points in time when background trends may have differed. It may also bias the location of sampling points.

Analysis metrics – Useful metrics include mean speed, 85th percentile speed, and the proportion of vehicles in different speed bands, to monitor change in overall speeds, the highest speeds, and the speed profile; all important influences on safety and related outcomes. Flow data is required to weight site data, and identify any substantial changes in flow which may influence outcomes. The key analysis metrics should be identified at the outset, and software outputs tailored appropriately (where possible), to minimise the amount of data extraction required.

Effective monitoring of wider impacts (e.g. health, environment, local economy and community) represents a particular challenge, given the complexity of the relationships being examined and the range of compounding factors involved. These potential benefits may be better examined centrally, through bespoke research studies, rather than at an individual case study level.

6. Is there support for 20mph limits?

6.1. Introduction

This chapter examines the level of support for 20mph (signed only) limits amongst different user groups in the case study areas; why schemes are supported or opposed, and other factors influencing levels of support. The evidence is based on questionnaires with residents and drivers in the case study areas, interviews and focus groups with various road users in the case study areas, and national online surveys with cyclists and motorcyclists.

Theory of Change Hypothesis: 20mph scheme are generally supported, but with levels varying across socio-demographic groups, mode users, scheme area types, and general drivers' behaviour and attitude.

✓ Evidence broadly supports above hypothesis, with high levels of post implementation support amongst residents (drivers and non-drivers), non-resident drivers and cyclists; but less support amongst residents in neighbouring areas and opposition from motorcyclists.

Higher support amongst residents living in larger residential area-wide schemes, especially near schools; compared to small-scale residential and city centre focused schemes.

Higher support amongst residents living in non-car owning households. These households are most likely to appreciate any walking and cycling benefits (real or potential); and will be unaffected by any adverse impacts on drivers.

Higher support amongst those less likely to speed (i.e. exceed the limit by more than 5mph).

Higher support amongst those who perceive the schemes have delivered relevant positive benefits (although perceptions may not reflect actual outcomes).

6.2. How do levels of support vary amongst user groups?

Post implementation – Evidence from the questionnaire surveys shows high levels of post implementation support amongst case study residents (including drivers and non-drivers), non-resident drivers, and cyclists; but less support amongst residents in neighbouring areas and opposition from motorcyclists (Figure 12). Specifically:

- 75% of surveyed residents in case study areas thought the 20mph limit was a good idea;
- 66% of surveyed non-resident drivers thought the 20mph limit was a good idea; and
- 81% of cyclists responding to the national online survey supported the introduction of 20mph limits.

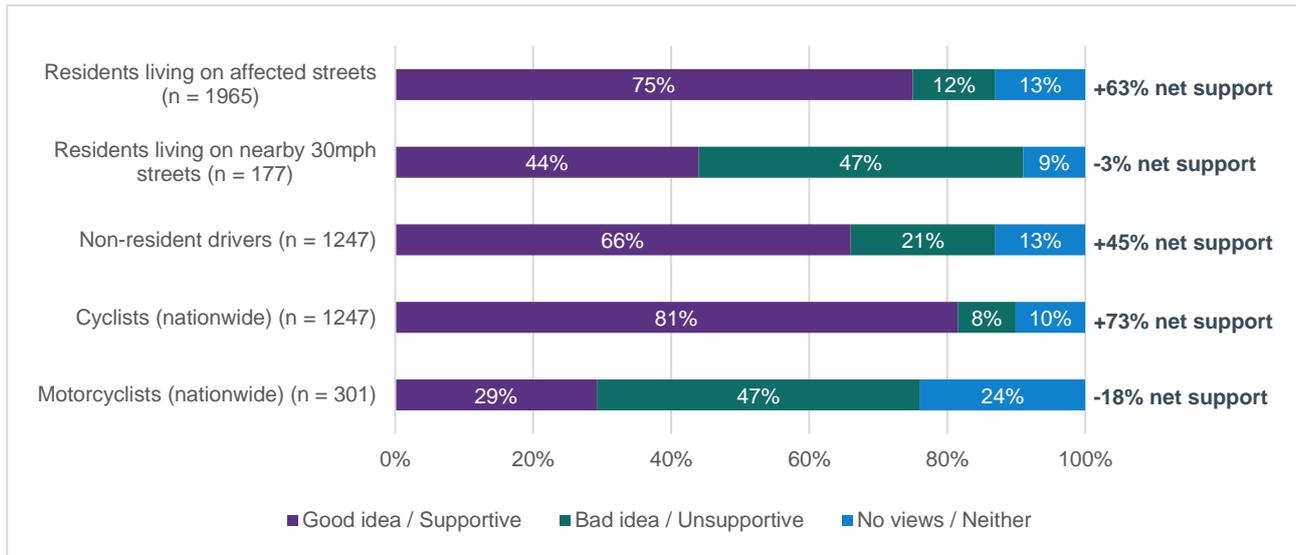
However:

- Residents living on nearby 30mph streets (in two of the case study areas) were split on whether the 20mph limit should be introduced on their street, with 44% agreeing it should and 47% disagreeing (based on a sample size of 177). These streets were surveyed because they could provide an alternative route for vehicles wishing to avoid the 20mph limit. This suggests that the benefits perceived by residents living on 20mph limit roads, are not so apparent to those on adjacent streets.
- Almost half of motorcyclists (47%) responding to the national online survey were unsupportive, and only 29% supported the introduction of 20mph limits.

Residents living on affected streets (75%) were significantly⁴⁰ more supportive than non-resident drivers surveyed at sites just outside the scheme area (66%). They are significantly more likely to perceive a 20mph limit as appropriate for the area, and less likely to agree that the scheme needs to be changed (Figure 13).

⁴⁰ The term "significant" is only used in this report when referring to statistical significance. To determine whether changes in questionnaire / survey responses in the before and after periods are statistically significant, 95% confidence intervals have been calculated for the difference in proportions.

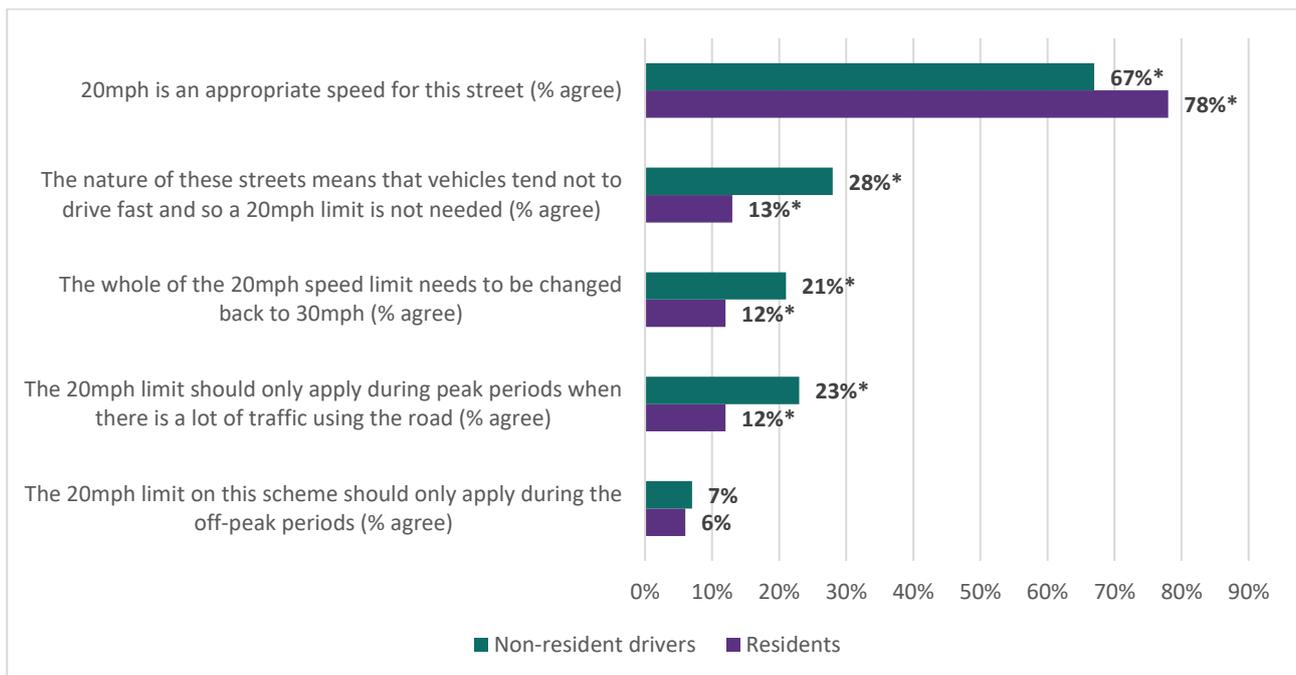
Figure 12. Levels of support amongst different user groups



Residents and non-resident drivers' questionnaires, and nationwide online surveys with cyclists and motorcyclists.

Net support = % responding 'good idea / supportive' - % saying 'bad idea / unsupportive'. A positive value indicates that there were more supportive than unsupportive respondents, and a negative value indicates a higher proportion of unsupportive respondents.

Figure 13. Views of appropriateness of limit and need for change



Residents and non-resident drivers questionnaires. Sample size varies from 1590 to 1985 for residents; and from 1250 to 1253 for non-resident drivers.

Significant differences between residents and non-resident drivers marked with an asterisk (*).

Overall, the majority of residents (78%) and non-resident drivers (67%) felt that that 20mph was an appropriate speed for the area; and perceived that speeds were previously too fast for the environment. Only 13% of residents and 28% of non-resident drivers agreed with the statement "The nature of these streets means that vehicles tend not drive fast and so a 20mph limit is not needed".

There is little call for the limit to be changed back to 30mph. Only 12% of residents and 21% of non-resident drivers felt that the area-wide limit should be changed back to 30mph.

There is majority support for 20mph limit applying at all times of day – Most residents (78%) and non-resident drivers (67%) felt that the limit should operate throughout the day, rather than during peak or off-

peak periods only. However, around a quarter of non-resident drivers (23%, compared with 12% of residents) felt that the limit should only apply during peak periods when there is a lot of traffic using the road (e.g. 07:30-09:30 and 15:00-19:00).

The above findings broadly reflect the evidence from other surveys:

The **British Social Attitudes Survey** shows overall support for 20mph limits on residential streets, varying from 68% to 73% between 2010 and 2016, based on a sample of approximately 900 respondents.

The **RAC's Annual Motoring Survey** shows majority support for 20mph limits, higher support for 20mph limits around schools, and lower support for the inclusion of major through roads, based on views of at least 1500 motorists.

Around three-fifths of drivers (58% in 2014, 61% in 2015) agree 20mph limits are appropriate in urban areas. There is overwhelming support for 20mph limits when there is a clear rationale: 91% of respondents agreed 20mph limits are worthwhile near schools, rising to 95% amongst drivers with children. However, support falls considerably outside residential areas, with 74% saying that 20mph limits should never be implemented on 'through roads'. This is based on specific questions asked in the 2014 survey.

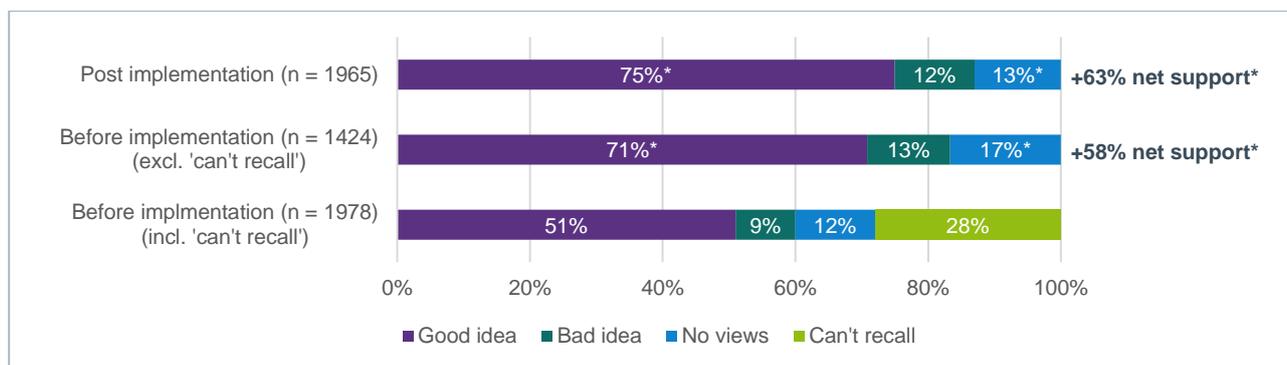
However, a substantial minority (33% in 2015, 41% in 2016, and 39% in 2017) say the limit should be higher. The RAC argues that when 20mph limits were first introduced, they were typically confined to residential areas, near schools and in accident black spots. Motorists understood why they were there and there was a high degree of acceptance. However, as 20mph limits have been introduced more widely on busy through-routes and major A-roads, acceptance has declined because motorists no longer see the logic behind their introduction.

Both surveys are based on a nationally sample, rather than just focusing on areas with 20mph limits.

Pre vs post implementation support – There is also evidence that support amongst residents increases post implementation, suggesting that some pre-implementation concerns do not materialise or become more acceptable. Specifically:

- The net level of support amongst residents (% saying 'good idea' - % saying 'bad idea') increased significantly from +58% (before implementation) to +63% (after implementation) (Figure 14).
- Almost half of residents (48%) and two-thirds of drivers (66%) stated that they were now more supportive of 20mph limits in general, following the implementation of the local scheme.

Figure 14. Residents support for 20mph limit on own street (Before and post implementation)



Residents questionnaire. n = sample size.

Significant differences in before and after results (excluding 'can't recall') marked with asterisk (*).

Wider evidence on post implementation support

Other studies have shown increased support for lower speed limits post implementation. In 1992, Graz in Austria became the first city in Europe to adopt a 30 kph (18.6mph) speed limit for all non-priority streets, covering around 80% of the whole city. Surveys of public support indicate that whilst there was initial enthusiasm (64% support in 1989) this declined to 44% support just before the trial; possibly due to public uncertainty about negative effects and a misunderstanding about the retention of the 50 km/h limit on priority streets (Wernsperger & Sammer, 1995). However, support increased following the introduction of the new area-wide limit, increasing steadily to 77% over the following 18 months (Wernsperger & Sammer, 1995).

6.3. Why are schemes supported or opposed?

6.3.1. Overview

The views of different user groups regarding the perceived benefits and areas of concern are presented below (Table 18).

Table 18. Views of different user groups (residents, non-resident drivers, cyclists and motorcyclists) on the benefits for 20mph limits - % agreeing

Statement	Residents	Non-resident drivers	Cyclists (nationwide)	Motorcyclists (nationwide)
Benefits for different user groups				
20mph limits are beneficial for local residents	70%	70%	89%	44%
20mph limits are beneficial for cyclists	69%*	74%*	69%	30%
20mph limits are beneficial for pedestrians		77%*	89%	52%
20mph limits are beneficial for motorcyclists	Not asked	Not asked	Not asked	13%
Walking and cycling benefits				
20mph limits provide a safer environment for walking and cycling	60%	Not asked	66% (cycling only)	Not asked
20mph limits provide a more pleasant environment for walking and cycling	51%	Not asked	Not asked	Not asked
Drivers are more considerate to pedestrians and cyclists	21% and 17%	Not asked	Not asked	Not asked
Other safety benefits				
20mph limits increase drivers' awareness of potential risks and hazards	44%* (drivers only)	64%*	58%	18%
It is safer to drive on these streets / in this area since the introduction of 20mph limits	Not asked	36%	Not asked	Not asked
20mph limits provide a safer environment for motorcyclists	Not asked	Not asked	Not asked	2%
The street now provides a safer environment for children	28%	Not asked	Not asked	Not asked
Driver experience				
The 20mph limit makes it more acceptable to drive at a lower speed	72% (drivers only)	69%	Not asked	Not asked
The 20mph limit is frustrating for drivers / riders	Not asked	48%	Not asked	13%
Do you find that since the introduction of the 20mph limit you feel frustrated?	26% (drivers only)	24%	Not asked	Not asked
Do you find that since the introduction of the 20mph limit you have to drive slower than you would like?	34%* (drivers only)	50%*	Not asked	Not asked
Environment				
20mph limits are beneficial for the environment	Not asked	Not asked	72%	15%

Residents questionnaire (sample size varies from 1184 to 1980); non-resident drivers questionnaire (sample size varies from 1092 to 1375; also includes responses from residents living on nearby streets); nationwide online cyclists survey (sample size varies from 1421 to 1425); and nationwide online motorcyclists' survey (sample size varies from 296 to 299).

Significant differences between residents and non-resident drivers marked with an asterisk (*).

In summary:

- The majority of residents, non-resident drivers and cyclists perceive 20mph limits to be beneficial for residents, cyclists and pedestrians.
- Cyclists are generally the most positive / supportive group, and two-thirds of cyclists (66%) agree that 20mph limits provide a safer environment for people cycling.
- Half (51%) of residents agree that 20mph limits provide a more pleasant environment for walking and cycling, and 60% agree that 20mph limits provide a safer environment for walking and cycling; but only around a fifth think that drivers were more considerate to pedestrians and cyclists, and only 28% feel that the street now provides a safer environment for children.
- There are mixed views on whether the 20mph limits increase drivers' awareness of potential risks and hazards (with 64% agreement amongst non-resident drivers, 58% agreement amongst cyclists, and 44% agreement amongst residents).
- Most resident and non-resident drivers (72% and 69% respectively) agreed that 'the 20mph limit makes it more acceptable to drive at a lower speed'. However, there is some evidence of driver frustration with the new limit:
 - a quarter (26% of resident drivers, 24% of non-resident drivers) said that they personally felt frustrated at times;
 - a higher proportion (34% of resident drivers, 50% of non-resident drivers) are driving slower than they would like; and
 - around half of non-resident drivers (48%) agreed that 'the 20mph limit is frustrating for drivers'.
- Only 36% of non-resident drivers agreed that 'it is safer to drive on these streets / in this area'. This does not necessarily mean that drivers now feel less safe, just not safer.
- In general, motorcyclists did not perceive 20mph limits to be beneficial for motorcyclists. Only 13% felt that 20mph limits were beneficial for motorcyclists, with 49% perceiving the limits to be detrimental for riders. Only 2% agreed that '20mph provides a safer environment for motorcyclists'. In addition, they were less likely to perceive 20mph limits as beneficial for others than other respondent groups.

6.3.2. Views of residents

Reasons for support were discussed with focus group participants. When asked about the main benefits of 20mph limits all groups focused on **safety**, including safer environments around schools; safer crossing facilities (particularly for older people and those with disabilities); safer conditions for cyclists; and the possibility of fewer and less severe collisions. Other factors mentioned less frequently included encouraging walking and cycling, a perceived reduction in air and noise pollution and associated health benefits, a more relaxed residential environment, and better conditions for drivers. These are perceived benefits and most groups expressed mixed views on whether speeds had actually reduced, and hence the actual level of benefit delivered.

Cyclists and young drivers mentioned a wider range of benefits than other focus group participants, encompassing safety, mode shift, and quality of environment. The greater appreciation of potential benefits amongst young drivers probably reflects their recent educational background, which is likely to have covered environmental and safety topics. This could also influence the driving behaviour of this group now and in the future, resulting in higher levels of compliance. It has not been possible to test this hypothesis as part of this study.

The most common area of concern was around **compliance**, with most participants of the opinion that stronger enforcement measures are needed if 20mph limits are to be effective. In three of the nine focus groups, participants initially stated that there had been no benefits because of little or no driver compliance.

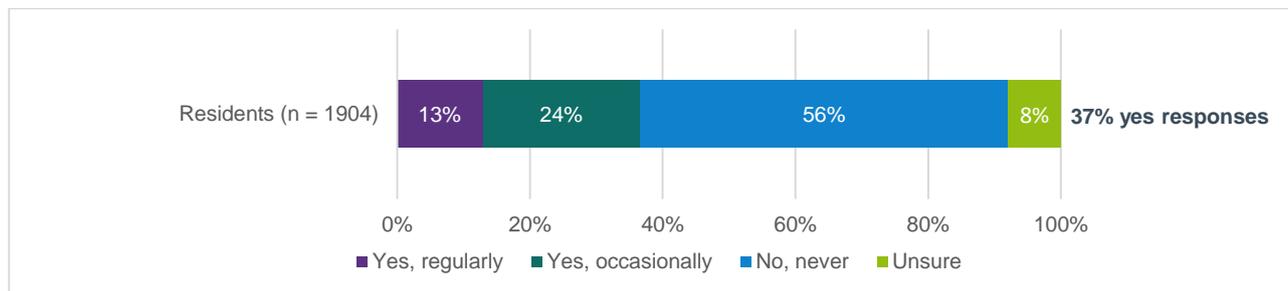
However, others felt that even if the 20mph limit wasn't being adhered to, drivers were typically driving more slowly than they would have been in a 30mph limit.

"People are going to speed in a 20mph limit, but I think they might cap it at 30mph. Whereas if the limit was 30, they might be doing 35 or 40. Psychologically it's probably stopped them going at 30."

Another common concern related to **aggressive and careless** driving as a result of frustration at having to drive at a slower speed. Examples were given of drivers tailgating, flashing their headlights, beeping and overtaking, putting pressure on those adhering to the limit and increasing stress levels amongst all concerned. However, aggressive or careless driving, as a result of frustration with the conditions, does not appear to be a substantial problem in most areas. Only 37% of residents said that they had seen evidence

of driver frustration (Figure 15). A number of drivers in Liverpool (Area 7) felt that incidents of tailgating in the area had reduced following the introduction of the 20mph limit, as it was now more acceptable to drive at a slower speed.

Figure 15. Since the introduction of 20mph limit on THIS street, have you noticed any evidence of driver frustration? (residents only)



Non-resident drivers questionnaire. n = sample size.

Other common concerns included the following:

- the mix of driving speeds (with some complying with the limit and others not), along with the distraction of slowing to 20mph, was felt by some to have worsened rather than improved safety;

"...in the 20 [limit], you spend more time looking at your speed monitor than obviously watching the road. So, from my point of view I think it's more dangerous driving 20 than 30"

- drivers speeding once leaving the 20mph limit, in order to make up time; and

"I'm guilty of that... In the 20 I'm doing less, but as soon as it goes 30, I'm doing 40."

- the possibility that lower speeds increase vehicle emissions.

Some participants had conflicting views, recognising the wider benefits of 20mph limits, but also finding them frustrating.

"As a driver I feel it's slow. As a pedestrian and mother I think 20mph is what it needs".

6.3.3. Views of non-resident drivers

Findings from in-depth interviews with non-resident drivers shows that concern about the **safety of vulnerable users**, particularly children and the elderly, was a key factor driving support for 20mph schemes. A smaller proportion of participants also mentioned factors relating to noise and air pollution, and overall quality of life of residents, as reasons for supporting the schemes.

Those participating in a young driver focus group reported that the slower limit enables them to build confidence, allows more reaction time, means that mistakes are more forgivable, and encourages good habits and attitudes which will be carried through to roads with higher speed limits.

Areas of concern were similar to those identified by residents.

6.3.4. Views of cyclists

Perceived benefits identified by cyclists responding to the online survey relate to the **reduced speed differential** between cars and cycles, as well as slower vehicle speeds. These factors are perceived to create a safer environment in general and reduce the severity of injuries, reduce the risk from overtaking, make it more acceptable to adopt a prominent position in the centre of the lane, give cyclists more time to manoeuvre, put cyclists under less pressure, and reduce the likelihood of drivers getting frustrated with cyclists. 20mph limits are also perceived to increase driver awareness and observance regarding cyclists, and give both parties more reaction time.

However, **lack of compliance** is perceived as reducing or making the intervention ineffective. In addition, some of the evidence contradicts the benefits outlined above, with respondents perceiving 20mph limits to

increase driver frustration, increase the likelihood of conflict or fear of a collision (particularly when overtaking), and create false expectations; all having an adverse impact on perceived safety amongst the cyclists concerned. A few respondents commented that 20mph limits are often implemented in environments where there is little space for cars and cyclists, so the risk to cyclists is high regardless of the speed limit.

6.3.5. View of motorcyclists

Reasons given in favour of 20mph limits were in the minority and typically non-motorcycle specific, and included:

- increased rider awareness of potential risks and hazards⁴¹;
- fewer and less severe collisions;
- benefits for pedestrians, cyclists, children, and other vulnerable groups.

The most common reason given for opposing 20mph limits was **lack of enforcement and compliance**, which is viewed as making the limits ineffective.

Other common themes were more motorcycle-specific, and included the following:

- Concerns about other vehicles overtaking, tail-gating or driving aggressively.
- An expectation / assumption that motorcyclists ride according to the conditions and will adjust their speed in response to the environment and potential hazards.
- Practical difficulties associated with riding at slow speeds, including lack of stability and difficulties getting out of first gear (requiring frequent use of the clutch), which can make complying with the speed limit challenging and uncomfortable⁴².

“While complying with 20 mph speed limits without physical features I am often overtaken by other road users who often put others at risk.”

“An alert motorcyclist will already be aware of the hazards and adjust speed, gear and position appropriately.” ... “Awareness of the potential hazards is more important than reluctantly obeying a speed restriction.”

“It is hard to get out of 1st gear at such low speeds and speed control in first at low speed is difficult without wearing the clutch out.”

However, only 13% of respondents agreed that ‘20mph limits are frustrating for motorcyclists’ and only 13% agreed with the statement ‘I avoid riding on roads with 20mph limits, if possible.’

6.4. What other factors influence levels of support?

Other factors associated with levels of support have been identified through focus group discussions and using multi-variate regression analysis to test for the association between level of support and various respondent and area characteristics. The regression models test for association rather than causality, and have been applied separately to the residents and non-resident drivers questionnaire results.

Attitudes about the benefits of 20mph limits – Levels of support seem to reflect positive perceptions of the schemes and their impacts, as expected. Regression analysis shows higher levels of support amongst residents who think 20mph limits have made their street a more desirable place to live, are beneficial for local residents, and are beneficial for pedestrians and cyclists⁴³; and higher levels of support amongst non-resident drivers who think 20mph limits increase driver awareness of risk and who think there are fewer vehicles driving at excessive speeds⁴⁴.

Those less supportive are generally disappointed with the extent of change on the ground (in terms of observed reduction in speeds and level of compliance) and failure to address specific issues (e.g. high

⁴¹ 18% of the sample agreed with the statement ‘20mph limits increase riders’ awareness of potential risks and hazards’.

⁴² 14% of the sample agreed with the statement ‘Riding at 20mph or below is more challenging than riding at 30mph’.

⁴³ These residents are 4.4, 3.5, and 2.5 times more likely than those who do not agree to be supportive of the 20mph limit.

⁴⁴ These drivers are 4.6 and 1.8 times more likely than those who do not agree to be supportive of the 20mph limit.

speeds and flows, including HGVs, on the main route through the estate in the Walsall case study, see Box Q); rather than specifically opposing the scheme.

Case study example – Low post-implementation support in Walsall (Box Q)

Post implementation, 23% of residents in **Walsall** thought the 20mph limit was a ‘bad idea’, compared with an average of 12% across all case studies. Opposition appears to reflect the failure of the scheme to address high speeds on Barns Lane, the main route through the estate, which also provides access to an adjacent industrial estate.

Evidence from the analysis of GPS journey speed data shows that before speeds in Walsall were substantially higher than elsewhere, and well in excess of the new 20mph limit (with a median before speed of 28.2mph). They remained high post-implementation, despite a small reduction in recorded speeds. These results are heavily influenced by speeds on Barns Lane, which has a much higher volume of traffic than other roads in the estate.

Focus group participants (general residents) revealed on-going concerns regarding high speeds and safety issues on Barns Lane. HGV speeds were a particular concern:

“People look at Barns Lane and see it’s a long main through road, so they just put their foot down and go”.

Participants generally felt that achieving 20mph compliance on Barns Lane would be challenging given the volume and type of traffic using it, and its use as an access or through route; but felt that something needed to be done to improve safety for residents and others.

“For a busy road [Barns Lane] like it is, 20mph is too slow. But it needs something because it is such a busy main road, and the traffic does come bombing up”.

Some focus group participants felt that the 20mph limit had contributed to congestion on the route at certain times of day.

Socio-demographic characteristics (age, gender, affluence, car ownership) – Regression analysis shows no evidence that age, gender, and household-based measures of affluence are significant predictors of levels of support amongst case study residents or non-resident drivers. However, the results do show higher support amongst residents living in non-car owning households⁴⁵. These households are most likely to appreciate any walking and cycling benefits delivered by the 20mph scheme; and will be unaffected by any adverse impacts on drivers.

Driver behaviour – Regression analysis shows higher support amongst non-resident drivers less likely to drive above the speed limit, as expected. This analysis is based on responses to questions about general propensity to speed (e.g. exceed the limit by more than 5mph)⁴⁶.

However, the analysis found no significant association between level of support and familiarity with the area (frequency of driving through area). This analysis was undertaken to examine whether drivers are more supportive of local scheme where they are likely to see the benefits, compared to schemes further afield where they have less vested interest.

Scheme type – Regression analysis shows higher support in the eight larger residential area-wide schemes, compared with the two city centre schemes (Figure 16); suggesting the former are seen as more beneficial and less disruptive.

Focus group participants identified general support for 20mph limits in residential areas, due to the safety benefits for children and other vulnerable users.

In both city centre areas, a blanket 20mph limit has been introduced which includes more strategic A and B routes, alongside more minor roads. This is in contrast to the residential schemes which generally exclude strategic roads. Evidence from focus groups undertaken in Brighton Phase 1 (city centre area) suggests a number of factors which may have contributed to the lower levels of post implementation support compared

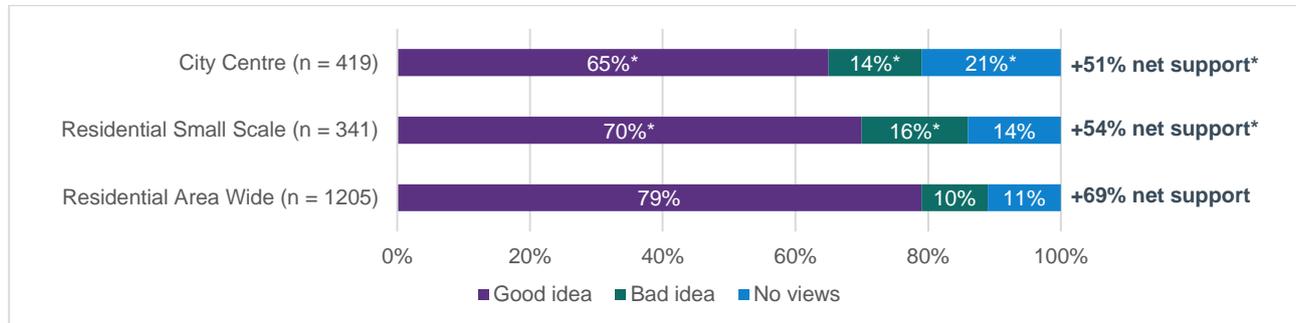
⁴⁵ Residents without a car are 1.5, 1.8, and 3.2 times more likely to be supportive of the 20mph limit than those with one car, two cars, or three cars (respectively).

⁴⁶ Those who ‘frequently’ exceed a 20mph speed limit by more than 5mph are 5.6 times less likely than those who ‘do not’ frequently do so, to be supportive of the 20mph limit.

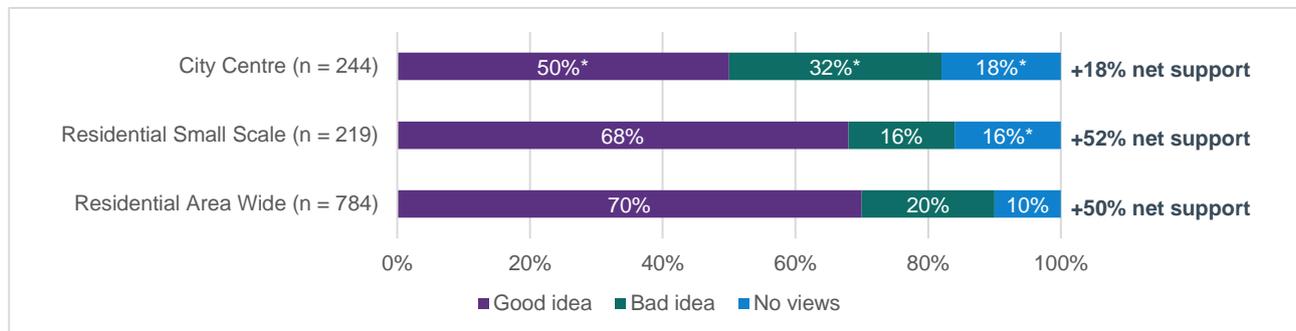
with elsewhere (Box R). Amongst focus group participants, main roads were the most frequently mentioned road type considered unsuitable for a 20mph limit, particularly if long and straight, making compliance without enforcement unlikely. However, others felt that main roads tend to have more hazards and the benefits would be greater.

Figure 16. Support for 20mph limit (Post implementation, by area type)

Residents



Non-resident drivers



Residents and non-residents questionnaire. n = sample size.

Significant differences in Residential Area Wide vs Residential Small Scale, and Residential Area Wide vs City Centre results marked with asterix (*).

Case study example – Low post-implementation support in Brighton Phase 1 (Box R)

Post implementation, 22% of residents in **Brighton Phase 1** thought the 20mph limit was a 'bad idea', compared with an average of 12% across all case studies. The level of support was lower than elsewhere in both the pre- and post-implementation periods.

Focus group participants (resident drivers and cyclists) suggested several reasons for this:

- High expectations that were not realised due to lack of compliance and lack enforcement with no prosecutions. There were several negative articles in the press (before and after implementation) about the difficulties the police would have in enforcing the new limit, which may have influenced views.
- Concerns about the perceived high cost of the scheme and whether public money could have been spent more effectively on different initiatives, again linked to articles in the media.
- Some drivers may have found that routes previously used as short cuts no longer saved as much time.
- In contrast to other case study areas, a blanket 20mph limit was introduced across Brighton Phase 1, including on a number of major A and B roads through the city centre. On these roads, the 20mph limit was felt to have added to the frustration drivers already experience as a result of congestion and delays at traffic lights. An alternative view was that speeds were already slow in this area, questioning the need for a 20mph limit.

Questionnaire results show that a high proportion of non-resident drivers (69%, more than anywhere else) found the limit frustrating. Drivers in Brighton participating in the in-depth interviews were supportive of 20mph limits where there were high volumes of tourists and other pedestrians, but felt that the speed was too slow elsewhere, where the roads are wider and there are low volumes of traffic.

However, focus group participants felt that the 20mph limit has now been accepted as the norm, and despite causing a lot of public debate at the time of implementation there is no longer widespread

discussion about the issue. The general view amongst both focus groups a couple of years on, is that the scheme has had a positive impact on the city for tourists and residents, and has made it feel safer.

Road environment – Regression analysis shows mixed findings, but the results do not support the hypothesis that levels of support are higher in areas where roads are narrow, the distance from the road to houses is small, and there is limited open space - assumed to create a more intimidating environment for walking, cycling, and other community activities. In practice, level of support is likely to reflect a combination of environmental characteristics, which cannot easily be captured in this type of regression analysis.

Focus group participants identified both narrow and wide roads as being suitable for 20mph limits:

- narrow roads - because of the risks associated with poor sight lines, parked vehicles and restricted road space (obscuring pedestrians, making it difficult for vehicles to pass in opposite directions of overtake, and increasing the likelihood of conflict); and
- wide roads – where speeds are likely to be higher, and it can be difficult for pedestrians to cross.

However, compliance was felt to be less likely on long, wide and straight roads.

Pre-implementation accident rates – Regression analysis shows no significant association between pre-implementation accident rate (casualties per road-km) and level of support. The evidence does not support the hypothesis that levels of support are higher in areas where there are high levels of accidents. However, evidence from stakeholder interviews and focus groups suggests that one or two high profile accidents (e.g. involving children or other vulnerable road users, see Box S), rather than the accident rate in general, can drive substantial support.

Near schools – Focus group participants expressed almost universal support for 20mph limits near schools; with some participants suggesting that 20mph limits should only be implemented close to schools, and that extending the limit across a wider area dilutes the impact on roads around schools. The counter-argument is that this approach endorses higher speeds on the rest of the network.

Role of communication – Evidence in Chapter 5 identifies clear articulation of scheme objectives and intended benefits, early consultation with stakeholders, and a high profile engagement campaign tailored to local circumstances, as key factors for successful delivery and buy-in from the public.

Evidence from the questionnaires show that levels of post-implementation support amongst residents were highest in Liverpool Area 7 (90%) and Area 2 (88%), and in Middlesbrough (88%); compared with an average of 75% across all case studies. In both locations, implementation was accompanied by a high profile public consultation and engagement plan, tailored to local circumstances, with on-going awareness raising activity post implementation and visible signs of enforcement through community-based initiatives (Box S). In contrast, Brighton Phase 1 (Box R) recorded the lowest levels of post-implementation support (58%); believed to be partly a result of the negative press coverage about the ability of the police to enforce the scheme and use of public money. The level of investment in publicity and communication was also less than in Liverpool, for example.

Case study examples – Strong post-implementation support in Liverpool and Middlesbrough (Box S)

Liverpool – Support for the speed limit was considered by focus group participants (parents and non-drivers) to be partly a result of a fatality outside a school on a road which remained at 30mph and the subsequent campaign ‘Slow down for Bobby’. Although it was found that driver speed was not the cause of the fatality, the incident raised awareness and concern about child safety and highlighted the potential benefits of 20mph limits.

The high level of support is also likely to reflect the consultation-led design approach and the high-profile community engagement campaign which was undertaken, in comparison with the most of the other case study areas. See Section 5.4 (Box F).

Finally, feedback from the questionnaire surveys showed that residents and non-resident drivers were positive about the benefits of 20mph limits; possibly influenced by the community engagement programme. Compared with elsewhere, a high proportion felt that the average speed of vehicles had reduced following implementation of the 20mph limits, that fewer vehicles were now driving at an excessive speed for the

area, that the number of vehicles on the affected streets had reduced, that the limit had increased drivers' awareness of potential risks and hazards, and that the roads in the area were now safer to drive on. They were also more likely to perceive the scheme to have delivered benefits for local residents and the community, and pedestrians and cyclists, than elsewhere. See Appendix C for case study percentages.

Middlesbrough – Focus group participants (parents) suggested two potential reasons for the high level of support for the Middlesbrough scheme. Firstly, there had been two fatal collisions in the area, and secondly, the areas affected have tight knit communities which 'buy in' to community schemes.

The high level of support is also likely to reflect the extent to which local residents feel that their views have been taken into account in the design of the scheme. Consultation formed a key element of the initial scheme design process, and was considered by the Council to be the most important aspect of scheme delivery. The strategy focused on the wider benefits of 20mph limits (safety, quality of life, health, etc.) rather than reducing speeds to 20 mph. Residents were invited to community meetings across the Borough, and overall levels of support for the scheme were determined by a vote. During the pre-implementation period, residents in some areas campaigned for the removal of existing traffic calming measures, as they felt that physical measures would no longer be required. The Council responded by removing approximately a third of the existing traffic calming measures.

There was also evidence of enforcement and awareness raising activity post implementation, with additional signs and markings and temporary Speed Activated Signs installed on streets with on-going speeding issues; Community Speed Watch initiatives; and work with local schools to reinforce the message that driving at 20mph in residential areas is fast enough.

Compared with other case study areas, a high proportion of surveyed residents in Middlesbrough felt that the average speed of vehicles had reduced following implementation of the 20mph limits. They were also more likely to perceive the scheme to have delivered benefits for pedestrians and cyclists than elsewhere. See Appendix C for case study percentages.

In Chichester, pro-scheme campaigners took an active role in promoting the wider benefits of 20mph schemes and selling a vision focused on creating a safe and pleasant environment for cycling; and the Council employed a 20mph Officer for a year to work with the community to encourage take-up of active travel modes. This resulted in positive perceptions about the benefits of 20mph limits for walking and cycling (see Chapter 9, Box X).

Attention effect – Finally, residents may view the 20mph limit more favourably simply because they are aware that there has been some change (regardless of how beneficial or not it actually is to them), and due to a sense that the Council has taken an interest in them and their community.

6.5. Summary and key messages

A summary of the key findings is presented below.

6.5.1. How do levels of support vary amongst user groups?

Evidence shows high levels of post implementation support amongst cyclists (81%), residents (75%), and non-resident drivers (66%); but less support amongst residents in neighbouring 30mph areas (44%) and opposition from motorcyclists (29% supportive, 47% unsupportive).

The majority of residents (78%) and non-resident drivers (67%) felt that that 20mph was an appropriate speed for the area.

There is little call for the limit to be changed back to 30mph (12% support amongst residents and 21% amongst non-resident drivers).

There is majority support for 20mph limit applying at all times of day (78% amongst residents and 67% amongst non-resident drivers), rather than during peak or off-peak periods only.

Net support (% saying 'good idea' - % saying 'bad idea') amongst residents increases significantly after the implementation of the schemes (from +58% to +63%)⁴⁷, suggesting that some pre-implementation concerns do not materialise or become more acceptable.

6.5.2. Why are schemes supported or opposed?

The majority of residents, non-resident drivers and cyclists (between 69% and 89%) perceive 20mph limits to be beneficial for residents, cyclists and pedestrians.

Cyclists are generally the most positive / supportive group, and two-thirds of cyclists (66%) agree that 20mph limits provide a safer environment for people cycling. Perceived benefits relate to the reduced speed differential between cars and cycles, as well as slower vehicle speeds, which are felt to create a safer environment in general and reduce the severity of injuries.

Most resident and non-resident drivers (72% and 69% respectively) agreed that 'the 20mph limit makes it more acceptable to drive at a lower speed'. However, there is some evidence of driver frustration with the new limit (identified by 48% of non-resident drivers).

Resident and non-resident drivers perceive the benefits of 20mph limits to be focused around safety for pedestrians, cyclists and other vulnerable users; but are sceptical about the actual level of benefit delivered locally. Those participating in a young driver focus group reported that the slower limit enables them to build confidence, allows more reaction time, means that mistakes are more forgivable, and encourages good habits and attitudes which will be carried through to roads with higher speed limits.

In general, motorcyclists did not perceive 20mph limits to be beneficial for motorcyclists. Only 2% agreed that '20mph provides a safer environment for motorcyclists', and 49% perceived the limits to be detrimental for riders. Reasons include concerns about other vehicles overtaking, tail-gating or driving aggressively; an expectation / assumption that motorcyclists ride according to the conditions and will adjust their speed in response to the environment and potential hazards; and practical difficulties associated with riding at slow speeds, including lack of stability and difficulties getting out of first gear (requiring frequent use of the clutch), which can make complying with the speed challenging and uncomfortable.

The most common area of concern across all groups was around compliance, with most focus group and survey participants of the opinion that stronger enforcement measures are needed if 20mph limits are to be effective. There is a widespread view amongst the public that 20mph limits are not enforced, and the likelihood of being caught exceeding the limit is very small; and this is one reason why bigger reductions in speed have not been observed in scheme areas.

⁴⁷ % saying 'good idea' increased from 71% to 75%.

6.5.3. What other factors influence levels of support?

The evidence from statistical analysis shows:

- Significantly higher support amongst residents living in larger residential area-wide schemes (79% of residents); compared to small-scale residential (70% of residents) and city centre focused schemes (65% of residents). Focus group participants identified specific issues in the small-scale and city centre schemes (e.g. on-going concerns about high speeds on particular roads, negative press coverage, and implementation of 20mph limits on more strategic routes), which may have contributed to the findings.
- Significantly higher support amongst residents living in non-car owning households. These households are most likely to appreciate any walking and cycling benefits (real or potential); and will be unaffected by any adverse impacts on drivers.
- Significantly higher support amongst those less likely to drive above the speed limit, as expected. This analysis was based on responses to questions about general propensity to speed.
- No significant association between level of support and familiarity with the area (frequency of driving through area). This analysis was undertaken to examine whether drivers are more supportive of local scheme where they are likely to see the benefits, compared to schemes further afield where they have less vested interest
- Significantly higher support amongst those who perceive the schemes as having delivered relevant positive benefits - not a surprising finding. It should be noted however, that perceptions may not reflect actual outcomes.

In addition:

- Focus group participants expressed almost universal support for 20mph limits near schools.
- Focus group participants typically unsupportive of 20mph limits on main roads, however, others felt that main roads tend to have more hazards and the benefits would be greater.
- Strong communication, public engagement and advocacy amongst key stakeholders (including the press) play an important role in driving public support and creating positive perceptions about the benefits.

Finally, residents may view the 20mph limit more favourably simply because they are aware that there has been some change (regardless of how beneficial it actually is to them), and due to a sense that the local authority has taken an interest in them and their community.

6.5.4. Lessons and considerations for decision makers

Motorcyclists were less likely to perceive 20mph limits as beneficial for others than other respondent groups. Given the low levels of self-reported compliance amongst motorcyclists, an education and awareness intervention for motorcyclists surrounding the rationale and potential benefits of 20mph limits could be beneficial.

7. How have speeds and driver behaviour changed?

7.1. Introduction

7.1.1. Outline

This chapter tests the following assumptions about the impact of new 20mph limits (signed only) on vehicle speeds and driver behaviour (as set out in the theory of change logic maps in Figures 3-5):

- The majority of users comply with the 20mph limit.
- Self-enforcement process ensures that providing a few drivers comply with the new limit, others behind are forced to drive at a similar speed (process most effective where volumes are higher).
- Reduction in average and top percentile (excessive) speeds.
- Smoother more consistent driving speeds (reduction in range of speeds, and less acceleration / deceleration).
- No change in driving speeds on neighbouring roads.
- Perceived reduction in speeds amongst residents and users.
- Increased acceptability for drivers already travelling at speeds close to 20mph.
- Increase in driver awareness of other road users (pedestrians, cyclists and other vulnerable groups) and appropriate speed for environment. ... But, risk that drivers consider 20mph to be inherently safer, so pay less attention to driving.
- Drivers have more time to, and are more likely to respond to road hazards.

The analysis is based on the following evidence sources (described in more detail in Section 3.4):

- GPS area-wide journey speed data provided by TomTom for 12 case study areas;
- spot speed provided by case study local authorities;
- questionnaire surveys with residents and non-residents drivers; and
- feedback from in-depth interviews with non-resident drivers, focus groups with residents and specific users groups, and local stakeholder interviews.

Journey speed and spot speed data is used to estimate the change in vehicle speeds on new 20mph limits (signed only) in case study areas. This is important as it has a direct impact on number and severity of collisions, journey times, and vehicle noise and emissions. A summary of the strength and weaknesses of these two datasets is provided in Section 3.4.

It is worth re-emphasising that the two datasets measure speed in very different ways. GPS data measures **journey speed**. This is the effective speed of a vehicle on a journey between two points (e.g. from one end of a road to another). It is calculated by dividing the distance between the two points by the total time taken for the vehicle to complete the journey, including any stopped time. It is therefore influenced by any delays occurring between the two points, such as slowing down to give way to on-coming vehicles, and accelerating / decelerating at junctions. In contrast, spot speed surveys measure the **instantaneous speed** of a vehicle as it passes a specified location.

Both data sets have been filtered to enable a focus on new 20mph limits (signed only). Roads with pre-existing traffic calming (road humps, chicanes, etc.), existing 20mph limits (implemented before the main case study schemes) and higher speed limits have been separated out and analysed independently. Greater emphasis has been given to the journey speed data, as this provides information speeds across the whole of the network, and a consistent format and comprises a very large sample size when aggregated across all case study areas. In addition, it is the most representative of the typical speed at which drivers travel along a road. Spot speed results are also presented for comparison. While spot speed data has the benefit of capturing the speed of every single vehicle passing the detection point, it is acknowledged that the surveys are typically conducted for short periods only and at a limited number of locations. Furthermore, feedback from case study authorities suggests that site locations can be biased towards busier and more important routes, and those where speeding has been reported as an issue or are expected to have a low level of compliance.

Analysis of journey speed data uses the median (denoted as the value lying at the midpoint of a frequency distribution of observed values) to measure average speeds, as this helps to dampen the impact of slow moving vehicles (e.g. vehicles slowing to allow an on-coming vehicle to pass). Use of the mean (rather than the median) would result in a much lower estimate of the average speed. However, for spot speed data, it is common practice to use the mean to measure average speed, to reflect the full range of instantaneous speeds. As shown in Section 3.4.7, spot speed data typically reports higher speeds than journey speed data, and mean spot speeds are higher than median journey speeds.

Questionnaire data is used to examine self-reported driving behaviour and perceptions. Drivers views about their own behaviour may help explain the actual changes in speed; while perceptions about speeds are important in terms of the attractiveness of walking and cycling, and views about the quality of the community environment.

The rest of this chapter is structured around the following sections:

- To what extent do drivers comply with the limit?
- How has the profile of speeds changed?
- How has effectiveness changed over time?
- How have speeds on neighbouring roads changed?
- Have residents and drivers noticed a change in speed?
- What do drivers say about their own driving behaviour?
- Do 20mph limits make slower speeds more acceptable?
- How has driver awareness and assessment of risk changed?

An assessment of the extent to which the evidence supports, partly supports, or rejects the theory of change hypotheses, is provided at the start of each section.

Vehicle kilometres (vkms) are a measure of traffic volume that considers the total distance travelled by users rather than just the number of users. This is determined by multiplying the number of vehicles on a set of road segments by the corresponding length of the segments.

Vehicle kilometres observed refers to the sample size of journey speed data available.

7.1.2. Background context

An appreciation of the speeds before implementation of the 20mph limits (Table 19) is important in understanding the speed changes and user perceptions reported in this chapter.

Analysis of GPS journey speed data shows that a substantial proportion of drivers were already travelling at less than 20mph prior to the introduction of the new limits (44% in residential case studies and 59% in city centre case studies); and median before speeds were already close to 20mph (21.1mph in residential areas and 18.0mph in city centre areas).

This trend reflects the high proportion of minor local roads within the case study areas:

- In residential areas, 87% of new 20mph roads are 'minor local roads'; and 67% of road length within the sample is 'minor local road' with a before median speed of less than 20mph.
- In city centre areas, 55% of new 20mph limits are 'minor local roads', and 53% of road length within the sample is 'minor local road' with a before median speed of less than 20mph.

Minor local roads are likely to be narrower roads, primarily within residential areas or estates (with a destination function only); where drivers may struggle to reach higher speeds due to parked cars, cul-de-sacs, or high volume of pedestrians in the area (e.g. outside a school).

Although the majority of road length has a before speed of <20mph, the total vehicle kilometres undertaken on 'faster' roads is higher, and hence the impact of the different speed categories on the overall results is broadly similar, e.g. 37% for <20mph roads, 30% for 20-24mph roads, and 33% for >24mph roads in residential areas.

Before speeds were lower in city centre areas than residential areas. This suggests that the presence of congestion, pedestrians and cyclists, crossing points, parking and a high density of buses may have been influencing the speeds at which drivers were able or chose to drive.

The baseline conditions suggest that the new speed limits have formalised a lot of the previous behaviour, and a substantial reduction in speed is unlikely in these locations. However, across the case studies, median before speeds varied from 17.8mph to 28.2mph; indicating that 20mph limits have been implemented in a range of different speed environments, which is likely to affect the speed outcomes observed.

Table 19. Road types and before speeds in case study areas – based on GPS journey speed data

Characteristics	Residential areas ^a	City centre areas ^b
Road type^c		
Major strategic roads - Major roads used to travel between different parts of the country or region. (FRC1-3)	1% of road length	19% of road length
Important local roads - Local connecting roads which provide access to settlements or parts of settlements, and the main connections within a settlement, where important through traffic is possible e.g. arterial roads within suburban areas, industrial areas or residential areas. (FRC 4-5)	12% of road length	27% of road length
Minor local roads - Roads of minor connecting importance within a settlement, and roads that only have a destination function, e.g. roads inside living area, dead-end roads, alleys. (FRC 6-7)	87% of road length	55% of road length
Before speeds		
Before median speed	21.1mph	18.0mph
Proportion driving <20mph	44%	59%
Speed categories - Approx. road length with:		
Before median speeds <20mph	70% of road length	82% of road length
Before median speeds 20-24 mph	17% of road length	16% of road length
Before median speeds >24 mph ⁴⁸	13% of road length	2% of road length

a. Includes the two small-scale residential schemes, the eight area-wide residential schemes, and Brighton Phase 1 (residential area).

b. Brighton Phase 1 (core city centre area only) and Winchester City Centre.

c. Case study roads have been classified using TomTom's Functional Road Classes (FRC), which provides a good proxy for the size and nature of each road.

Local authority response to DfT Circular 2013/01 – The findings suggest that local authorities have broadly taken into account the guidance in DfT Circular 2013/01 (Setting Local Speed Limits) when deciding where to implement 20mph limits. This says that signed only 20mph limits are most appropriate where the mean speed is already below 24mph, and introducing a 20mph limit on these types of roads is likely to lead to general compliance with the new limit. The guidance is based on early findings from Portsmouth (the first extensive area-wide 20mph scheme to be implemented in England, in 2008), based on spot speed data.

Due to the urban characteristics of Portsmouth (roads are often narrow with high levels of on-street parking) the majority of roads (86%) where a 20mph limit was introduced had a mean before speed of less than 20mph. Data presented later in this chapter (Table 22) shows that this is higher than in nearly all of the 'other' case studies considered in this study (where the proportion varied from 20% to 67%). Across all of the 'other' case studies where spot speed data was available⁴⁹, 60% of sites had a mean before speed of less than 24mph. It should be noted that the number of spot speed survey locations in these case studies (between 3 and 54 sites) was substantially less than in Portsmouth (223 sites), and known to be biased

⁴⁸ This is the recommended threshold for fixed penalty notices or speed awareness courses in the ACPO Speed Enforcement Policy Guidelines 2011-2015. In addition, Circular 01/2013 suggests that where average speeds exceed 24mph the introduction of signage only is unlikely to lead to 20mph compliance.

⁴⁹ I.e. excluding Portsmouth, Liverpool (Area 7), and Liverpool (Area 2).

towards sites where higher speeds were expected. The actual proportion of roads with a mean before speed less than 24mph, taking all roads into account, is therefore likely to be higher.

These findings suggest that local authorities have taken into account the guidance in Circular 2013/01 and the majority of 20mph limits have been implemented on roads where mean before speeds were below 24mph. However, the limits have been introduced in a range of different environments, which includes roads with higher before speeds. Some authorities reported that they had decided to include streets with higher limits to avoid isolated 30mph roads and to provide consistency in signage and road user perceptions. Others deliberately excluded streets with average speeds of more than 24mph or with known speeding issues.

The journey speed data also shows that the majority of 20mph limits have been implemented on roads with lower speeds. Approximately 87% of road length in residential areas and 98% in city centre areas had a median before speed of less than 24mph.

7.2. To what extent do drivers comply with the new limits?

Theory of Change Hypothesis: The majority of road users comply with the 20mph limit.

✓ *GPS journey speed data suggests 47% compliance in residential areas and 65% in city centre areas. Whilst a substantial proportion are exceeding the limit, the majority are travelling less than 24mph (i.e. at speeds close to 20mph): 70% in residential areas and 86% in city centre areas.*

Compliance is higher in city centre areas, compared with residential areas; higher on roads with a median before speed of <20mph; and higher on 'minor local roads', compared with 'important local roads'. Evidence suggests that within the case study areas, the character of the road has a bigger influence on driver speed than whether the limit is 30mph or 20mph. Compliance is higher in peak than non-peak periods; but if roads with a before median speed of less than 20mph are excluded to remove the influence of congestion and isolate the impact of journey purpose, then the results show very little difference. Data collected in one case study area (but not available for other case studies) suggests that 20mph compliance amongst HGV drivers is poorer than for car and LGV drivers.

Theory of Change Hypothesis: Self-enforcement process ensures that providing a few drivers comply with the new limit, others behind are forced to drive at a similar speed (process most effective where volumes are higher).

✓ *The nature of the roads where the limits have been introduced means that lower speeds were already 'self-enforced'. Reducing the speed limit to 20mph has helped reinforce this process. There are now slightly more drivers travelling at speeds of less than 24mph (+5 percentage points in residential areas, and +7 percentage points in city centre areas), suggesting faster drivers have slowed down.*

This section looks at overall compliance; variation by area type, road type, vehicle type, and time of day; and makes a comparison with compliance on other types of roads.

7.2.1. Overall compliance

Evidence from the journey speed analysis shows that following implementation, 47% of drivers in residential areas and 65% of drivers in city centre areas (equating to 51% across both categories) complied with the new 20mph limit, travelling at speeds of less than 20mph. Whilst a substantial proportion are exceeding the limit, the majority are travelling less than 24mph (i.e. at speeds close to 20mph): 70% in residential areas and 86% in city centre areas.

There has been a small increase in drivers travelling less than 20mph (+3 and +6 percentage points in residential and city centre areas), and less than 24mph (+5 and +7 percentage points respectively).

The scale of the change is expected as a substantial proportion were already travelling less than 20mph before the new limits were introduced. It appears that the nature of the roads where the limits have been introduced means that lower speeds were already 'self-enforced'. Reducing the speed limit to 20mph has helped reinforce this process. There are now slightly more drivers travelling at speeds of less than 24mph, suggesting faster drivers have slowed down.

Case study examples – Different levels of compliance (Box T)

Levels of compliance vary substantially across the case studies:

Walsall – *Both data sources show compliance to be lowest in Walsall (16% based on journey speed data, and 14% based on spot speed data). Before speeds were much higher in Walsall than elsewhere, and despite reporting the largest reduction in median speed (-1.5mph), the majority of drivers still seem to be travelling well in excess of 20mph.*

Portsmouth – *Spot speed data shows that compliance was highest in Portsmouth (71%). The 20mph scheme in Portsmouth was one of the first to be implemented in the country, and pre-dated the other case study schemes by at least four years. A much higher proportion of monitoring sites (63%) already had a mean speed of <=20mph, compared with elsewhere.*

7.2.2. By area type, road type, and time of day

Levels of before and after compliance, by area type, road type, vehicle type, and time of day are summarised in Table 20.

Table 20. Proportion driving less than 20mph in case study areas (based on journey speed analysis)

Category	Before (30mph limit)	After (20mph limit)	Change
Residential areas	44%	47%	+3%
City centre areas	59%	65%	+6%
Residential areas only ^a			
Before median speeds <20 mph	78%	80%	+2%
Before median speeds 20-24 mph	37%	42%	+5%
Before median speeds >24 mph	12%	16%	+4%
Major strategic roads	43%	46%	+3%
Important local roads	36%	40%	+4%
Minor local roads	56%	57%	+1%
Peak periods (07:00-10:00; 16:00-19:00) ^b	48% (24%)	52% (30%)	+4% (+6%)
Non-peak periods (All other hours) ^b	42% (24%)	45% (27%)	+3% (+4%)

a. A similar breakdown has not been provided for city centre areas due to the smaller sample size.

b. Peak and non-peak figures in brackets exclude roads with a before median speed <20mph, to remove the influence of congestion and isolate the impact of journey time.

By before speed and road type – Not surprisingly, the journey speed data shows that 20mph compliance in residential areas is much higher on roads which previously had the slowest speeds (80% on roads with a before speed <20mph), and much poorer on roads which previously had faster speeds (16% on roads with a before speed >24mph). Following the change to the limit, the proportion driving less than 20mph increased by +2 and +4 percentage points on the two categories of road.

Related to this, 20mph compliance is found to be higher on 'minor local roads' (57%), than on 'important local roads' (40%) where before speeds were generally faster; and the proportion driving less than 20mph increased by +1 and +4 percentage points on the two categories of road.

The evidence suggests that, within the case study areas, the character of the road has a bigger influence on driver speed, than whether the limit is 30mph or 20mph. The difference in speed between the different road types is far larger than the change brought about by the change in speed limit. It appears that some roads lend themselves to good 20mph compliance more than others, probably due to the characteristics of the roads themselves.

In other words, some roads are naturally 'self-explaining roads' where drivers 'instinctively' drive more slowly, while in other cases the look and feel of the road environment naturally encourages higher speeds. Changing the look and feel of a street (e.g. through road markings, landscaping, and roadside activity – see Kennedy et al. 2005) may therefore result in higher levels of compliance.

Self-explaining roads

The concept of self-explaining roads on which the driver is encouraged to naturally adopt behaviour consistent with design and function originated in the Netherlands (Theeuwes, J, 1998). The aim is that different classes of roads should be distinctive, and within in each class features such as width of carriageway, road markings, signing, and use of street lighting would be consistent throughout the route. Drivers perceive the type of road and "instinctively" know how to behave. The environment effectively provides a "label" for the particular type of road resulting in less need for separate traffic control devices such as additional traffic signs to regulate traffic behaviour.

Such an approach uses simplicity and consistency of design to reduce driver stress and driver error. It is already used for the highest road classes (motorways) but on low class roads consistency in design is often compromised by other objectives such as high access levels, variable alignment, mixed use and

variable roadside development, which result in lack of consistency and lack of differentiation between road classes.

(https://ec.europa.eu/transport/road_safety/specialist/knowledge/road/designing_for_road_function/self_explaining_roads_en)

Impact of road environment – Further evidence regarding the impact of the road environment can be determined by examining the characteristics of the spot speed sites with the highest after speeds (poorest compliance) and the lowest after speeds (highest compliance) (Table 21).

Analysis of the characteristics of the seven spot speed sites with the highest after speeds shows that poor compliance is associated with environments which create a perception of space and openness, and provide the driver with good visibility. This may encourage drivers to adopt higher speeds, because they do not need to slow down to allow vehicles to pass, and perceive there to be less risk of a collision. The highest spot speeds were recorded on Barns Lane (Walsall), which can be used as a through route linking adjacent areas, as an access road to the industrial estate to the east, and by local residents driving to/from home.

In contrast, the roads with the highest compliance are all located on ‘minor local roads’ and have environments which are likely to constrain speeds - because their length provides less opportunity to build-up speed, visibility may be limited, drivers feel that they need to ‘squeeze’ passed parked vehicles and do not feel that they have sufficient space to drive faster, and possibly because they are either starting or ending their journey and are in less of a hurry at this point.

Table 21. Characteristics of roads with poorest and highest compliance (post implementation)

Characteristics associated with poor compliance	Characteristics associated with high compliance
<ul style="list-style-type: none"> Open road environment (wide roads, and moderate-high distances from the middle of the road to the adjacent houses), with low levels of on-street parking. Often contain long sections of straight or slightly curved road. Typically at least 500m long, allowing drivers to progressively build up speed. Mainly residential streets. Generally no schools or major trip attractors nearby which might generate high levels of walking and cycling. Roads are likely to be used as through routes as well as by local residents. In many cases, they could be used as shortcuts or rat runs, with drivers keen to maintain a higher speed to reach their destination. 	<ul style="list-style-type: none"> All located on ‘minor local roads’. Narrow road environment (in terms of carriageway, road and/or building to building width), with medium to high levels of on-street parking; Typically straight roads with few junctions, but all are short roads where there is less scope to achieve faster speeds. Mainly residential streets, located within a housing estate / area. Roads are likely to be used predominantly by local residents leaving or arriving home. Most drivers are likely to be either at the start or the end of their journey.

By mode and vehicle type – The data collected by Portsmouth City Council, as part of the on-going programme to monitor speeds on roads where complaints have been received by the public, categorises vehicles by type (bicycle / motorcycle, car, LGV, and HGV). The data provides an indication of compliance by mode, albeit on roads where compliance is perceived to be poor rather than at representative locations.

The results suggest that 20mph compliance amongst HGV drivers (41%) is lower than compliance amongst car (46%) and LGV (45%) drivers, with the difference found to be significant.

However, those driving excessively (>30mph) are more likely to be car or LGV drivers. Some 99% of HGV drivers were driving <30mph, compared to only 94% of car drivers and 93% of LGVs, representing a significant difference.

By time of day and journey purpose – GPS journey speed data shows that compliance is higher in peak (52%) than non-peak periods (45%). However, if roads with a before median speed of less than 20mph are excluded to remove the influence of congestion and isolate the impact of journey purpose, then the results show very little difference in compliance: 30% in the peak and 27% in the non-peak.

7.2.3. Comparison with other types of roads

Comparison with existing 20mph limits – A few of the case studies already had 20mph limits in place. Journey speed data shows that levels of speed limit compliance are substantially higher on these roads (68%), than they are on new 20mph roads (47%). This could be because compliance improves over time, and the existing roads have had their speed limit in place for a longer time. Alternatively, it could be that the new 20mph roads have characteristics which make them less desirable to comply with a lower speed limit (e.g. wider, straighter, busier roads, etc.).

Comparison with nearby 30 and 40mph roads – Journey speed data shows that compliance with the respective limits is substantially higher on nearby 40mph roads (84%) and 30mph roads (71%), than on new 20mph roads (47%). These roads have not experienced any change in speed limit during the period of analysis.

Free flow vehicle speeds by vehicle type in Great Britain 2016

The DfT monitor free flow speeds at a sample of Automatic Traffic Counters (ATCs) chosen to exclude locations where external factors might restrict driver behaviour (e.g. junctions, hills, sharp bends and speed enforcement cameras). Data for 2016 shows the following levels of compliance:

- Motorways (25 sites) – 54% compliance
- National speed limit single carriageways (26 sites) – 92% compliance
- 30 mph speed limit roads (29 sites) – 47% compliance
- 20 mph speed limit roads 3 (9 sites) – 19% compliance

The data shows that levels of compliance are lowest on 20mph limit roads. The absolute % compliance is substantially lower than the case study figures reported above, due to the focus on free flow conditions.

7.3. How have speeds changed in new 20mph limits?

Theory of Change Hypothesis: Reduction in average and top percentile speeds i.e. reduction in vehicles driving at excessive speeds.

✓ *Journey speed data shows a small reduction in average and 85th percentile speeds in the case study areas; and faster drivers have reduced their speed more.*

Journey speed analysis shows that the median speed has fallen by 0.7mph in residential areas and 0.9mph in city centre areas. Spot speed analysis shows a reduction in mean speed in four case study areas (based on unweighted and flow weighted data, where available) varying from -0.9mph to -2.3mph; and in a fifth case study area (-1.5mph) based on flow weighted data but not unweighted data. There was no significant change in three case study areas.

Bigger changes in mean speed were recorded at individual spot speed sites varying from -7.2mph (reduction) to +4.3mph (increase). Overall, 88% of sites showed a decrease in mean speed, following the change in limit.

Faster drivers have reduced their speed most, with the 85th percentile speed falling by -1.1mph in residential areas and by -1.6mph in city centre areas, based on journey speed data.

Journey speed data shows that the overall change in speeds is greater where speeds were faster before (the median speed fell by -1.3mph on residential roads with a before speed of more than 24mph); and on 'important local roads' (where the median speed fell by -1.1mph) compared with 'minor local roads' (where the median speed fell by -0.1mph). Similar conclusions can be drawn from the spot speed data.

Comparator analysis (evidence of 20mph policy impact) - Statistical analysis shows a significant reduction in speeds, relative to comparator areas, for important local roads in residential areas and for an aggregation of all road types in city centre areas. The findings suggest that the absolute changes in speed observed in the case study areas are partly due to the implementation of 20mph limits, but also reflect background trends in speed on urban roads.

Theory of Change Hypothesis: Smoother more consistent driving speeds.

✓ *Journey speed data shows that the spread of speeds, indicated by the 15th-85th percentile range, has declined by 1.3mph in residential areas, and by 2.0mph in city centre areas; indicating more consistency in the driving speeds on 20mph limit roads.*

?*(Unclear) However, it has not been possible to collect evidence to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual driver level (with less acceleration and deceleration).*

This section looks at how the profile of speeds has changed, based on the median or mean speed (to reflect the average), the 85th percentile speed⁵⁰ (to reflect the highest speeds), and the 15th-85th percentile (to reflect the range of speeds).

Firstly the change in speed is examined at a case study and site specific level. Regardless of whether this is due to the introduction of the new speed limits, the actual change is important in influencing subsequent outcomes such as the attractiveness of walking and cycling, perceptions about the environment, journey times, the number and severity of collisions, and environmental impacts.

Secondly, the results of the comparator analysis are presented to estimate the extent to which the observed change can be attributed to the introduction of the 20mph limits.

7.3.1. Actual change in speed in the case study areas

Change in median / mean speed – Evidence from both datasets shows a small reduction in speeds following the introduction of 20mph limits. The scale of reduction is not surprising, as a substantial proportion of drivers were already travelling at speeds close to 20mph prior to the introduction of the new limits.

⁵⁰ The 85th percentile speed is the speed that 85 percent of vehicles do not exceed. Only 15 percent of vehicles go faster than this speed, and 85 percent go at or below this speed. It is regularly used in traffic engineering as a standard to set safe speed limits and in the design of roads.

Journey speeds – Journey speed data shows that the median speed has fallen by 0.7mph in residential areas and 0.9mph in city centre areas (Figure 17).

Instantaneous speeds – Spot speed data (based on unweighted and flow-weighted data) has been averaged across all monitoring sites within each area to identify changes in speed at a scheme level (Table 22). Unweighted metrics treat all sites equally, and reflect average speeds across the chosen sites; flow-weighted metrics place more emphasis on higher flow sites and are more representative of the behaviour of all drivers. Flow-weighted mean speeds are typically higher, reflecting higher speeds on busier roads. Flow data was not provided for all case study areas, so flow weighted speeds could not be calculated for some locations.

Statistical analysis⁵¹ shows a significant reduction in mean speed in four case study areas based on unweighted speed data, varying from -0.9mph to -2.3mph (Middlesbrough, Chichester, Brighton Phase 2, Brighton Phase 1). Flow-weighted differences were also found to be significant where suitable data was available. In addition, the flow weighted difference in a fifth case study (Calderdale Phase 1) was significant, although the findings are based on 3 sites only.

No significant change in mean speed was found in three case studies (Walsall (Rushall), Winchester (Stanmore) and Winchester City Centre). It was not possible to calculate confidence intervals for Portsmouth as the disaggregated data was not readily available.

Case study variation - The case study schemes with the biggest / smallest change in average spot speed, differ from the schemes with the biggest / smallest change in area-wide GPS speeds. This is likely to be due to the specific location of the monitoring sites chosen for the spot speed surveys.

In both cases, the variation in speed reduction across the case studies is small, varying from -1.5mph to +0.6mph for the GPS journey speed data and -2.3mph to +0.4mph for the unweighted spot speed data.

None of the case studies stand out as performing particularly strongly or poorly overall, in terms of the scale of the average change in speeds across the scheme areas. This is despite the schemes being implemented in a range of different geographical and speed environments.

Change in 85th percentile speeds – Faster drivers have reduced their speed more. This is a key finding, as other research shows that higher speeds are associated with increased safety risk (more collisions, increased severity, perceptions that the environment is not safe for vulnerable users).

Journey speeds – Journey speed data shows that 85th percentile speed has fallen by -1.1mph in residential areas and by -1.6mph in city centre areas (Figure 17).

Instantaneous speeds – The spot speed analysis supports these findings (Table 22). In general, the change in the 85th percentile speed is equal to or slightly bigger than the change in mean speed. Statistical analysis⁵² shows a significant reduction in 85th percentile speeds in five case study areas based on unweighted speed data, varying from -0.9mph to -2.8mph (Walsall (Rushall), Calderdale, Brighton Phase 2, Chichester, Brighton Phase 1). Flow-weighted differences were also found to be significant in four of the five case studies.

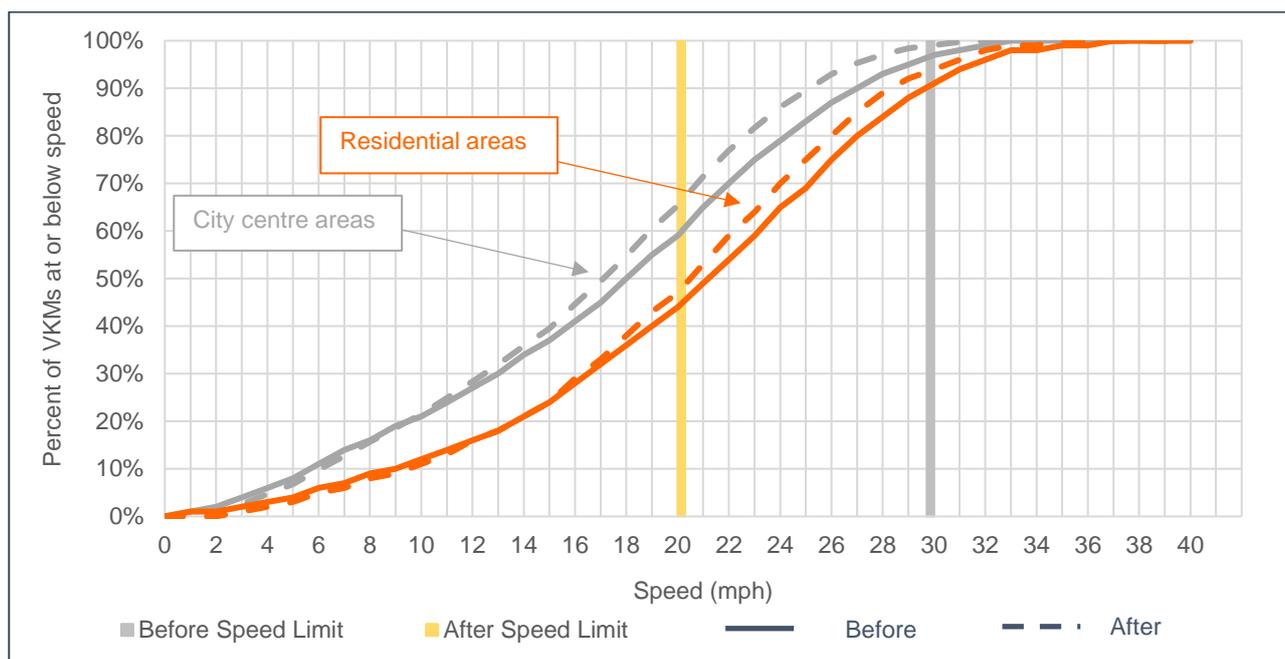
No significant change in mean speed was found in: Winchester (Stanmore) and Winchester City Centre.

Change in range of speeds – The spread of speeds, indicated by the 15th-85th percentile range, has declined by 1.3mph in residential areas, and by 2.0mph in city centre areas (Figure 17); largely due to the reduction in the 85th percentile speed. There is now more consistency in the driving speeds on 20mph limit roads.

⁵¹ A paired t-test was used for the unweighted data, and a weighted least squares model for the weighted data.

⁵² A paired t-test was used for the unweighted data, and a weighted least squares model for the weighted data.

Figure 17. New 20mph limits (signed only) – Cumulative speed distribution, residential and city centre areas, based on GPS journey speed data



New 20mph limits (signed only)	Residential areas			City centre areas		
	Before, After, Diff			Before, After, Diff		
Speed limit	30mph	20mph		30mph	20mph	
Road length	450.5km	450.5km		20.6km	20.6km	
Vehicle kilometres (VKMs) observed	952,551	1,136,370		274,342	296,273	
Median Speed (mph)	21.1	20.5	-0.7	18.0	17.1	-0.9
85 th Percentile (mph)	28.1	27.0	-1.1	25.4	23.8	-1.6
15 th - 85 th percentile	16.6	15.2	-1.3	17.9	16.0	-2.0
% Driving <20	44%	47%	+3%	59%	65%	+6%
% Driving 20-24	21%	23%	+2%	20%	21%	+1%
% Driving 24-30	26%	24%	-2%	18%	13%	-5%
% Driving >30	9%	6%	-3%	3%	1%	-2%
% Driving >24	35%	30%	-5%	21%	14%	-7%

Interpretation of cumulative distribution graphs – The above graph shows the percentage of driver vehicle kilometres (vkms) travelling at or below a specific speed; with 20mph and 30mph speeds highlighted by vertical lines to show the before and after speed limits.

When the speed limit was 30mph (i.e. during the 'before' period, represented by the solid orange and grey lines), a higher percentage of vehicles travelled at / close to this speed, resulting in the curve of the graph being skewed to the right. Following implementation of the 20mph limit (i.e. during the 'after' period, represented by the dashed orange and grey lines), a higher percentage of drivers are travelling at lower speeds, moving the distribution curve to the left.

The larger the shift to the left (and the bigger the gap between the before and after period), the higher percentage of drivers now travelling at lower speeds.

For both residential and city centre areas, the dashed ('after') curves are consistently to the left of the solid ('before') curves indicating slower speeds in the 'after' period across the whole of the speed profile.

Table 22. Speed characteristics on new 20mph limits, based on instantaneous spot speed data

a) Before speeds

Case study	No. of spot speed sites	Unweighted data ^a		Flow weighted data ^a		% of sites with before mean speed <20mph	% of sites with before mean speed <24mph
		Mean speed	85 th speed	Mean speed	85 th speed		
Walsall (Rushall) (R-SM1)	10	25.2mph	30.7mph	29.5mph	35.2mph	30%	60%
Winchester (Stanmore) (R-SM2)	3	25.2mph	30.9mph	26.0mph	31.8mph	0%	33%
Liverpool (Area 7) (R-AW1a)	No monitoring data provided.	-	-	-	-	-	-
Liverpool (Area 2) (R-AW1b)	No monitoring data provided.	-	-	-	-	-	-
Middlesbrough (R-AW2)	25	26.8mph	-	-	-	0%	20%
Calderdale^b (R-AW3)	3	24.4mph	31.7mph	22.9mph	30.0mph	0%	67%
Nottingham (Bestwood) (R-AW4)	5	19.0mph	28.5mph	20.4mph	29.2mph	40%	100%
Brighton (Phase 2) (R-AW5)	46	22.4mph	27.6mph	23.7mph	28.6mph	17%	72%
Portsmouth (R-AW6)	223	19.8mph	-	-	-	63%	86%
Chichester (R-AW7)	35	23.0mph	28.7mph	-	-	14%	69%
Brighton (Phase 1) (TC-AW1)	54	21.5mph	23.0mph	27.2mph	28.2mph	34%	64%
Winchester City Centre (TC-AW2)	11	21.0mph	22.2mph	25.9mph	26.9mph	36%	55%

a. Unweighted metrics treat all sites equally, and reflect average speeds across the chosen sites; flow-weighted metrics place more emphasis on higher flow sites and are more representative of the behaviour of all drivers.

b. The study area for Calderdale includes Sidall and Southowram only.

Data availability - Spot speed surveys were undertaken in the two Liverpool case study areas but were not available within the timescales of this study. In the case of Nottingham (Bestwood) resource challenges meant that 'after' monitoring did not take place, although before and after monitoring was undertaken in other parts of the city. Elsewhere, not all case studies were able to provide 85th percentile speeds, flow data, or site specific data, due to the way in which the raw data had been collected or reported.

b) Change in speed

Case study	Time period after (no. of sites, unweighted mean before speed)	Unweighted data ^a		Flow weighted data ^a		Change in mean speed at individual sites	Change in 85 th speed at individual sites
		Change in mean speed	Change in 85 th speed	Change in mean speed	Change in 85 th speed		
Walsall (Rushall) (R-SM1)	30 months after (10 sites, 25.2mph)	-0.3mph <i>(not sig)</i>	-2.1mph <i>(sig)</i>	-0.1mph <i>(not sig)</i>	-1.6mph <i>(sig)</i>	-3.1mph to +1.6mph	-7.1mph to +0.9mph
Winchester (Stanmore) (R-SM2)	17-21 months after (6 sites, 25.2mph)	+0.4mph <i>(not sig)</i>	+0.7mph <i>(not sig)</i>	-0.2mph <i>(not sig)</i>	0.0mph <i>(not sig)</i>	-1.8mph to +2.5mph	-2.2mph to +3.6mph
Liverpool (Area 7) (R-AW1a)	No monitoring data provided.	-	-	-	-	-	-
Liverpool (Area 2) (R-AW1b)	No monitoring data provided.	-	-	-	-	-	-
Middlesbrough (R-AW2)	3-12 months after (25 sites, 26.8mph)	-2.3mph <i>(sig)</i>	Data not available	Data not available	Data not available	-5.9mph to +0.3mph	Data not available
Calderdale^b (R-AW3)	3 months after (3 sites)	-1.8mph <i>(not sig)</i>	-2.2mph <i>(sig)</i>	-1.5mph <i>(sig)</i>	-1.7mph <i>(not sig)</i>	-2.8mph to -1.1mph	-2.8mph to -1.3mph
Nottingham (Bestwood) (R-AW4)	No after data collected.	-	-	-	-	-	-
Brighton (Phase 2) (R-AW5)	12 months after (46 sites, 22.4mph)	-0.9mph <i>(sig)</i>	-0.9mph <i>(sig)</i>	-1.1mph <i>(sig)</i>	-1.2mph <i>(sig)</i>	-5.0mph to +1.0mph	-5.8mph to +1.3mph
	24 months after (46 sites, 22.4mph)	-0.9mph <i>(sig)</i>	-0.9mph <i>(sig)</i>	-1.4mph <i>(sig)</i>	-1.4mph <i>(sig)</i>	-3.8mph to +2.1mph	-3.8mph to +2.2mph
	Difference	0.0mph <i>(not sig)</i>	0.0mph <i>(not sig)</i>	-0.2mph <i>(not sig)</i>	-0.2pmh <i>(not sig)</i>	-	-
Portsmouth (R-AW6)	6-18 months after (223 sites)	-1.3mph <i>(not tested)</i>	Data not available	Data not available	Data not available	Data not available	Data not available
Chichester (R-AW7)	8 months after (35 sites, 23.0mph)	-1.7mph <i>(sig)</i>	-2.8mph <i>(sig)</i>	Data not available	Data not available	-5.4mph to +2.1mph	-7.8mph to +0.4mph
Brighton (Phase 1) (TC-AW1)	13 months after (47 sites, 21.5mph)	-1.3mph <i>(sig)</i>	-2.0mph <i>(sig)</i>	-1.6mph <i>(sig)</i>	-1.8mph <i>(sig)</i>	-6.5mph to +4.3mph	-7.5mph to +3.3mph
	26 months after (47 sites, 21.5mph)	-1.2mph <i>(sig)</i>	-1.9mph <i>(sig)</i>	-1.3mph <i>(sig)</i>	-1.3mph <i>(sig)</i>	-7.2mph to +3.9mph	-9.0mph to +7.6mph
	Difference	+0.1mph <i>(not sig)</i>	+0.1mph <i>(not sig)</i>	+0.3mph <i>(not sig)</i>	+0.5mph <i>(not sig)</i>	-	-
Winchester City Centre (TC-AW2)	7-8 months after (11 sites, 21.0mph)	-0.4mph <i>(not sig)</i>	-0.0mph <i>(not sig)</i>	-0.7mph <i>(not sig)</i>	-0.3mph <i>(not sig)</i>	-3.6mph to +1.9mph	-4.3mph to +3.3mph

a. Unweighted metrics treat all sites equally, and reflect average speeds across the chosen sites; flow-weighted metrics place more emphasis on higher flow sites and are more representative of the behaviour of all drivers.

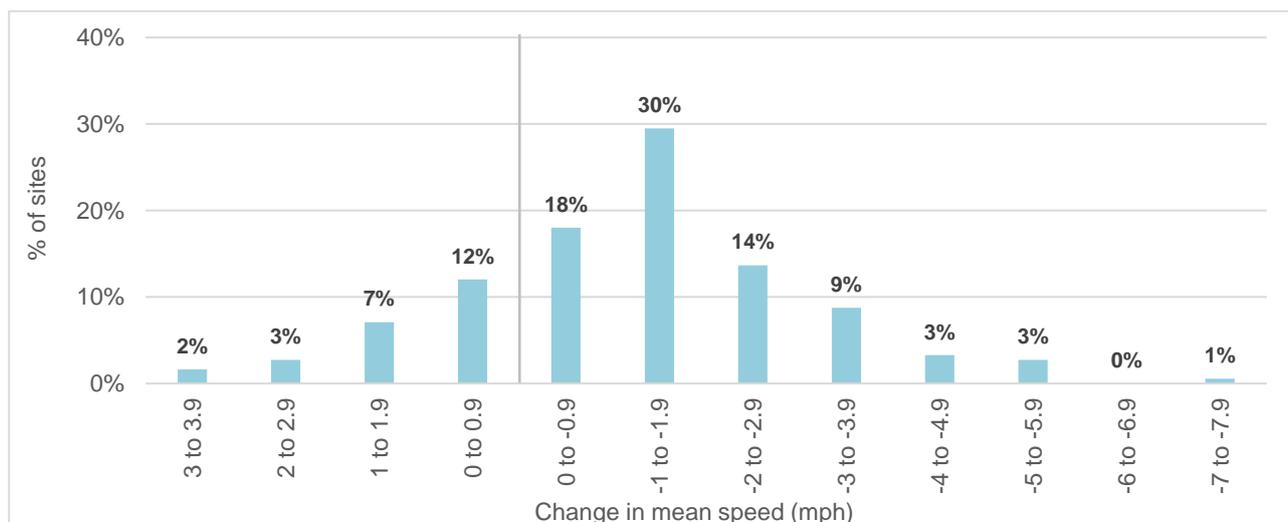
b. The study area for Calderdale includes Sidall and Southowram only.

Site specific results - Data for individual spot speed sites shows more variability than the scheme averages.

Instantaneous speeds – Across the case study schemes with comprehensive data, the change in mean speed at individual sites varied from -7.2mph (decrease) to +4.3mph (increase); and the change in the 85th percentile speed varied from -9.0mph (decrease) to +7.6mph (increase) (Table 22).

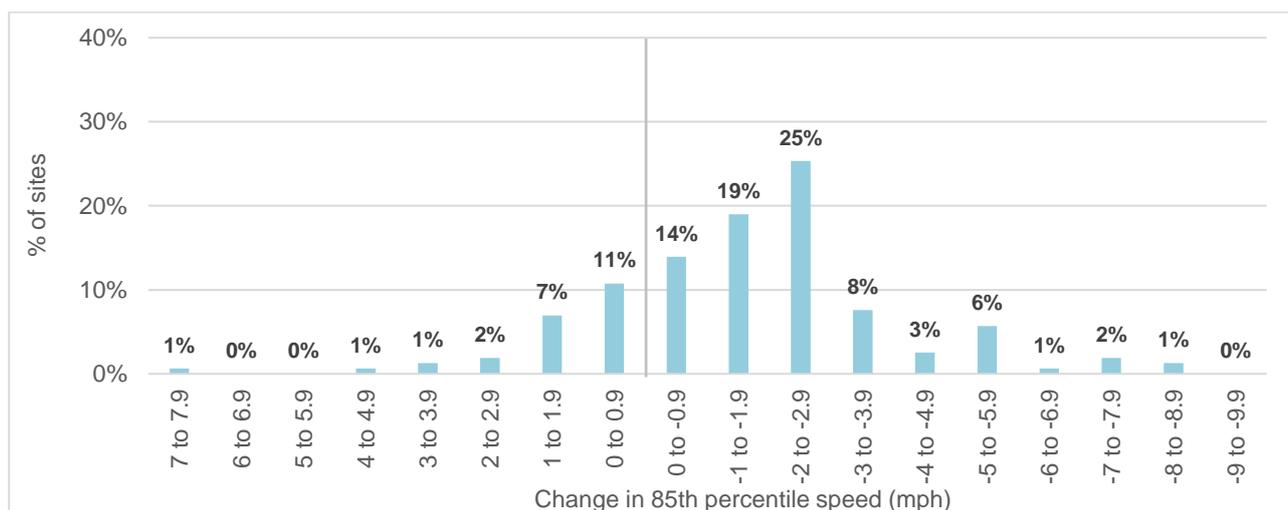
The majority of sites experienced a reduction in mean speed (88%) and 85th percentile speeds (78%) (Figures 18 and 19)⁵³. However, a small number of sites (12%) reported an increase in mean speed. Around a third of these sites had a before mean speed of less than 20mph, and it is possible that the introduction of the 20mph limit may have encouraged some drivers to increase their speeds, now seeing 20mph as a target.

Figure 18. Change in mean speed - % of sites in each change band



n = 183 sites in Walsall (Rushall), Winchester (Stanmore), Middlesbrough (Phases 1 and 2), Calderdale, Brighton Phase 2 (After 2), Chichester, Brighton Phase 1 (After 2) and Winchester City Centre.

Figure 19. Change in 85th percentile speed - % of sites in each change band



n = 158 sites in Walsall (Rushall), Winchester (Stanmore), Calderdale, Brighton Phase 2 (After 2), Chichester, Brighton Phase 1 (After 2), and Winchester City Centre.

The proportion of sites with a mean speed of <24mph increased from 59% to 75%, and the proportion with an 85th percentile speed <30mph increased from 70% to 87%.

⁵³ Both graphs exclude data for Portsmouth. This scheme was implemented much earlier than the other cases studies, and a much higher proportion of monitoring sites already had a mean speed of <=20mph; providing less scope for a reduction in speed. In addition, the number of monitoring sites was much higher than elsewhere, which skews the results.

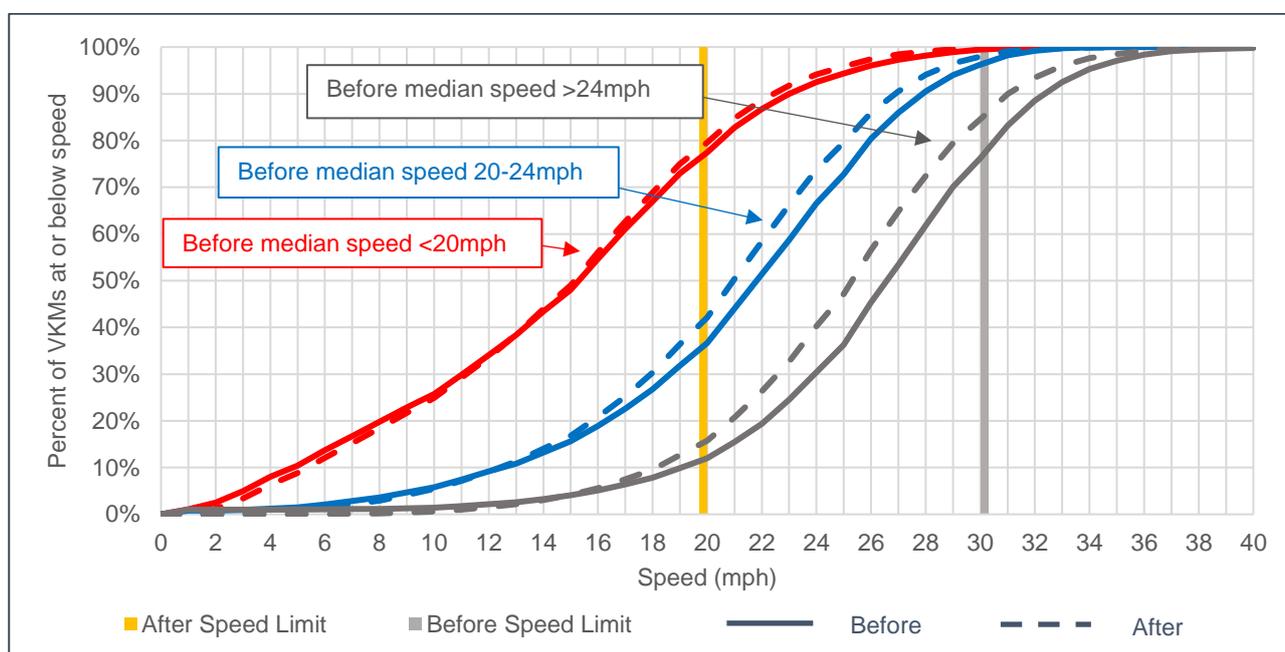
By before speed and road type – Road type and context has an important influence on speeds.

Journey speeds – Evidence from the journey speed analysis shows that the 20mph limits have had a bigger impact on roads with higher pre-scheme speeds, although even on the fastest roads the speed reduction is still small. On residential roads with a before median speed of >24mph, the median speed fell by -1.3mph and the 85th percentile by -1.2mph (Figure 20).

Similarly, the reduction in speed was greater on ‘important local roads’, where the median speed dropped by 1.1mph. On ‘minor local roads’, which make up the majority of the residential sample, the median speed was already below 20mph and dropped by just 0.1mph (Figure 21).

The results suggest that road characteristics (as approximated by pre-scheme speed and functional road category) have a much larger impact on the speeds that drivers choose to adopt than whether the road has a 30mph or 20mph limit. The differences in speed between the different road categories in Figures 20 and 21 are far larger than the changes brought about by lowering the speed limit.

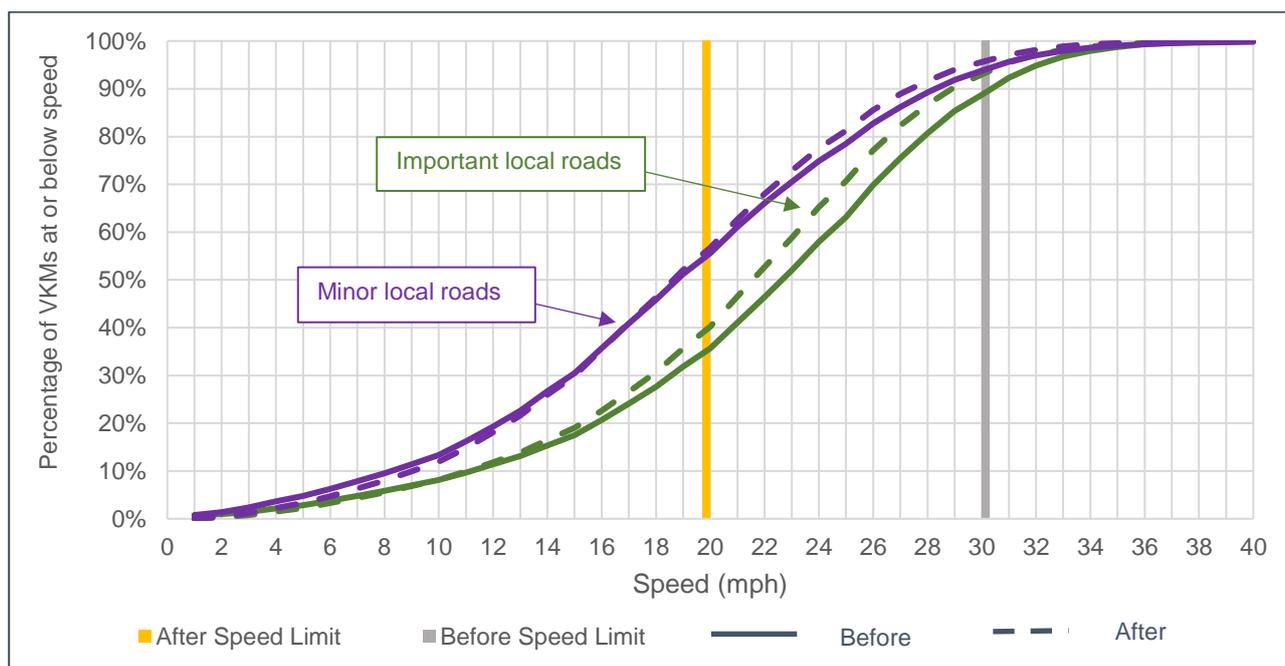
Figure 20. New 20mph limits (signed only) – Cumulative speed distribution, by pre-scheme speed (residential areas only), based on GPS journey speed data



New 20mph limits (signed only)	A - Before Median <20mph			B - Before Median 20-24mph			C - Before Median >24mph		
	Before, After, Diff			Before, After, Diff			Before, After, Diff		
Approx road length ^a	315.4km (70%)			78.6km (17%)			56.4km (13%)		
Vehicle kilometres (VKMs) observed	356,252	416,511		285,998	330,117		310,301	389,742	
Median Speed (mph)	15.3	15.1	-0.2	21.8	21.0	-0.9	26.5	25.2	-1.3
85 th Percentile (mph)	21.5	20.9	-0.6	26.8	25.9	-1.0	31.2	30.0	-1.2
15 th - 85 th percentile	14.8	13.9	-0.9	12.1	11.5	-0.6	10.3	10.3	0.0
% Driving <20mph	78%	80%	+2%	37%	42%	+5%	12%	16%	+4%

a. The results are based on an aggregation of peak and non-peak outputs. Segments may fall into different categories depending on the time of day.

Figure 21. New 20mph limits (signed only) – Cumulative speed distribution, by road type (residential areas only), based on GPS journey speed data



New 20mph limits (signed only)	Major strategic roads			Important local roads			Minor local roads		
	Before, After, Diff			Before, After, Diff			Before, After, Diff		
Road length	5.3km (1%)			52.4km (12%)			392.8km (87%)		
Vehicle kilometres (VKMs) observed	237,113	247,200		405,779	496,901		309,658	392,268	
Median Speed (mph)	21.5	20.8	-0.8	22.6	21.6	-1.1	18.7	18.6	-0.1
85 th Percentile (mph)	28.3	27.2	-1.1	28.9	27.6	-1.3	26.6	25.9	-0.6
15 th - 85 th percentile	18.7	17.1	-1.6	15.1	14.2	-0.9	15.7	14.8	-0.9
% Driving <20mph	43%	46%	+3%	36%	40%	+5%	56%	57%	+1%

n (sample size) = 957,917 veh-kms (before) and 1,131,894 veh-kms (after).

Major Strategic Road data greyed out due to the limited length of road represented in the sample, and not included in the graph.

Instantaneous speeds – These findings are supported by the spot speed analysis, which examined the change in speed profile for three of the case study schemes, reflecting small-scale residential, area-wide residential, and city centre environments. This found that the introduction of a 20mph limit has had a bigger impact on roads with a higher pre-scheme speed, and that both before and after speeds were generally higher on roads with a higher pre-scheme speed and were generally higher on ‘important local roads’.

While the relationship between pre-scheme speed and change in speed appears to apply at a case study level, other factors appear to influence outcomes at a site specific level. Plotting the before mean speed at individual sites against (i) the change in mean speed⁵⁴, and (ii) the change in 85th percentile speed⁵⁵, shows a significant but weak relationship (based on regression analysis)⁵⁶.

Analysis by road type shows that both relationships are stronger (and significant) for important local roads^{57, 58} where before speeds are likely to be higher generally, than minor roads.

⁵⁴ Change in mean speed (y) = 2.76 - 0.17 (before mean speed, x); where R² = 0.15. Based on 183 sites.

⁵⁵ Change in 85th percentile speed (y) = 1.31 - 0.13 (before mean speed, x); where R² = 0.05. Based on 159 sites.

⁵⁶ The x coefficient indicates the strength of the relationship. R² (the coefficient of determination) measures how well the regression line approximates the real data points. An R² value of 0.15 for change in mean speed indicates that only 15% of the variability in the data can be explained by the before mean speed; with 85% of the variability due to other factors.

⁵⁷ Change in mean speed (y) = 5.20 - 0.27 (before mean speed, x); where R² = 0.24. Based on 54 important local road sites.

⁵⁸ Change in 85th percentile speed (y) = 7.34 - 0.37 (before mean speed, x); where R² = 0.25. Based on 47 important local road sites.

Nevertheless, the result show that mean before speed, on its own, is a poor predictor of change in speed, suggesting other factors (such as road type and characteristics, the types of drivers and vehicles using the road, publicity and community engagement, and the behaviour and attitudes of local drivers) are influencing the change in speed.

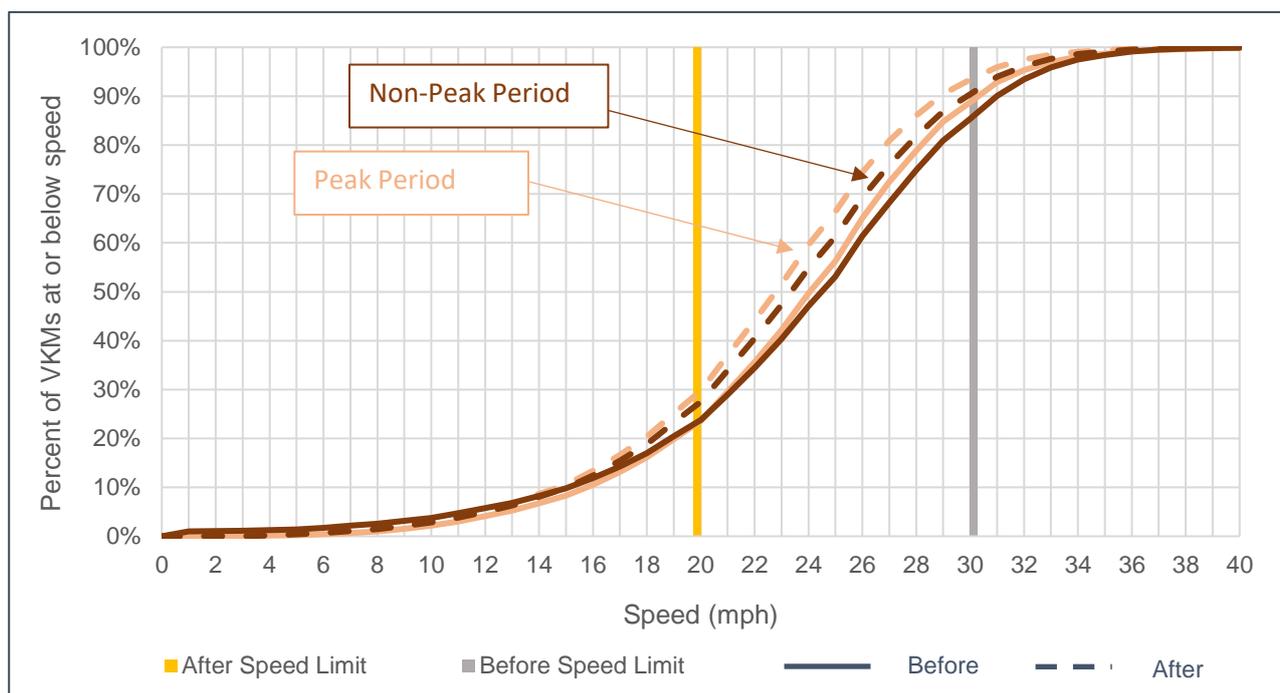
Impact of road environment – The impact of road environment is complex.

Instantaneous speeds – Analysis of the characteristics of ten sites with the biggest reduction in mean speed shows no evidence to suggest that one particular type of road characteristic (e.g. length, width, straight / curved, housing style / size, openness / density of environment) is associated with bigger reductions in mean speed. However, the results do support the findings reported earlier in this report which show larger reductions in speed tend to be associated with more important local roads, and those which support a number of functions (i.e. likely to be used by local residents, other road users to access local amenities, and as a through route).

Impact of time of day and journey purpose – This study has found very little difference in impact by time of day or journey purpose.

Journey speeds – Journey speed data shows that the profile of speeds during peak and non-peak periods are so similar that there is little reason to believe that there is a difference in how commuters and business travellers (in the peaks) and business, social, leisure and other drivers (at other times of the day) respond to the 20mph limit (Figure 22). The analysis only considers roads with a before median speed above 20mph, where traffic is free flowing and the speed of travel is predominantly chosen by the driver and not dictated by congestion. This is intended to isolate the influence of journey purpose on vehicle speeds.

Figure 22. New 20mph limits (signed only) – Cumulative speed distribution, by time period (residential areas only, segments with before speed >20mph), based on GPS journey speed data



New 20mph limits (signed only)	Peak periods			Off-peak periods		
	Before, After, Diff			Before, After, Diff		
Vehicle kilometres (VKMs) observed	127,617	162,521		468,681	557,338	
Median Speed (mph)	24.0	22.8	-1.2	24.4	23.3	-1.1
85 th Percentile (mph)	28.9	27.7	-1.2	29.8	28.6	-1.2
% Driving <20mph	24%	30%	+6%	24%	27%	+4%

7.3.2. Comparator analysis (evidence of 20mph limit impact)

To strengthen the evidence relating to changes, data for comparator areas has been used to compare case study trends with background trends on 30mph roads with similar characteristics to the case study areas. This provides a more robust methodology than a simple before and after analysis and interpretation of intervention logic; and provides evidence on the extent to which case study changes may be attributed to the introduction of 20mph limits.

Wider speed trends – Existing evidence suggests that there has been a small downward trend in speeds in recent years, across a range of road types, based on data collected by the DfT on locally managed A roads and free-flowing 30mph roads:

- Between December 2011 and December 2015, average vehicle speeds on locally managed A roads during the weekday morning peak dropped at a fairly consistent rate by 1.9mph, from 25.4mph to 23.5mph.
- In addition, between 2011 and 2016, there was a slight reduction in average free flow speeds for cars – of less than 1mph on 30mph roads (31mph in 2011, 31mph in 2016).

It is possible that this trend may have extended to the 20mph limit roads in the case study areas, and that the reduction in speeds reported in the above section may be simply a reflection of background trends and would have occurred even if the 20mph limits had not been introduced.

Wider evidence on trends in speed in urban areas

Average vehicle speeds on local authority A roads (Department for Transport, 2017a⁵⁹)

DfT published statistics on average speeds on local authority A roads suggest that average speeds fell between 2014 and 2016: by 1.0mph across all A roads (all day), by 0.8mph in urban areas (all day), and by 0.7mph in rural areas; and by 0.9mph in the weekday morning peak, and by -1.1mph in the weekday evening peak. This broadly corresponds to the 'before' and 'after' period for many of the case study schemes.

The dataset weights speed observations from a sample of vehicles by associated traffic flows so that it is representative of traffic volumes on the roads in different locations and at different times of day. The statistics are compiled of journey time data from in-vehicle global positioning systems (GPS) and flows estimated using automatic traffic counters and the Department's manual traffic count data.

Previous statistics suggest that speeds had been dropping steadily on these roads since 2011. Between December 2011 and December 2015, average vehicle speeds during the weekday morning peak dropped at a fairly consistent rate by 1.9mph, from 25.4mph to 23.5mph (Figure A) (Department for Transport, 2016⁶⁰). The methodology used for calculating the average weekday morning peak statistics changed in 2016 so more recent statistics are not directly comparable.

Figure A: Average vehicle speeds (flow-weighted) during the weekday morning peak on locally managed 'A' roads (mph) – to Dec 2015



⁵⁹ Department for Transport (2017a) Average speed on local 'A' roads: monthly and annual averages (Table CGN0501) – updated May 2017. <https://www.gov.uk/government/statistical-data-sets/average-speed-and-delay-on-local-a-roads-cgn05>

⁶⁰ Department for Transport (2016) Average vehicle speeds (flow-weighted) during the weekday morning peak on locally managed 'A' roads, by local authority in England: annual average from year ending July 2007 (Table CGN0206) – last update in February 2016. <https://www.gov.uk/government/statistical-data-sets/cgn02-flow-weighted-vehicle-speeds>

Wider evidence on trends in speed in urban areas

Free flow speeds on 30mph roads in Great Britain (Department for Transport, 2017b⁶¹)

Since 2011, the Department for Transport has published average speeds in free flowing conditions on roads in Great Britain. These are based on speed data collected from a sample of DfT's Automatic Traffic Counters (ATCs), chosen to exclude locations where external factors might restrict driver behaviour (e.g. junctions, hills, sharp bends and speed enforcement cameras). A total of 29 sites are on 30mph roads. The statistics provide insights into speeds at which drivers choose to travel when free to do so, but are not estimates of average speeds across the whole network.

Between 2011 and 2016, there was a slight reduction in average free flow speeds for cars – of less than 1% on 30mph roads (31mph in 2011, 31mph in 2016).

Factors likely to affect background speeds in local areas include a general lowering of speed limits, national speed campaigns (such as the DfT's *Think!* road safety speed campaign), an increase in the number of fixed penalty notices issued for speed limit offences and increasing attendance at speed awareness / retraining courses⁶², and use of in-car technology (including satellite navigational devices which display the speed limit, cruise control, and speed limiters).

Overall approach – As outlined in Section 3.4.7, each case study area has been associated with a 30mph comparator area, used as a control for what would have been likely to occur over time had the 20mph signed only limits not been introduced. This provides context against which to measure the observed speed changes in the case study areas.

It should be noted that for practical reasons it was only possible to obtain speed data for three comparator areas, each covering a 20km² area. These have been matched to three groupings of case studies, based on geographical region, Rural Urban Classification, and index of multiple deprivation. For context, the case study areas included in the comparator analysis cover a combined area of 110km².

Speed trends in comparator areas – A summary of the high level metrics for the residential and city centre comparator areas is provided in Tables 23 and 24.

Table 23. Sample size and median speeds for residential and city centre comparator areas

	Comparator Area	Vehicle kilometres (VKMs) observed		Median speed		
		Before	After	Before	After	Diff
Residential	Worthing (A1)	979,473	1,026,961	25.0	24.0	-1.0
	Worthing (A2)	1,069,224	1,449,319	24.4	23.9	-0.5
	Wolverhampton (B1)	1,759,714	2,239,861	25.5	24.8	-0.7
	Wolverhampton (B2)	1,563,626	4,494,554	25.3	24.5	-0.8
	Sunderland (C1)	430,125	434,504	25.7	25.6	-0.1
City	Worthing (A1)	52,900	57,325	19.8	19.2	-0.6
	Worthing (A2)	60,868	82,402	19.6	19.3	-0.3

Table 24. 85th percentile and speed range for residential and city centre comparator areas

	Comparator Area	85 th Percentile speed			15-85 th Percentile range		
		Before	After	Diff	Before	After	Diff
Res	Worthing (A1)	30.6	30.0	-0.6	13.8	13.9	+0.1
	Worthing (A2)	30.3	29.9	-0.4	14.2	14.0	-0.1

⁶¹ Department for Transport (2017) Free flow vehicle speeds in Great Britain: 2016 tables
<https://www.gov.uk/government/statistics/free-flow-vehicle-speeds-in-great-britain-2015>

⁶² Between 2011 and 2016 the number of fixed penalty notices issued nationally for speed limit offences (across all speed limits) increased by 30%, and the proportion attending driver awareness / retraining courses increased from 14% to 46% (Police powers and procedures, England and Wales, year ending 31 March 2017, Home Office).

	Comparator Area	85 th Percentile speed			15-85 th Percentile range		
		Before	After	Diff	Before	After	Diff
	Wolverhampton (B1)	31.1	30.6	-0.5	15.2	15.4	+0.2
	Wolverhampton (B2)	30.9	30.6	-0.3	15.3	16.2	+0.9
	Sunderland (C1)	32.1	31.4	-0.6	15.4	14.4	-1.0
City	Worthing (A1)	26.3	25.7	-0.6	13.6	13.8	+0.2
	Worthing (A2)	26.0	25.7	-0.3	13.9	13.8	-0.1

It was not possible to purchase separate timespans for each case study area. Instead, data was purchased for up to two sets of timespans (each comprising one year before and one year after) for each of the three comparator areas. The case study implementation dates within each group were sufficiently similar to justify this approach. Worthing A1 and A2 refer to the two timespans purchased for Worthing, and used as the comparator areas for two groupings of case studies in the South (all categorised as 'urban city and town' based on the Rural Urban Classification system). Similarly, Wolverhampton B1 and B2 refer to the two timespans purchased for Wolverhampton, and used as the comparator areas for two groupings of case studies in the North and Midlands (all categorised as 'urban conurbations' based on the Rural Urban Classification system). Sunderland C1 refers to the single timespan purchased for Sunderland, and used as the comparator area for one case study in the North (categorised as 'urban city and town').

The metrics demonstrate that in all instances median speed and 85th percentile speed has reduced in the comparator areas, by a similar magnitude to the reductions seen in case study areas. This provides some context in which to view the case study area results.

In terms of the 15-85th percentile range, the results show a mixed picture with some ranges increasing and some decreasing but all within the scale of +/-1mph. Where the range has increased, this can be interpreted as the 15th percentile speed reducing by **more than** the reduction in the 85th percentile.

Statistical analysis to compare case study and comparator trends – Table 25 shows the statistical analysis outputs for the residential and city centre areas. Note that not all case study areas have new 20mph signed only roads in all three road categories and so the number of case study area observations differs in each test.

The results show a significant reduction in speeds, relative to comparator areas, for important local roads in residential areas and for an aggregation of all road types in city centre areas.

Table 25. Statistical outcomes (weighted least squares analysis)

	Relative change in median speed	Relative change in 85 th percentile speed	Relative change in 15-85 th percentile range	Number of matched pairs in sample
Residential areas				
All roads (agg.)	-0.38mph (sig)	-0.72mph (sig)	-1.06mph (sig)	21
Major strategic roads ^a	-0.06mph (not sig)	-0.65mph (not sig)	-2.00mph (not sig)	2
Important local roads	-0.81mph (sig)	-1.11mph (sig)	-1.00mph (sig)	9
Minor local roads	-0.02mph (not sig)	-0.25mph (not sig)	-0.49mph (sig)	10
City centre areas				
All roads (agg.)	-0.57mph (sig)	-0.99mph (sig)	-1.27mph (sig)	5
Important local roads	-0.72mph (not sig)	-1.20mph (not sig)	-1.14mph (not sig)	2
Minor local roads	-0.26mph (not sig)	-0.29mph (not sig)	-0.48mph (not sig)	2

a. Major strategic roads with 20mph limits are only present in the two Brighton case study areas. It was not possible to conduct a separate test on major strategic roads in city centre as this category of road was only present in Brighton Phase 1; however, this data is included in the all roads outputs.

Residential areas – In residential area, the reduction in speeds in the case study areas is found to be significant relative to the comparator areas, when all road types are considered in aggregate. More detailed analysis, however, shows that the relative reduction in the median and 85th percentile speeds is significant for important local roads but not for major or minor local roads. It therefore appears that the important local roads are driving the overall results, and are where there is the most confidence that a small decrease in

speed has occurred due to the introduction of 20mph (signed only) limits. The relative change on important local roads, as a result of the 20mph limit policy, is estimated at -0.81mph for the median speed, -1.11mph for the 85th percentile speed, and -1.0mph for the 15th-85th percentile range.

The results are consistent with the earlier findings which shows that, in absolute terms, median and 85th percentile speeds have reduced most on important local roads (-1.1mph and -1.3mph); and less on major strategic roads and particularly minor local roads.

City centre areas – In city centre areas, the results for the aggregation of all road types are all significant. The relative change across all roads, as a result of the 20mph limit policy, is estimated at -0.57mph for the median speed, -0.99mph for the 85th percentile speed, and -1.27mph for the 15th-85th percentile range.

However, further investigation shows that on important local roads and minor local roads none of the changes observed in the case study areas are significant. This could be a reflection of the greater number of observations in the aggregated dataset, which gives greater confidence that small changes are significant. However, there is also some evidence to suggest that the change is being driven by the relative change in speeds on major strategic roads in Brighton Phase 1. The actual change in median, 85th percentile, and 15th-85th percentile speeds on these roads is -0.73mph, -1.33mph, and -1.93mph, compared with -0.33mph, -0.19mph, and +0.80mph in the comparator areas; supporting this hypothesis. This observation also has the highest weighting in the aggregated statistical model.

Overall –The findings suggest that the absolute changes in speed observed in the case study areas are partly due to the implementation of 20mph limits (particularly on important local roads in residential areas), but also reflect background trends in speed on urban roads. The comparator areas all show a reduction in speeds over the period of analysis (varying from -0.1 to -1.0mph); broadly consistent with wider evidence that there has been a small downward trend in speeds in recent years across a range of road types (based on data collected by the DfT on locally managed A roads and free-flowing 30mph roads). The results provide no evidence to indicate that 20mph limit interventions have resulted in a significant reduction in speeds on minor local roads (where speeds were already close to 20mph).

7.4. How has effectiveness changed over time?

The study was able to draw on limited data regarding the effectiveness of 20mph limits over time. While this means that the findings can't be generalised to other areas, the findings do not support the hypothesis that speeds might increase over time.

Case study examples – Effectiveness of 20mph limits over time (Box U)

Portsmouth – The city-wide 20mph limit in Portsmouth was implemented substantially earlier than other case study schemes, enabling long term analysis to be undertaken, comparing outcomes one year and seven years' post implementation. Evidence from journey speed analysis shows an increase in 20mph compliance over time, from 58% one year after (2009) to 62% seven years after (2015); a reduction in the median speed (from 18.4mph to 17.9mph); and a reduction in the 85th percentile (from 25.8mph to 24.8mph).

It has not been possible to fully account for background trends in speed, as comparator data was not obtained for this timespan.

Brighton – Data for Brighton Phase 2 (residential) and Phase 1 (city centre focused) was collected one year and two years post implementation. In both cases, there is no evidence to suggest a significant change in mean or 85th percentile speeds between the two after periods (Table 17).

Wider evidence on effectiveness of 20mph limits over time (European experience)

Long-term analysis of the city-wide 30km/h limit in Graz, Austria, shows that whilst a noticeable reduction in mean speeds was initially achieved, the sustained reduction was much less. The measurements undertaken in October 1992 (just after the 30 km/h limit was introduced) showed a 2.8 km/h reduction in mean speed and a 4.2 kph reduction in 85th percentile speed. By March 1993 mean speeds had increased to almost the same as (only 0.5 kph less than) mean speeds before the 30 kph limit was introduced. The 85th percentile speed was however still 1.7 kph less than the 85th percentile speed before the 30 kph limit. Both the mean and 85th percentile speeds recorded in 2002 were very similar those recorded in 1993. (Wernsperger and Sammer, 1995; Fischer, 2010)

Enforcement was an essential component to implementing the 30 km/h speed limit. Legislation allows Council staff to be sub-contracted to the police to undertake speed limit enforcement. The Council also introduced 13 devices to show drivers their current speed. The devices were moved around each month, among 130 specially prepared locations, in particularly sensitive areas (e.g. near schools). Evaluations show that automatic feedback helped to keep cars within the speed limit.

7.5. How have speeds on neighbouring roads changed?

Theory of Change Hypothesis: No change in driving speeds on neighbouring roads.

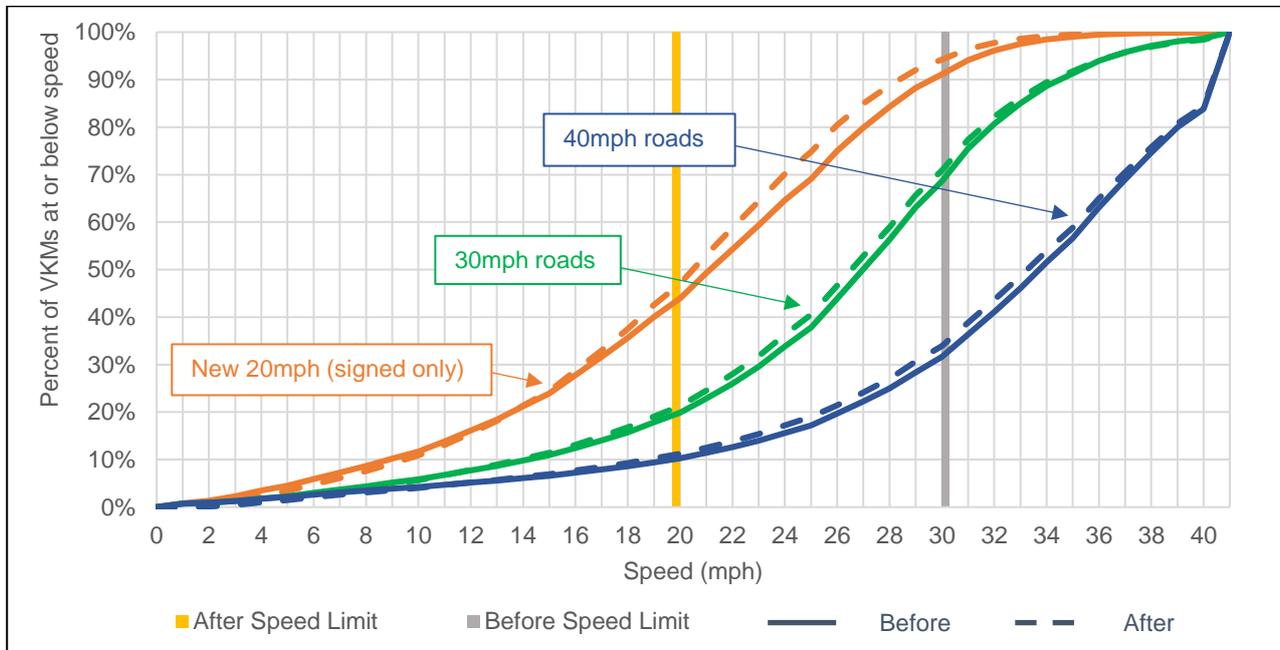
✓ *Almost half of non-resident drivers said that they were more likely to drive above the speed limit when leaving the 20mph area – due to the frustration associated with driving slowly or to make up time. However, journey speed analysis shows a small decline in speeds on surrounding 30mph and 40mph roads across the case study areas; suggesting that this is not happening on a regular basis. Spot speed data available for one case study only, shows a small increase in speeds on nearby roads.*

This section draws on journey speed analysis to examine how speeds have changed on nearby 30mph and 40mph roads; with supporting case study information and questionnaire findings.

7.5.1. Change in speed

Journey speeds – Speeds appear to have fallen on nearby 30mph and 40mph roads following the introduction of the new 20mph limits, with both categories of road experiencing a reduction in the median speed of -0.5mph. While the difference is small, the reduction occurs across the whole of the speed profile.

Figure 23. Cumulative speed distribution for new 20mph roads, and nearby 30mph and 40mph roads (residential areas only), based on GPS journey speed data



Residential areas only	New 20mph limits (signed only)			30mph Roads			40mph Roads		
	Before, After, Diff			Before, After, Diff			Before, After, Diff		
Distance of Roads	450.5km	450.5km		456.6km	456.6km		46.0km	46.0km	
Sample of vehicle kilometres observed	952,551	1,136,370		4,305,056	5,321,683		1,067,782	1,401,167	
Compliance	91%	47%	-44%	68%	71%	+3%	84%	84%	0%
Median Speed	21.1	20.5	-0.7	27.0	26.6	-0.5	34.1	33.6	-0.5
85 th Percentile Speed	28.1	27.0	-1.1	33.0	32.7	-0.3	40.3	40.2	-0.1
15 th -85 th percentile	16.6	15.2	-1.3	15.4	15.6	+0.2	15.8	17.0	+1.2
%<20mph	44%	47%	+3%	20%	21%	+1%	10%	11%	+1%

The observed reduction in median speeds on 30mph and 40mph roads could suggest that drivers are getting used to travelling at slower speeds and are carrying this behaviour from the 20mph roads onto surrounding roads. Alternatively, it could be due to a general downward trend in speeds. As shown above, the comparator areas all show a reduction in speeds over the period of analysis; and wider evidence also suggests that there has been a small downward trend in speeds in recent years, across a range of road types, based on data collected by the DfT on locally managed A roads and free-flowing 30mph roads.

Case study example – Speeds on neighbouring roads (Box V)

Brighton Phase 2 – In the Brighton (Phase 2) area, a decision was made to retain a 30mph limit on a substantial number of roads. Spot speed surveys were undertaken at 28 sites on roads which remained 30mph, at the same time as monitoring took place on the new 20mph roads.

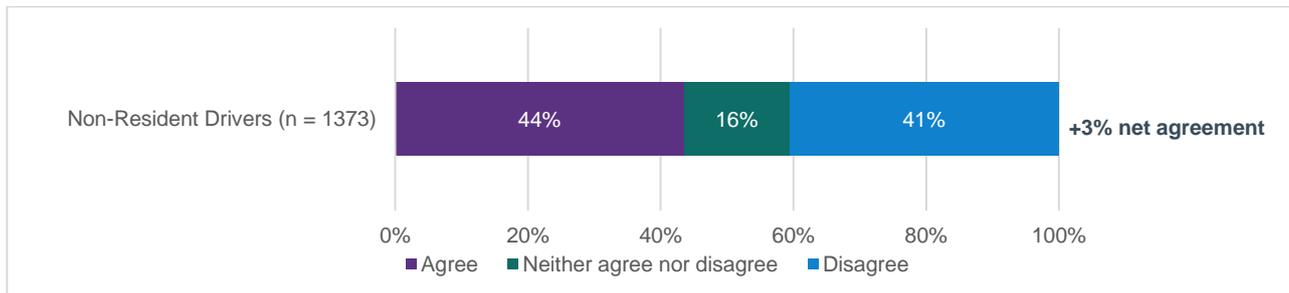
Results for roads retaining a 30mph limit show a marginal increase in mean and 85th percentile speeds (+0.4mph and +0.8mph respectively), compared with the small decline recorded on new 20mph limits (-1.1mph and -1.4mph respectively).

This differs to the findings from the journey speed analysis, which shows that speeds on surrounding 30mph declined following the implementation of nearby 20mph limits – but to a lesser extent than in the new 20mph areas. The Brighton findings are based on one case study only, and cannot therefore be generalised to other areas.

7.5.2. Feedback from residents and non-resident drivers

Just over two fifths (44%) of non-resident drivers agreed with the statement “I comply with the limit most of the time, but find myself more likely to drive above the speed limit when I get onto faster roads”.

Figure 24. I comply with the limit most of the time, but find myself more likely to drive above the speed limit when I get onto faster roads (non-resident drivers only)



Non-resident drivers questionnaire. n = sample size.

However, 41% disagreed and 16% provided a neutral response.

“You’re less compliant because you feel a moment of liberation and some people are then likely to be more exuberant in a 30mph than they would have been...they want to make up time.” (Liverpool)

In two locations, questionnaire surveys were undertaken on parallel roads which have retained a 30mph limit and could be used as an alternative route by drivers wishing to avoid the 20mph limit. Most residents on these streets (69%) had not noticed an increase in the speed of vehicles on their street, suggesting that this is not a substantial problem.

Some drivers interviewed said that they were now more likely to comply with nearby 30mph limits, either because they are now more aware of the limit, or because they feel like they are driving fast.

7.6. Have residents and drivers noticed a change in speed?

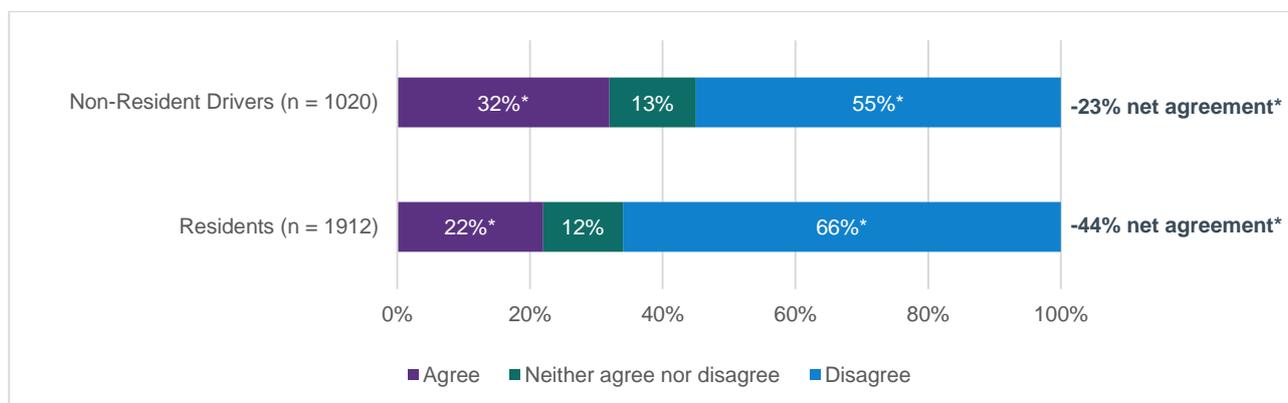
Theory of Change Hypothesis: Perceived reduction in speeds amongst residents and users.

** Questionnaire results show that the majority of resident and non-resident drivers have not noticed a reduction in the speed of vehicles, and do not perceive there to be fewer vehicles driving at excessive speeds for the area. This is not surprising as the actual reduction in speeds has been small.*

The majority of resident and non-resident drivers responding to the questionnaire do not perceive speeds to have reduced. This is not surprising as the actual reduction in speeds has been small.

Perceived change in average speed of vehicles – Most residents (66%) and non-resident drivers (55%) participating in the questionnaire disagreed that the average speed of vehicles had reduced; however, a sizeable minority did perceive an improvement. Non-resident drivers were more likely to think the average speed of vehicles had reduced (32%), than residents living on the affected streets (22%).

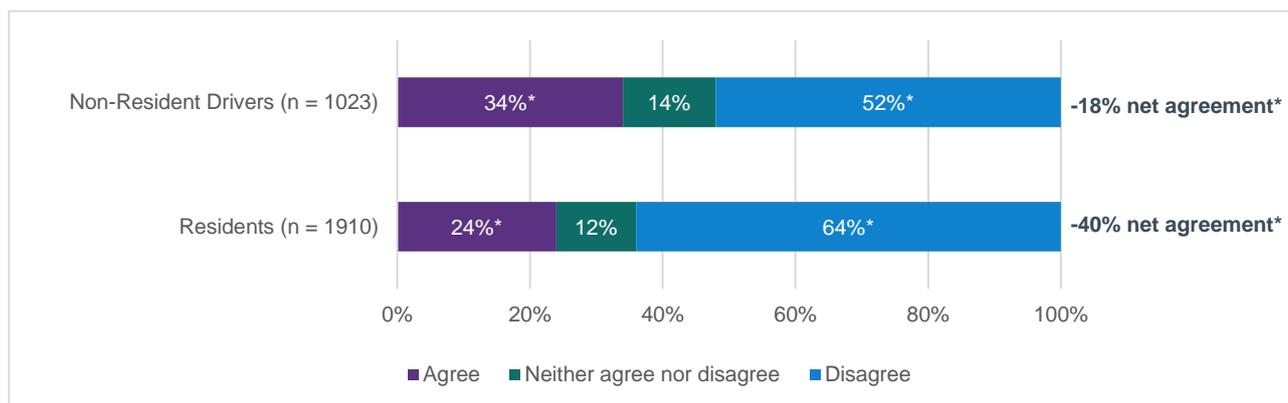
Figure 25. The average speed of vehicles has reduced



Residents and non-resident drivers questionnaires. n = sample size.
 Significant differences in drivers and residents results marked with asterix (*).

Perceived change in incidents of excessive speeding – Similarly, most residents (64%) and non-resident drivers (52%) disagreed that fewer vehicles were now travelling at excessive speeds for the area. Again, non-resident drivers (24%) were more likely to perceive an improvement than residents.

Figure 26. Fewer vehicles are driving at excessive speeds for the area



Residents and non-resident drivers questionnaires. n = sample size.
 Significant differences in drivers and residents results marked with asterix (*).

Characteristics associated with perceived change in speed – Multi-variate regression analysis was undertaken to identify respondent and area characteristics associated with perceived change in speed. The model was applied separately to the residents and non-resident drivers' questionnaire results.

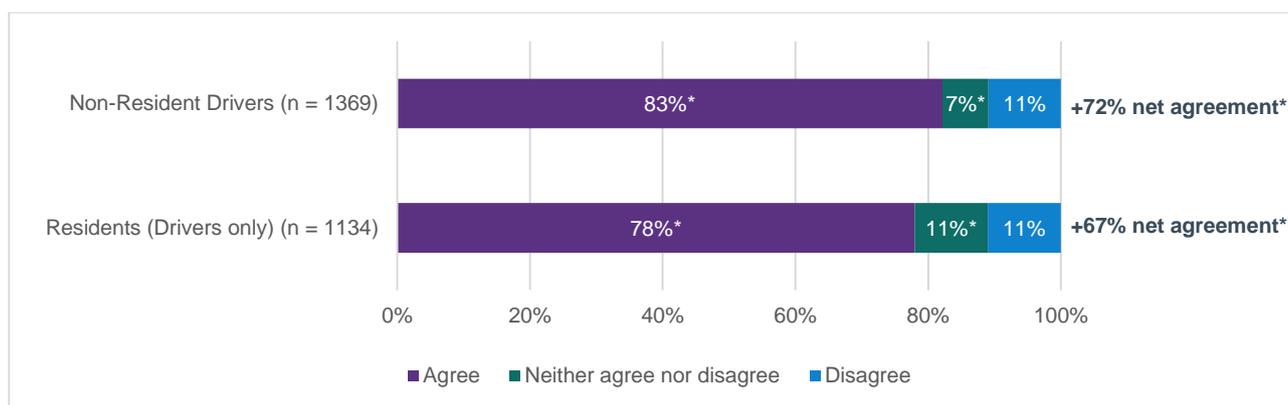
In summary:

- residents aged 60+ (including both drivers and non-drivers) were less likely to have noticed a reduction in speeds; and,
- residents and non-resident drivers in less deprived areas (possibly an indicator of road environment or other locally specific factors) were more likely to have perceived a reduction in speeds⁶³.

7.7. What do drivers say about their own driving behaviour?

Compliance - Approximately four fifths of drivers (residents 78%, and non-residents 83%⁶⁴) participating in the questionnaires stated that they complied with the 20mph limit most of the time; much higher than indicated by the journey speed and spot speed data. This may be because respondents are unaware of their true speed or are reluctant to admit to speeding in their local area.

Figure 27. I comply with the speed limit most of the time on these streets



*Residents and non-resident drivers questionnaires. n = sample size.
The non-resident drivers sample includes residents living on nearby 30mph streets (in two case study areas).
Significant differences in resident and non-resident drivers results marked with asterix (*).*

Characteristics associated with self-reported compliance – Multi-variate regression analysis was undertaken to identify respondent and area characteristics associated with self-reported compliance. The model was applied separately to the residents and non-resident drivers’ questionnaire results.

The analysis shows that self-reported compliance is higher amongst:

- resident and non-resident drivers who support 20mph limits⁶⁵ (these individuals are likely to want to be seen to be acting according to their convictions); and
- resident and non-resident drivers who agree that there is sufficient signage⁶⁶, and are therefore most likely to be aware of the limit⁶⁷;

and lower amongst:

- resident and non-resident drivers who are most likely to speed in general (based on questions about propensity to speed).

Change in driving speed – Some 69% of resident drivers and 74% of non-resident drivers stated that they now drive at a slower speed than previously. Comparison with the results above (Section 7.6) shows that survey respondents were more positive about their own driving behaviour than that of others.

⁶³ Those in less deprived areas were 2.3 and 2.5 times more likely than those in more deprived areas to agree that the average speed of vehicles has reduced.

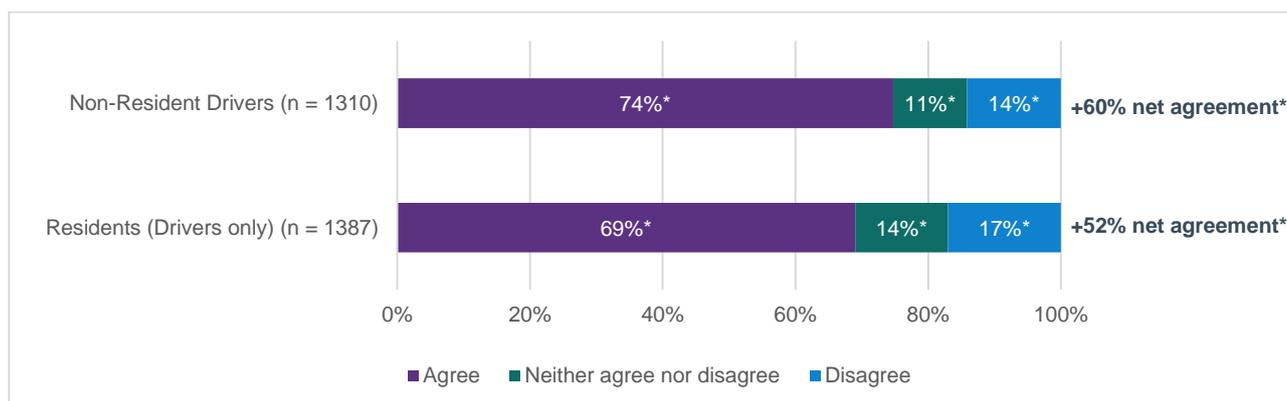
⁶⁴ Drivers and riders interviewed at sites within or just outside the sample areas selected for the residents’ questionnaires; and residents living on nearby 30mph streets (in two case study areas).

⁶⁵ Those who agree that 20mph is an appropriate speed are 4.8 and 2.1 times more likely than those who do not, to say that they comply with the limit.

⁶⁶ Residents and non-resident drivers who agree that 20mph is an appropriate speed are 4.8 and 2.1 times more likely than those who do not to say that they comply with the limit.

⁶⁷ Those who agree that there is sufficient signage are 1.4 and 1.6 times more likely than those who do not, to say that they comply with the limit.

Figure 28. Since the introduction of the 20mph speed limit I am more likely to drive through this area at a slower speed than previously



Residents and non-resident drivers questionnaires. n = sample size.
 The non-resident drivers sample includes residents living on nearby 30mph streets (in two case study areas).
 Significant differences in resident and non-resident drivers results marked with asterix (*).

Consistency of driving speed – Non-resident drivers participating in the in-depth interviews were asked ‘do you drive at a consistent speed through the 20mph limit, or do you find yourself accelerating and decelerating?’.

Responses to this question varied across the case study locations, with no one location showing all respondents agreed. However, in general, many respondents said they drove at a consistent speed through the limit.

“Yes you can drive at a consistent speed in those roads. I try to do 20mph but often probably 25mph”

Some respondents identified extraneous factors such as the layout of the road, obstacles and inclines/declines which caused them to accelerate and decelerate, as opposed to the 20mph limit.

Other respondents claimed that they found themselves accidentally speeding and had to decelerate to bring their speed back down to 20mph.

“You do accelerate and then it suddenly dawns on you and you take your foot off.”

“You have to slow down when you realise its 20mph because you think its 30mph which I do because I don’t drive on these roads that often.”

However, it has not been possible to collect sufficient evidence to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual driver level (with less acceleration and deceleration).

Propensity to speed on different types of roads - Questionnaire respondents were asked about their propensity to speed in different types of speed limits. The findings show:

- around half of respondents acknowledge a tendency to speed; and
- propensity to speed tends to be broadly similar on 20mph (signed only), 30mph and motorway roads.

However, drivers felt that they were less likely to speed on 20mph roads with traffic calming compared with 20mph (signed only) roads.

Table 26. Propensity to speed in different types of speed limits - % often or occasionally

	Resident drivers	Non-resident drivers
Find yourself driving faster than you intend to	48%	51%
Exceed the speed limit on a 20mph (signed only) road by more than 5mph	34%	35%
Exceed the speed limit on a 20mph road with traffic calming - by more than 5mph	21%	23%
Exceed the speed limit on a 30mph road by more than 5mph	31%	37%
Exceed the speed limit on a motorway by more than 10mph	35%	41%

Residents and non-resident drivers questionnaires. n (sample size) = 1225 (Resident drivers), 1228 (Other drivers).

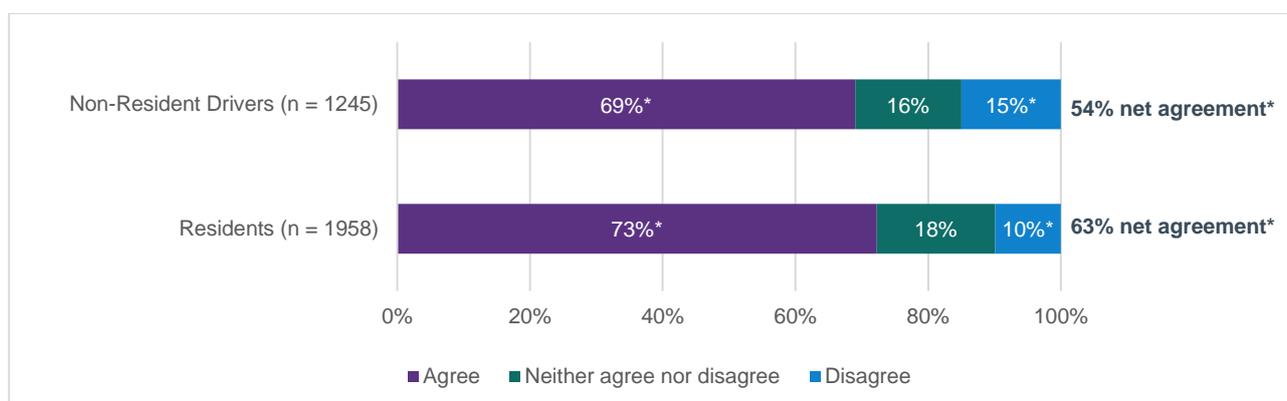
7.8. Do 20mph limits make slower speeds more acceptable?

Theory of Change Hypothesis: Increased acceptability for drivers already travelling at speeds close to 20mph. 20mph seen as normal. Reduction in driver stress.

✓ Questionnaire data support above hypothesis. Most resident drivers and non-resident drivers (72% and 69% respectively) agreed that “the 20mph limit makes it more acceptable to drive at a lower speed. This implies a reduction in stress for drivers already travelling at speeds close to 20mph.

Most resident drivers (72%) and non-resident drivers (69%) agreed that “the 20mph limit makes it more acceptable to drive at a lower speed”.

Figure 29. The 20mph limit makes it more acceptable to drive at a lower limit



Residents and non-resident drivers questionnaires. n = sample size.
 Significant differences in resident and non-resident drivers results marked with asterix (*).

This implies a reduction in stress for drivers already travelling at speeds close to 20mph.

“I think before it would have caused problems with a lot of people getting annoyed...now it feels more acceptable.” (Non-resident driver)

“I’m more relaxed, less anxious. I just add a bit more time to my journeys, take it into account.” (Non-resident driver)

7.9. How has driver awareness and assessment of risk changed?

Theory of Change Hypothesis: Increase in driver awareness of other road users (pedestrians, cyclists and other vulnerable groups).

✓ A net proportion (% agree - % disagree) of non-resident drivers (+44%) and resident drivers (+7%) agreed that 20mph limits increase driver awareness of potential risks and hazards.

But, risk that drivers consider 20mph to be inherently safer, so pay less attention to driving.

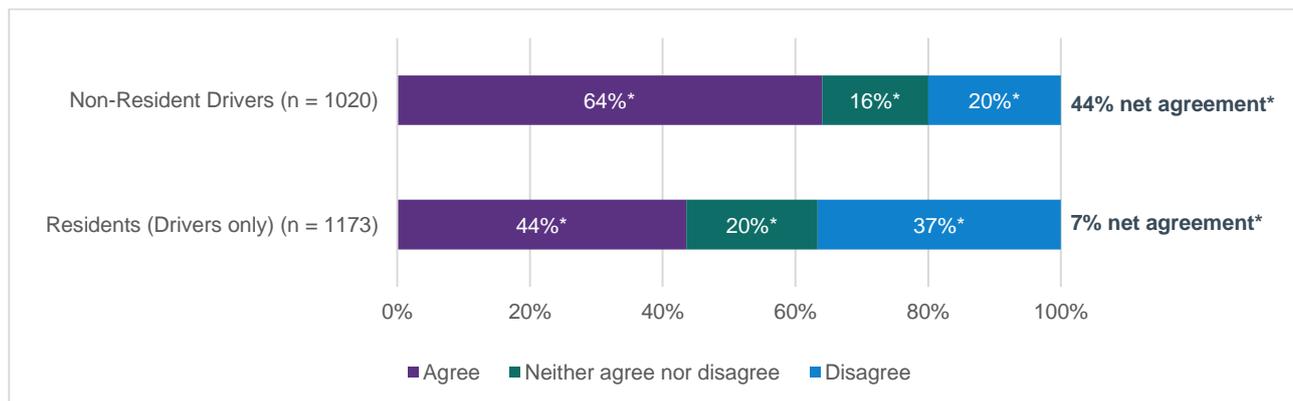
✓ Feedback from driver interviews suggests that a minority are likely to pay less attention, because they are focusing on their speed, distracted by in-car devices, or frustrated with driving slowly.

Theory of Change Hypothesis: Drivers have more time to, and are more likely to respond to road hazards.

✓ Most drivers interviewed report that they are more conscious of their driving environment, and are therefore likely to be better able to respond to hazards.

Overall – A net proportion (% agree - % disagree) of non-resident drivers (+44%) and resident drivers (+7%) agreed that 20mph limits increase driver awareness of potential risks and hazards (e.g. cyclists, children playing, etc.), possibly encouraging a safer and more considerate driving style.

Figure 30. The 20mph limit increases drivers' awareness of potential risks and hazards



Residents and non-resident drivers questionnaires. n = sample size.
 Significant differences in drivers and residents results marked with asterix (*).

Multi-variate regression analysis was undertaken to identify respondent and area characteristics associated with the responses. The model was applied separately to the residents and non-resident drivers' questionnaire results.

The results show that (perceived) increased awareness of potential risks and hazards is associated with those who perceive positive speed outcomes⁶⁸.

In-depth interviews with non-resident drivers – The majority of drivers interviewed said that they were now more conscious of their driving environment, more aware of other road users, more likely to drive accordingly, and better able to react to incidents and avoid potential accidents.

“It makes you think about pedestrians crossing the road. And also about cars coming from side roads; with parked cars there, you can't see so well.” (Brighton Phase 1)

“More [awareness] because the speed limit has been put down for a reason to make you more aware of the dangers that are present.” (Nottingham)

⁶⁸ Residents and non-resident drivers who agree 'less vehicles are driving at excessive speeds for the area' are 4.3 times and 3.0 times more likely, and those who agree 'the average speed of vehicles has reduced' are 4.0 times and 2.2 times more likely, to agree that the introduction of the 20mph limit increases drivers' awareness of potential risks and hazards.

*“The slower you go, the easier it is to stop and the impact is reduced, so the risk has to be lower.”
(Winchester City Centre)*

A minority said that the new limit hadn't affected their driving style or their awareness of other road users. They felt that their reaction time was already sufficient to avoid any potential collisions, and were not aware or did not appreciate the safety benefits of slower speeds.

“I'm conscious of the 20mph limits but I don't drive differently.” (Brighton Phase 2)

“I think there's very little difference between 20mph and 30mph, they are both relatively slow. I've not had an accident at these speeds so I think the difference would be tiny.” (Chichester)

A few drivers stated that the limit made them less aware of others, because they spent more time focusing on their speed.

“It makes me less aware of my surroundings because I'm always watching my speed and not the road.” (Calderdale)

Others thought that awareness would reduce, as the lower speed limit may make it seem more acceptable to use a mobile phone or adjust the radio while driving. Some thought that driver frustration as a result of having to drive slowly may distract drivers, and reduce awareness.

7.10. Summary and key messages

A summary of the key findings is presented below.

7.10.1. Background context

A substantial proportion of drivers were already travelling less than 20mph prior to the introduction of the new limits: 44% in residential areas and 59% in city centre areas (based on GPS journey speed data); suggesting that the new limits have formalised a lot of the previous behaviour, and a substantial reduction in speed is unlikely in these locations.

This trend reflects the high proportion of minor local roads within the case study areas: 67% and 53% of road length within the residential and city centre areas is 'minor local road' with a before median speed of less than 20mph. Minor local roads⁶⁹ are likely to be narrower roads, primarily within residential areas or estates (with a destination function only); where drivers may struggle to reach higher speeds due to parked cars, cul-de-sacs, or high volume of pedestrians in the area (e.g. outside a school).

7.10.2. To what extent do drivers comply with the new limits?

Evidence from the journey speed analysis shows that following implementation, 47% of drivers in residential areas and 65% of drivers in city centre areas (equating to 51% across both categories) complied with the new 20mph limit, travelling at speeds of less than 20mph. Whilst a substantial proportion are exceeding the limit, the majority are travelling less than 24mph (i.e. at speeds close to 20mph): 70% in residential areas and 86% in city centre areas.

The nature of the roads where the limits have been introduced means that lower speeds were already 'self-enforced'. Reducing the speed limit to 20mph has helped reinforce this process. There are now slightly more drivers travelling at speeds of <24mph (+5 percentage points in residential areas, and +7 percentage points in city centre areas), suggesting faster drivers have slowed down.

Compliance with the new 20mph limits is: higher in city centre areas, compared with residential areas; higher on roads with a median before speed of less than 20mph; and higher on 'minor local roads', compared with 'important local roads' (which act as the main connections within a settlement, catering for local and through traffic).

Evidence suggests that within the case study areas, the character of the road has a bigger influence on driver speed than whether the limit is 30mph or 20mph. Changing the look and feel of the street (e.g. through road markings, landscaping, and roadside activity) may therefore result in higher levels of compliance.

Compliance is higher in peak than non-peak periods; but if roads with a before median speed of less than 20mph are excluded to remove the influence of congestion and isolate the impact of journey purpose, then the results show very little difference. Data collected in one case study area (but not available for other case studies) suggests that 20mph compliance amongst HGV drivers is poorer than for car and LGV drivers.

7.10.3. How have speeds changed in new 20mph limits?

Actual change in speed in case study areas – Journey speed analysis shows that the median speed has fallen by 0.7mph in residential areas and 0.9mph in city centre areas. Spot speed analysis shows a reduction in mean speed in four case study areas (based on unweighted and flow weighted data, where available) varying from -0.9mph to -2.3mph; and in a fifth case study area (-1.5mph) based on flow weighted data but not unweighted data. There was no significant change in three case study areas.

Faster drivers have reduced their speed more, with the 85th percentile speed falling by -1.1mph in residential areas and by -1.6mph in city centre areas, based on journey speed data. This is a key finding, as other research shows that higher speeds are associated with increased safety risk (more collisions, increased severity, perceptions that the environment is not safe for vulnerable users).

⁶⁹ Roads of minor connecting importance within a settlement, and roads that only have a destination function, e.g. roads inside living area, dead-end roads, alleys.

The spread of speeds, indicated by the 15th-85th percentile range, has declined by 1.3mph in residential areas, and by 2.0mph in city centre areas, indicating more consistency in the driving speeds on 20mph limit roads.

The overall change in speeds is greater where speeds were faster before (the median speed fell by -1.3mph on residential roads with a before speed of more than 24mph). The reduction in speed was also greater on 'important local roads' (where the median speed dropped by 1.1mph); while on 'minor local roads', which make up the majority of the sample, the median speed was already below 20mph and dropped by just 0.1mph. The results suggest that road characteristics have a much larger impact on the speeds that drivers choose to adopt than whether the road has a 30mph or 20mph limit. The differences in speed between the different road categories are far larger than the changes brought about by lowering the speed limit.

Bigger changes were recorded at individual spot speed sites, with the change in mean speed varying from -7.2mph (reduction) to +4.3mph (increase); and the change in 85th percentile speeds varying from -9.0mph (decrease) to +7.6mph (increase).

None of the case studies stand out as performing particularly strongly or poorly overall, in terms of the average change in speeds across the scheme areas. This is despite the schemes being implemented in a range of different geographical and speed environments.

Comparator analysis (evidence of 20mph policy impact) – Statistical analysis shows a significant reduction in speeds, relative to comparator areas, for important local roads in residential areas and for an aggregation of all road types in city centre areas:

- The relative change on important local roads in residential areas is estimated at -0.81mph for the median speed, -1.11mph for the 85th percentile speed, and -1.0mph for the 15th-85th percentile range.
- The relative change across all roads in city centre area, is estimated at -0.57mph for the median speed, -0.99mph for the 85th percentile speed, and -1.27mph for the 15th-85th percentile range.

The findings suggest that the absolute changes in speed observed in the case study areas are partly due to the implementation of 20mph limits (particularly on important local roads in residential areas), but also reflect background trends in speed on urban roads. The comparator areas all show a reduction in speeds over the period of analysis (varying from -0.1 to -1.0mph); broadly consistent with wider evidence that there has been a small downward trend in speeds in recent years across a range of road types (based on data collected by the DfT on locally managed A roads and free-flowing 30mph roads).

Factors likely to affect background speeds in local areas include a general lowering of speed limits, national speed campaigns (such as the DfT's *Think!* road safety speed campaign), an increase in the number of fixed penalty notices issued for speed limit offences and increasing attendance at speed awareness / retraining courses⁷⁰, and use of in-car technology (including satellite navigational devices which display the speed limit, cruise control, and speed limiters).

Wider evidence on speed change in 20mph limits (UK experience)

The reductions in average speed presented here are similar to those observed in other studies, including early evaluations of schemes in Scotland (Burns, A et al., 2001), Portsmouth (Atkins, 2010), Bristol pilot areas (Bristol City Council, 2012), and Edinburgh pilot area (Edinburgh City Council, 2013), which reported reductions in average speed of 0.5-2mph based on spot speed data.

They also reflect a more recent evaluation of the Bristol scheme (Pilkington et al. 2018) which reported a 0.8mph reduction in journey-based speeds (but with no comparison against background trends), and a significant 2.7mph decrease in vehicle speeds, after controlling for time of day, day of week, season, year, type of road, etc. The study also observed that the highest reduction in speed was on 20mph A and B roads. In the areas that kept a 30mph limit, there was a very small but significant reduction in speed (0.04 mph).

The change in speed observed is broadly consistent with the findings of Finch et al. (1994) which found that a change in the speed limit results in a change in the average traffic speed which is roughly one-quarter of the value of the change in the limit.

⁷⁰ Between 2011 and 2016 the number of fixed penalty notices issued nationally for speed limit offences (across all speed limits) increased by 30%, and the proportion attending driver awareness / retraining courses increased from 14% to 46% (Police powers and procedures, England and Wales, year ending 31 March 2017, Home Office).

7.10.4. How has effectiveness changed over time?

Limited data was available regarding the effectiveness of 20mph limits over time. While the findings can't be generalised to other areas, the findings do not support the hypothesis that speeds might increase over time.

7.10.5. How have speeds on neighbouring roads changed?

Almost half of non-resident drivers (44%) said that they were more likely to drive above the speed limit when leaving the 20mph area – due to the frustration associated with driving slowly or to make up time. However, journey speed analysis shows a small decline in speeds on surrounding 30mph and 40mph roads (-0.5mph for both categories) across the case study areas; suggesting that this is not happening on a regular basis.

The observed reduction in median speeds on 30mph and 40mph roads could suggest that drivers are getting used to travelling at slower speeds and are carrying this behaviour from the 20mph roads onto surrounding roads; or it could be due to a general downward trend in speeds. The comparator areas all show a reduction in speeds over the period of analysis; and evidence collected by DfT suggests that there has been a small downward trend in speeds on local urban roads in recent years.

7.10.6. Have residents and drivers noticed a change in speed?

The majority of resident (about two-thirds) and non-resident drivers (just over half) have not noticed a reduction in the speed of vehicles, and do not perceive there to be fewer vehicles driving at excessive speeds for the area. This is not surprising as the actual reduction in speeds has been small.

7.10.7. What do drivers say about their own driving behaviour?

Compliance – Approximately four fifths of drivers (residents 78%, and non-residents 83%) participating in the questionnaires stated that they complied with the 20mph limit most of the time; much higher than indicated by the journey speed and spot speed data. This may be because respondents are unaware of their true speed or are reluctant to admit to speeding in their local area.

Change in driving speed – Some 69% of resident drivers and 74% of non-resident drivers stated that they now drive at a slower speed than previously.

Consistency of driving speed – It has not been possible to collect evidence to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual driver level (with less acceleration and deceleration).

Propensity to speed on different types of roads – Around half of resident drivers and non-resident drivers acknowledged a tendency to speed. Propensity to speed tends to be broadly similar on 20mph limit roads, 30mph and motorway roads (e.g. 35%, 37%, 41% of non-resident drivers). However, some drivers felt that they were less likely to speed on 20mph roads with traffic calming (23% of non-resident drivers).

7.10.8. Do 20mph limits make slower speeds more acceptable?

Most resident drivers (72%) and non-resident drivers (69%) agreed that *“the 20mph limit makes it more acceptable to drive at a lower speed”*.

7.10.9. How has driver awareness and assessment of risk changed?

A net proportion (% agree - % disagree) of non-resident drivers (+44%) and resident drivers (+7%) agreed that 20mph limits increase driver awareness of potential risks and hazards.

Feedback from driver interviews suggests that a minority are likely to pay less attention, because they are focusing on their speed, distracted by in-car devices, or frustrated with driving slowly.

Most drivers interviewed report that they are more conscious of their driving environment, and are therefore likely to be better able to respond to hazards.

8. What factors influence speed compliance?

8.1. Introduction

The previous chapter shows that 53% of drivers in residential areas and 35% in city centre areas are exceeding the 20mph limit (based on journey speed analysis); although only 30% and 15% respectively are driving faster than 24mph⁷¹.

This chapter examines the factors associated with compliance and non-compliance; the role of enforcement in encouraging compliance; and what would make drivers comply more.

For context, DfT Circular 01/2013 (Setting Local Speed Limits) states that “*speed limits should be evidenced and self-explaining and seek to reinforce people's assessment of what is a safe speed to travel. They should encourage self-compliance.*” With specific reference to 20mph limits, it states that “*there should be no expectation on the police to provide additional enforcement beyond their routine activity, unless this has been explicitly agreed*”.

Furthermore, police guidelines⁷² indicate that enforcement should be reactive rather than proactive, and targeted where there is deliberate offending / disregarding, and the limits are clear (see Section 2.3).

8.2. What factors are associated with compliance?

Non-resident drivers participating in the in-depth interviews were asked why they or others did or didn't abide by the 20mph limit. Focus group participants were asked about enforcement, the consequences of exceeding 20mph, and driving behaviour in different circumstances.

The most frequently mentioned themes were:

- **Road environment** – A number of those involved in focus group discussions and in-depth driver interviews stated that they adapt their driving speed to the conditions and nature of the road. Some roads encourage slower speeds because they have characteristics which make it difficult to travel faster due to the geometry (e.g. narrow or twisty), presence of parked vehicles, or higher traffic flows. This was also a common theme amongst respondents to the online motorcyclists' survey.

“Very narrow roads, there are cars parked on each side and there are a few blind corners which you have to be careful of when buses are coming the other way, best to be slow.” (Non-resident driver)

- **Presence of vulnerable road users** – Non-resident drivers felt that compliance is likely to be higher in areas where there is an obvious reason for driving slower, e.g. the presence of a school or hospital where there are likely to be vulnerable groups using the roads (e.g. children, or older persons), or around other areas of high pedestrian activity. Similar views were expressed by focus group participants, with particular support for 20mph limits near schools, and an expectation that compliance would be higher in these areas.

“[It is easier] if there is an obvious reason for the 20mph limit, for example if it's outside of a school then people comply.” (Non-resident driver)

“I always look at the road, if there are loads of cars, I slow down. If there are kids I slow down.” (Resident)

- **Awareness and focus on safety benefits** – Non-resident drivers interviewed in Middlesbrough and Liverpool (Area 2) felt that the introduction of the 20mph limit had encouraged the community to discuss

⁷¹ This is the recommended threshold for fixed penalty notices or speed awareness courses in the ACPO Speed Enforcement Policy Guidelines 2011-2015. In addition, Circular 01/2013 suggests that where average speeds exceed 24mph the introduction of signage only is unlikely to lead to 20mph compliance.

⁷² Speed Enforcement Policy Guidelines 2011-2015: Joining Forces for Safer Roads (ACPO).

the issue of speed reduction and safety, and had increased awareness of the potential safety benefits and the reasons for implementing the scheme, which may have improved compliance.

“It got people to discuss it and it gets people aware of why it’s been reduced.” (Non-resident driver)

- **Parents** – Drivers with children were thought to be more likely to comply, as they are more likely to recognise the benefits.

“As a parent... we all want this, we want our kids to be safe” (Resident parent)

Other themes covered:

- **Lack of familiarity with area** – Focus group participants were asked whether they drive differently on local 20mph roads, compared with those further afield. Some said that they were more likely to comply in new places, due to uncertainty about the likelihood of enforcement activity and unfamiliarity with the road environment. However, others reported that they drive the same in both situations, and adjust their speed to the conditions of the road. There was no evidence given to suggest that participants comply more on local roads because they have a vested interest in the area.
- **Driver training and instilled behaviour** – A common theme amongst the participants in the young driver focus group was that they pay more attention to the limit when driving locally, due to the high profile of the scheme within the local community and because the importance of complying with the 20mph limit had been instilled in them when learning to drive in the local area. However, this behaviour is not necessarily applied when driving elsewhere (where they are less aware / conscious of the limit) or on roads with higher speed limits.

8.3. What factors are associated with non-compliance?

Non-resident drivers participating in-depth interviews were then asked why they or others did or didn’t abide by the 20mph limit.

The issue raised most frequently was **perceived lack of enforcement** – Almost all non-resident drivers interviewed were either unsure how the limit was enforced or stated that it was not enforced; and thought this was a key factor in making drivers less inclined to comply. This was also the primary issue raised by focus group participants as to why the speed limits were not more effective.

“Very few people are driving at 20mph because the police don’t police it. If you aren’t going to get charged for it you aren’t going to do it.” (Non-resident driver)

“I don’t think it means anything unless it is policed, because for every two people that will drive at 20 there’s three behind who are practically in your back seat.... They’re overtaking you” (Resident parent)

“I mean do the police, I don’t think I’ve ever seen it enforced anywhere, I mean even if you had a minor enforcement every now and then where you had a police car just standing there, reminding people that it’s 20 miles an hour once every six months or something, then that would do a lot, but there’s nothing, well, I feel there’s nothing.” (Resident and cyclist)

Focus group participants were asked ‘what do you think drivers perceive the consequences to be of driving more than 20mph in a 20mph limit?’. The most common response was that there were no consequences because the limits are not enforced. Other responses focused on the personal consequences of getting caught - possibility of financial penalties, points on their license, or the possibility of higher legal liability if involved in a collision. There was very little mention of the potential impact on the safety of others, although evidence presented earlier (Section 6.3) suggests that the majority are aware that improved safety is a key objective for many of the case study schemes.

When asked to consider whether speeding in a 20mph limit has the same consequences of speeding in a 30mph limit, two groups felt that there would be little difference; and two groups felt that the consequence would be more serious in a 20mph limit.

Other common themes for non-compliance identified in the focus groups and driver interviews are summarised below:

- **Time pressures, pace of life** – Other than issues regarding enforcement, the most frequently mentioned reason for speeding cited in the driver interviews was that drivers are in a hurry, want to get to their destination as fast as possible.

“Probably a lot of it is the time factor, they are in a rush.” (Non-resident driver)

“Most people are just thinking about getting from A to B, about being on time.” (Non-resident driver)

- **Frustration** – Many focus group participants commented that 20mph seems very slow. Drivers get frustrated because they are having to drive more slowly than they would like, and consequently increase their speed.

“If you get someone who wants to stick to that 20mph at first and there is no room to overtake on those roads, you have to crawl along as slow as they are, which can cause frustration, and accidents as well if people try to overtake.” (Non-resident driver)

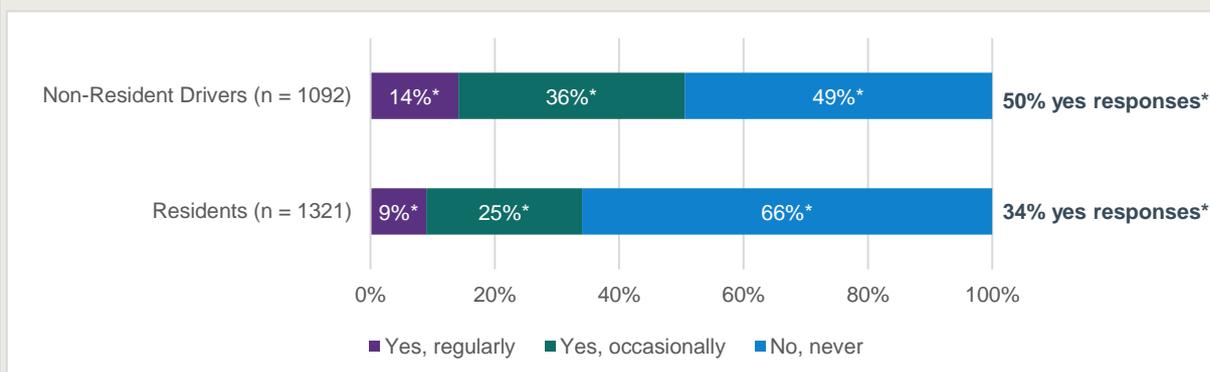
“I go slower and stick to the limit most of the time. But it’s frustrating when roads are empty and the limit still applies.” (Non-resident driver)

“Aggression has increased. Drivers don’t want to drive at 20mph and get more frustrated than they did previously.” (Non-resident driver)

Results from the questionnaire survey show some evidence of driver frustration with the new limit:

- A sizeable minority (26% of resident drivers, 24% of non-resident drivers) said that they personally felt frustrated at times.
- A higher proportion (34% of resident drivers, 50% of non-resident drivers) said that they are driving slower than they would like.
- Around half of non-resident drivers (48%) agreed that ‘the 20mph limit is frustrating for drivers’.

Do you find that since the introduction of 20mph limit you find you have to drive slower than you would like?



Residents and non-resident drivers questionnaires. n = sample size.
 Significant differences in drivers and residents results marked with asterix (*).

- **Limit perceived unnecessary or inappropriate** – Ignorance and arrogance were also commonly cited as reasons others do not comply with the 20mph limit. It was perceived that many drivers feel that they are able to drive safely at higher speeds, and consider the limit to be unnecessary or inappropriate for the nature of the road.

“They think they are above the law – they just don’t care.” (Non-resident driver)

"I've started ignoring speed limits now! I don't want to ignore speed limits. I wouldn't ignore a 30mph limit...you expect to slow down around schools, but you don't expect to have to drive at 20mph everywhere." (Non-resident driver)

This was especially felt to apply when it came to younger drivers who are perceived to speed more frequently due to a lack of experience and patience, and peer pressure.

"It's a challenge or thrill to young ones; it's a challenge to authority to say I'm not going to stick to this, why should I?" (Non-resident driver)

Another way of viewing this is that drivers instinctively adapt their driving speed to the conditions and nature of the road (see below).

- **Road environment and time of day** – In the same way some roads have characteristics which encourage compliance, others appear to have characteristics that encourage non-compliance. A common theme amongst those drivers interviewed and focus group participants was that higher speeds are more likely on roads which are wide, straight, without parked cars, and with less traffic (to hinder or enforce slower speeds) – enabling drivers to get a 'clear run'.

"Wide, straight roads are harder to stick to, you want to go faster naturally." (Non-resident driver)

"On Stanmore Lane and Wavell Way in particular people tend to pick up speed because they are quite wide straight roads." (Non-resident driver)

"If it's a clear run...people don't stick to 20mph. Most people are probably doing just over 20mph – 25 or 30mph." (Non-resident driver)

"[Compliance is] possibly better in the day when more people are abiding. They are more likely to break the speed limit when the roads are empty." (Non-resident driver)

A number of respondents commented that 20mph feels too slow on certain types of road.

- **Influence or pressure from other drivers** – Some non-resident drivers said that they naturally match the general speed of the traffic, and if most drivers are travelling faster they will also drive faster. Others felt hassled by other drivers to go faster; particularly on wide, straight roads where it is generally easier to driver faster (see below). This was echoed in the focus group discussions, where concerns were raised about aggressive driving putting pressure on those adhering to the limit.

"It's not easy [to stick to 20mph]. You get hassled by cars behind you, especially if they aren't local and they don't know it's a 20mph limit." (Non-resident driver)

"They'll overtake you on the inside if they can, to get past, when you're doing 20 miles an hour" (Resident)

The following themes were also covered in the interviews and focus groups, but less frequently:

- **20mph is an uncomfortable speed** – Although there was some disagreement regarding the appropriateness of the limit, most drivers interviewed felt that it was easy, at a practical level, to consistently drive at 20mph. However, others admitted that they struggled to keep their speed down or felt that the car was uncomfortable to drive at that speed.

"I find it difficult to abide by the 20mph limit. I struggle to keep my speed down." (Non-resident driver)

"20mph is so difficult; it's so slow it's ridiculous. It's not comfortable; have to be in second gear!" (Non-resident driver)

"The car doesn't like to go 20mph; new cars don't, I think, like to go at that speed." (Non-resident driver)

"I just find it's very difficult to keep at 20mph because modern cars are not meant to do 20mph. The car is wanting to do more so you have to keep slowing down to be at 20mph."

Respondents to the motorcycle online survey identified practical difficulties associated with riding at slow speeds, including lack of stability and difficulties getting out of first gear (requiring frequent use of the clutch), which can make complying with the speed challenging and uncomfortable. This was a common theme in the open responses, although only 14% of the sample agreed with the statement 'riding at 20mph or below is more challenging than riding at 30mph'.

- **Lack of awareness** – Lack of awareness of limit, particularly amongst those unfamiliar with the area.

*"It's difficult to know the limit – it could be an awareness issue. The signs could be more visible."
(Non-resident driver)*

In addition, **lack of awareness of own driving speed** may be a factor. As highlighted in the previous chapter a much higher proportion of drivers stated that they complied with the 20mph limit most of the time, than indicated by the journey speed and spot speed data. This may be because respondents are unaware of their true speed or are reluctant to admit to speeding in their local area.

Finally, in undertaking the journey speed analysis, the study team identified that the database used for **satellite navigation devices** is less accurate for 20mph limits than for other speed limits. There is a time lag between the introduction of 20mph limits and the updating of speed limit databases; and a further time lag if users do not regularly update the base maps used by their devices. While manufacturers and data providers advise users not to rely on the speed limit information displayed on the highlighted route, in practice this may mean that some drivers mistakenly believe the speed limit to be higher than 20mph.

8.4. What is the role of enforcement in encouraging compliance?

There was considerable discussion about the topic of enforcement within the focus group and driver interviews.

Level of enforcement – Lack of police enforcement was identified as a key reason for non-compliance in the driver in-depth interviews and focus group discussions; with those involved generally agreeing that police enforcement activity would encourage higher levels of compliance.

As highlighted in Section 5.7, evidence provided by the case study authorities (interviews with police and local authority officers) suggests that, most of the time, the level of enforcement has been low across the case study areas, broadly reflecting the above guidance set out in DfT Circular 01/2013 and ACPO Speed Enforcement Policy Guidelines 2011-2015. In a few cases, the police participate in education and enforcement days, but these tend to be sporadic and focused on a small number of locations only. Some case study areas run community speed watch initiatives, where members of the public use hand-held speed detection devices to monitor speeds. Others install Vehicle Activated Signs which display the actual speed vehicles are travelling at. Again, these tend to be focused on a limited number of locations and for short periods only.

This is likely to have contributed to the small change in average speed observed across all of the case studies, and the absence of any particularly strong performers in terms of speed reduction.

Should 20mph limits be enforced more? – While lack of enforcement appears to be a key reason for non-compliance, the public had mixed views on whether levels of enforcement activity on 20mph roads should be increased in practice.

A minority of non-resident drivers interviewed felt the limit should be enforced otherwise it was meaningless. However, others felt enforcement was not appropriate or required, for a range of reasons:

- Too expensive and the police have other priorities.
- Those who do exceed the limit aren't doing so excessively.
- The limit should be self-enforcing and self-imposed by drivers themselves.
- Enforcement would frustrate drivers further.

Focus group participants were considerably more supportive of enforcement, and felt this necessary to ensure the limit is adhered to. Police enforcement was certainly the favoured option, however participants

echoed the concerns of non-resident drivers regarding the availability of police resources and pressures on budgets.

When questioned further, many participants felt that police resources should be deployed to 20mph areas (rather than 30mph or over) as they are more likely to be areas where children and the elderly are at risk. However, others felt that police resource was better focused on the fastest roads (60mph and over) due to higher risks associated with collisions; or that police resources should be data-led and focused on areas with higher accident numbers, regardless of the speed limit in those areas.

Effectiveness of vehicle activated signs – Evidence from two case studies suggest that vehicle activated signs can achieve substantial reductions for short periods, but locations need to be re-visited to maintain benefits.

Case study examples – Effectiveness of vehicle activated signs (Box W)

Portsmouth – In Portsmouth, temporary Vehicle Activated Signs are installed for up to a month in locations where a high proportion of vehicles are found to be travelling at >24mph. Officers report that these can achieve substantial reductions, for short periods, but locations need to be re-visited to maintain benefits.

Walsall – Data collected by Walsall Council suggests that Vehicle Activated Signs combined with roadside police enforcement over a 7 day period achieved an additional reduction in mean speed of at least 5mph, on top of the change associated with the 20mph limit signs only. However, there is no evidence to suggest that the additional enforcement had a lasting effect, with speeds increasing again the following year. The enforcement activity was undertaken on Barns Lane, where the speeds following implementation of the new 20mph limit were still in excess of 30mph.

8.5. What would make drivers comply more?

Main suggestions – Non-resident drivers who felt the limit should be enforced to increase compliance, suggested greater use of cameras, random speed checks, mobile speed vans, community involvement, and fines; especially near schools.

“They have had kids outside with police with the speed cameras which I think is a fantastic way of engaging the drivers rather than just having the police there.” (Non-resident driver)

Amongst focus group participants police enforcement and vehicle activated signage were the most commonly discussed measures for successful enforcement (identified by 7 focus groups); followed by average speed cameras (mentioned by 6 groups), speed cameras (mentioned by 4 groups), awareness campaigns (mentioned by 4 groups), and finally awareness / retraining courses were suggested in one focus group.

Views on the various approaches are discussed further below:

- **Police presence** – Consistently identified as the most effective method of slowing down motorists, but general recognition that police resources are limited. Regular intervention would be needed, and it was acknowledged that some drivers will still adapt their behaviour depending on whether or not the police are present.

“If the police were there for five days, on the sixth day people would see they’d gone and speed up again” (Resident)

- **Speed cameras and average speed cameras** – Almost all focus groups felt that whilst speed cameras compel some motorists to drive slower, most drivers will speed up again after passing the camera and therefore this confines the effective range to small sections of the 20mph limit. Average speed cameras were viewed in a more positive light by participants because they ensure that motorists stick to the speed limit for a longer stretch of road.
- **Vehicle activated signs (VAS)** – All focus groups felt that vehicle activated signs (VAS) were an effective method for encouraging compliance. Young drivers stated that while most of their peers would be ashamed to activate the sign, some less responsible drivers may see it as a challenge, particularly

whilst driving with friends.

- **Awareness campaigns** – There was a mixed response from the focus groups as to how effective awareness campaigns can be. Most groups thought that the campaigns are often too short lived to be effective and are easy to forget. Some participants stated that campaigns need to be ‘hard hitting’ and memorable to be effective. Some parents felt the campaigns involving schools were useful as they encourage motorists to drive safely and help inform children; however, others were more sceptical.

“If my child came home from school and told me about 20mph limits, I’d be like “that’s nice”, we wouldn’t have a conversation about it. It would go out of mine and the kids’ heads.” (Resident - parent)

- **Awareness / retraining courses** – Those participants who had attended speed awareness course reported mixed feelings on effectiveness – some saying they are highly effective, and they have changed their driver behaviour, and others saying they are a ‘waste of time’.

Wider evidence on the effectiveness of speed awareness courses

The National Speed Awareness Course is offered by nearly all police forces in England and Wales and provides eligible offending drivers with a short course of retraining as an alternative to punishment for low-level speeding offences. It has the primary objective of encouraging and facilitating compliance with speed limits. The course aims to influence the attitudes and behaviour of drivers by directly challenging attitudes towards speeding, offering motorists insight, awareness and understanding about their speed choices, and helps equip participants to change their behaviour.

Impact Evaluation of the National Speed Awareness Course (Ipsos MORI, et. al., 2018)

The results of this recent evaluation indicated that participation in the NSAC was more effective at reducing speed reoffending than a Fixed Penalty Notice (comprising a fine and penalty points) over a period of 3 years following the initial offer to attend. This result was obtained using a variety of analytical approaches giving greater confidence that differences in reoffending rates are due to participation in the course rather than other factors (such as differences in the attitudes or characteristics of those who do and do not take the course).

Given the observed relationship between reoffending rates and collision rates, and other research showing that greater compliance with speed limits reduces collision rates, it is considered probable that the participation in NSAC has positive road safety effects, however, these could not be demonstrated in the evaluation study due to the low statistical power of the data sets available.

- **Other enforcement methods** – Some focus group participants suggested that social media could be used positively for publicity – particularly if tailored to local areas. Parents in Liverpool gave the example of the ‘Slow for Bobby’ campaign launched in their area after a local child was killed on a local road⁷³. Young drivers in particular thought social media was a good way of raising awareness of the consequences of speeding.

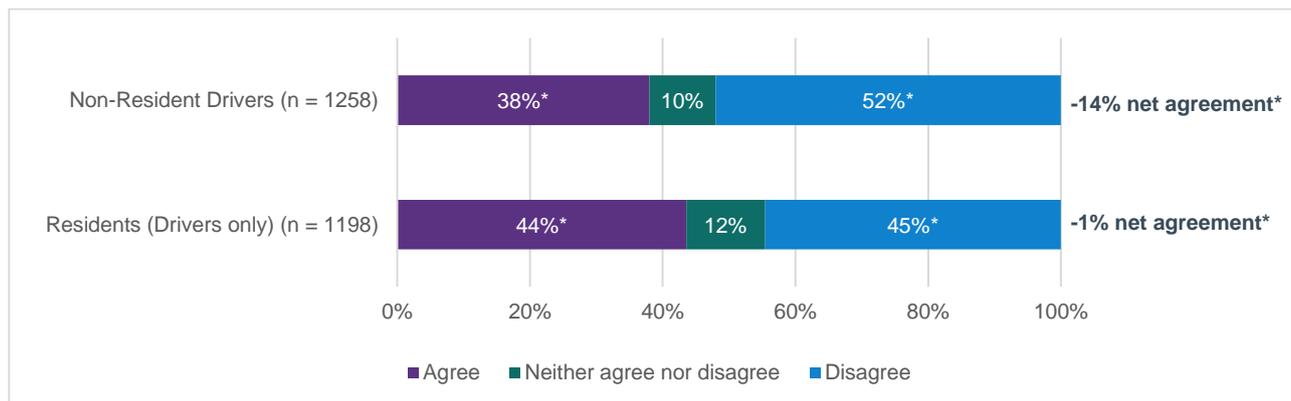
Others thought that naming and shaming motorists who have been caught speeding could be an effective deterrent. The ‘Kids Court’ intervention in Liverpool (see Box F) was identified as a good example – speeding drivers are stopped by the police and asked to attend a mock court run by children, to explain their driving behaviour.

Role of traffic calming – When asked whether they agreed that traffic calming measures should be introduced to encourage compliance, survey respondents revealed mixed views (Figure 31): with 44% of resident drivers agreeing and 37% disagreeing; and 38% of (non-resident) drivers agreeing and 52% disagreeing.

When (non-resident) drivers were asked about 20mph zones, as part of the in-depth interviews, a number commented that it is easier to comply with the limit in these areas, because it is physically harder to drive at a faster speed, and because it is often clearer why the limit has been reduced. However, a few drivers felt it was harder to comply with the limit in these areas, because they were constantly changing speed, speeding up and slowing down over the speed humps.

⁷³ This was not a Council led initiative but was supported by the Council.

Figure 31. Traffic calming measures (e.g. road humps, speed activated signs) should be introduced to encourage compliance



Residents and non-resident drivers questionnaires. n = sample size.

8.6. Summary and key messages

A summary of key findings is presented below.

8.6.1. What factors are associated with compliance?

The most frequently mentioned themes (in the driver interviews and focus groups) were:

- road environment (drivers adapt to the conditions and nature of the road, and some roads encourage slower speeds because they have characteristics which make it difficult or unsafe to travel faster, due to their geometry, presence of parked vehicles, or higher traffic flows);
- presence of vulnerable users (e.g. near a school or hospital) or around areas of high pedestrian activity;
- discussion within the community about road safety; and
- drivers with children (who may be more likely to recognise the benefits).

In addition, young drivers commented that they pay more attention to the limit when driving locally, due to the high profile of the scheme within the local community and because the importance of complying with the 20mph limit had been instilled in them when learning to drive in the local area. However, this behaviour is not necessarily applied when driving elsewhere (where they are less aware / conscious of the limit) or on roads with higher speed limits.

8.6.2. What factors are associated with non-compliance?

Drivers and focus group participants identified **lack of enforcement** and lack of concern about the consequences of speeding as the primary reason for non-compliance.

Other common themes identified in the focus groups and driver interviews include the following:

- time pressures and pace of life (drivers are in a hurry and want to get to their destinations quickly);
- frustration (20mph seems very slow);
- speed limit perceived unnecessary or inappropriate (drivers feel that they are able to drive safely at higher speeds, or instinctively adapt their driving speed to the conditions and nature of the road – see next bullet);
- road environment and time of day (higher speeds are more likely on roads which are wide, straight, without parked cars, and with less traffic to hinder or enforce slower speeds);
- influence or pressure from other drivers;

and to a lesser extent:

- 20mph is an uncomfortable speed; and lack of awareness of limit.

In addition, lack of awareness of own driving speed may be a factor; along with incorrect information about speed limits on satellite navigation devices.

8.6.3. What is the role of enforcement in encouraging compliance?

Evidence provided by the case study authorities (interviews with police and local authority officers) suggests that, most of the time, the level of enforcement has been low across the case study areas (reflecting DfT and police guidance that limits should encourage self-compliance). This is likely to have contributed to the small change in average speed observed across all of the case studies. While lack of enforcement appears to be a key reason for non-compliance, the public had mixed views on whether levels of enforcement activity on 20mph roads should be increased in practice. Evidence from two case studies suggest that vehicle activated signs can achieve substantial reductions for short periods, but locations need to be re-visited to maintain benefits.

8.6.4. What would make drivers comply more?

Drivers and focus group participants highlighted the pros and cons regarding the various enforcement options available (police presence, speed cameras and average speed cameras, vehicle activated signs, awareness campaigns, awareness courses, social media, initiatives to name and shame offenders). There was moderate support for introducing traffic calming measures to encourage compliance (with 44% of resident drivers and 38% of non-resident drivers agreeing).

9. What are the perceptions about walking and cycling in 20mph limits?

9.1. Introduction

This chapter examines the theory of change assumption (see Figures 3-5) that the introduction of 20mph limits (signed only) improves perceptions about the attractiveness of the local area for walking and cycling.

Changes in perception about walking and cycling are assumed to be driven by:

- the lowering of the speed limit and the designation of the area as a 20mph limit;
- a perceived reduction in the average vehicle speed and in the fastest speeds;
- a perceived increase in driver awareness of risks and hazards, and greater consideration towards pedestrians and cyclists; and
- a perception that the area is now safer with fewer collisions, casualties and near misses.

Existing research shows how fear of collisions may suppress travel by modes such as walking and cycling; and that improving driver behaviour has the potential to encourage active travel.

- Noland (1995) identifies risk, and its perception, as an important factor in people shifting to walking and especially cycling. The research shows that perceived safety improvements in cycle infrastructure have an aggregate elasticity value that is greater than one. This means that cycle safety improvements attract proportionately more people to commute by cycle (i.e. a 10% increase in safety results in a greater than 10% increase in the share of people cycling to work).
- Watkiss et al. (2000) notes that fear of traffic accidents amongst groups such as cyclists and children may reduce willingness to use these modes. However, they also highlighted that there was currently a lack of research available to quantify any such effect.
- Sanders (2013) shows that 'near miss' incidents are a key factor shaping cyclists' perceptions of risk and likelihood to cycle.

It is worth re-iterating that the majority of resident (about two-thirds) and non-resident drivers (just over half) surveyed for this study have not noticed a reduction in the speed of vehicles, and do not perceive there to be fewer vehicles driving at excessive speeds for the area (see Section 7.6.3). This is not surprising as the actual reduction in speeds has been small (around 1mph based on journey speeds).

The views of different user groups (residents, non-resident drivers, and cyclists) on perceived walking and cycling and related safety benefits has already been presented in Chapter 6 (Table 13). These findings are discussed in more detail below.

9.2. What do residents, drivers, and existing cyclists think?

Theory of Change Hypothesis: Improved perceptions regarding attractiveness of area for walking and cycling.

✓ *Questionnaire evidence supports above hypothesis. 20mph limits are perceived to be beneficial for (i) cyclists and (ii) pedestrians by 69% of residents (combined for both modes); by 74% and 77% of non-resident drivers; and by 69% and 89% of cyclists (nationwide). Residents in the larger area-wide residential case study areas (72%) are more positive than those in the city centre areas (61%).*

These views appear to be driven by perceptions about potential safety benefits of slower vehicle speeds, rather than because drivers have been seen to be more considerate to pedestrians and cyclists.

9.2.1. Views amongst residents⁷⁴

Overall – The introduction of the 20mph limit has improved perceptions regarding the attractiveness of the area for walking and cycling, amongst the majority of residents:

- 69% felt that the 20mph limits were beneficial for cyclists and pedestrians (16% disagreed);
- 51% agreed that the introduction of the 20mph limit provides a more pleasant environment for walking and cycling (24% disagreed); and,
- 60% felt that the limit provides a safer environment for walking and cycling (21% disagreed).

Slightly more residents⁷⁵ agreed (42%), than disagreed (37%), that the 20mph limit increases drivers' awareness of potential risks and hazards (e.g. cyclists, children playing, etc.). However:

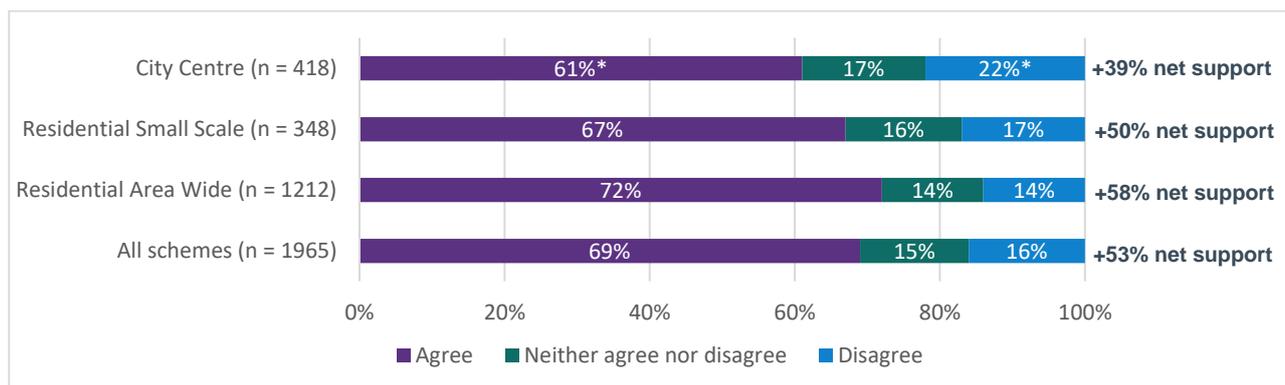
- only 21% of residents agreed that drivers are more considerate to pedestrians; and
- only 17% of residents agreed that drivers are more considerate to cyclists.

In addition, child safety remains a concern, and:

- only 28% of residents agreed that the street now provides a safer environment for children.

By area type – The proportion agreeing that 20mph limits are beneficial for walking and cycling is significantly higher in area-wide residential areas (72% agreement) than in the city centre areas (61% agreement) (Figure 32).

Figure 32. The 20mph limit is beneficial for both cyclists and pedestrians (by area type)



Residents questionnaire. n = sample size.

Significant differences in Residential Area Wide vs Residential Small Scale, and Residential Area Wide vs City Centre results marked with asterisk ().*

Similar trends can also be observed regarding the attractiveness (more pleasant environment) and safety of the environment for walking and cycling, with higher levels of agreement in residential areas.

⁷⁴ The questionnaire findings presented in this section are based on sample sizes varying from 1591 to 1985.

⁷⁵ Including drivers and non-drivers. There was no significant difference between the results for the two sub-categories.

Variation in perceptions by respondent and area-based characteristics – Multi-variate regression analysis was undertaken to identify respondent and area characteristics associated with positive perceptions about the benefits of 20mph limits for walking and cycling amongst residents. Separate models were developed for each of the following dependent variables:

- % agreeing “The introduction of the 20mph limit provides a more pleasant environment for walking and cycling”.
- % agreeing “The introduction of the 20mph limit provides a safer environment for walking and cycling”.

The regression models show that positive perceptions about the quality of the environment for walking and cycling are associated with:

- those who perceive positive speed outcomes⁷⁶;
- those living in areas with wider streets⁷⁷;
- those from more deprived areas⁷⁸; and
- those from largely residential areas (rather than residential areas mixed with retail, leisure or business)⁷⁹, reflecting the scheme type analysis presented in Figure 32.

A possible interpretation of these associations is that where speeds are thought to have decreased, and particularly on wider streets and in areas where there is likely to be more pedestrian / cycle activity, residents perceive that:

- it will be easier to cross the road; and
- cyclists will benefit from a more relaxed cycling environment (due to the reduced speed differential between cyclists and other vehicles), while also having sufficient road space to occupy.

Feedback from focus group participants, presented below, suggests that slower speeds are important in terms of creating a safe and attractive environment for walking and cycling, but other infrastructure improvements are also required to encourage greater use of these modes. A small proportion of focus group participants said that it was now easier to cross the road.

Case study differences – Residents in Chichester (83%) were most likely to agree that the 20mph limit is beneficial for cyclists and pedestrians, and has improved the attractiveness and safety of the environment for walking and cycling, possibly due to the role of cycle interest groups in the delivery of the scheme (see **Box X**).

Case study example – Positive perceptions about walking and cycling in Chichester (Box X)

Chichester – During the consultation period pro-scheme campaigners took an active role in promoting the wider benefits of 20mph schemes and selling a vision focused on creating a safe and pleasant environment for walking and cycling. The scheme launch was marked with a street party, balloon launch, scooter decorating competition and a 30mph piñata.

Following implementation, the Council employed a 20mph Officer for a year to encourage take-up of active travel modes, as part of a partnership between the Council and Sustrans. The aim was to inspire the users of the city to respect the new speed limit. This involves door-knocking within known “speed hotspots” in the city, pop-up events and on-street engagement (including a survey around behaviours and well-being).

This approach is likely to contribute to the positive perceptions about walking and cycling reported by residents in Chichester.

⁷⁶ Residents who agree ‘less vehicles are driving at excessive speeds for the area’ are 4.2 times and 4.00 times more likely, and those who agree ‘the average speed of vehicles has reduced’ are 1.8 times and 2.8 times more likely, to agree that the introduction of the 20mph limit (i) provides a more pleasant environment, and (ii) provides a safer environment for walking and cycling.

⁷⁷ Residents from areas with ‘medium or wide roads’ are 3.7 times and 3.9 times more likely than those from areas with narrow roads to agree that the introduction of the 20mph limit (i) provides a more pleasant environment, and (ii) provides a safer environment for walking and cycling.

⁷⁸ Residents from ‘more deprived’ areas are 2.2 times and 3.4 times more likely than those from ‘less deprived’ areas to agree that the introduction of the 20mph limit (i) provides a more pleasant environment, and (ii) provides a safer environment for walking and cycling.

⁷⁹ Residents from ‘mainly residential areas’ are 2.1 times and 2.2 times more likely than those from ‘mixed land-use’ areas to agree that the introduction of the 20mph limit (i) provides a more pleasant environment, and (ii) provides a safer environment for walking and cycling.

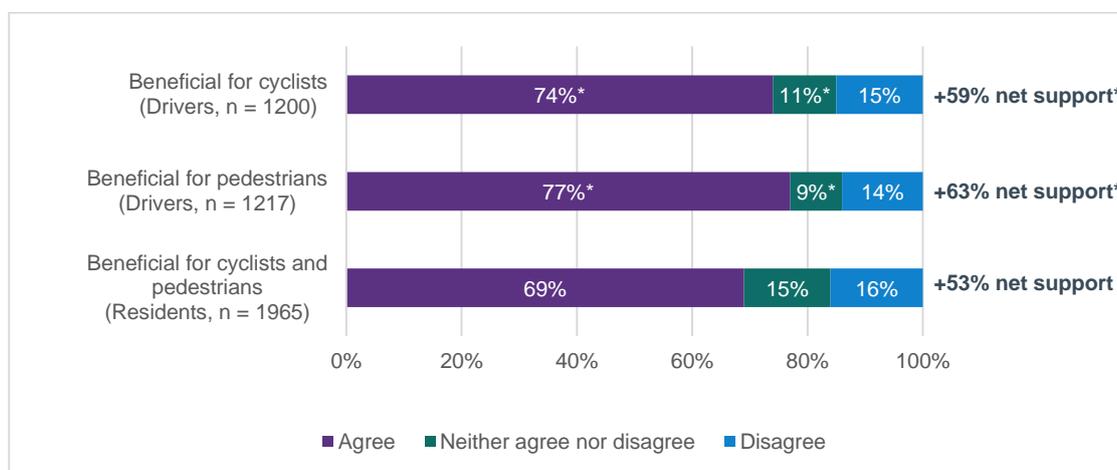
In contrast, residents in Brighton Phase 1 (52%) were least likely to perceive the benefits for walking and cycling. The central area of Brighton already has a strong walking and cycling culture, and as shown below (Section 9.4.1), while speed is considered an important factor, the actual change in speeds is believed to be have been small and other factors continue to act as barriers to increased levels of walking and cycling.

It is interesting to note that Liverpool Area 7 (80% agreement) and Liverpool Area 2 (79% agreement) were high scoring areas in terms of views about whether 20mph limits are beneficial for cyclists and pedestrians; but were amongst the weaker scoring areas in terms of pleasantness and safety of the environment. This suggests that there are other factors, related to the 20mph limit introduction, which are considered beneficial in terms of walking and cycling.

9.2.2. Views amongst non-resident drivers

Figure 33 shows that the proportion of drivers perceiving 20mph limits to be beneficial to cyclists and pedestrians is higher than for residents. Drivers were asked to consider each user type separately, while the question to residents combined the two groups. The positive response suggests that drivers are aware of the impact that their driving style and speed has on propensity for walking and cycling.

Figure 33. The 20mph limit is beneficial for cyclists and pedestrians



*Non-resident drivers questionnaire. n = sample size.
 Significant differences in drivers and residents results marked with asterix (*).*

9.2.3. Views amongst parents

Two focus groups were held with parents with children aged 7-10 years, one in Liverpool and one in Middlesbrough. Other groups also discussed issues around children walking to school or other destinations.

In general, participants reported that the introduction of the 20mph limit had little impact on whether they would allow their children to walk or cycle to schools or other destinations. Many felt that their children were too young to travel independently and were primarily concerned about the risks associated with crime, anti-social behaviour and personal security.

However, vehicle speeds and risk of injury were also considerations. Some parents reported that they would feel better about letting their children walk or cycle if they knew the traffic was travelling at 20mph, but others disagreed due to wider concerns.

A number of participants pointed out that children are travelling to and from school at the time when the roads are busiest. While they welcomed their children receiving cycling and road safety training, they felt the risks were too high to allow them to walk or cycle during peak periods.

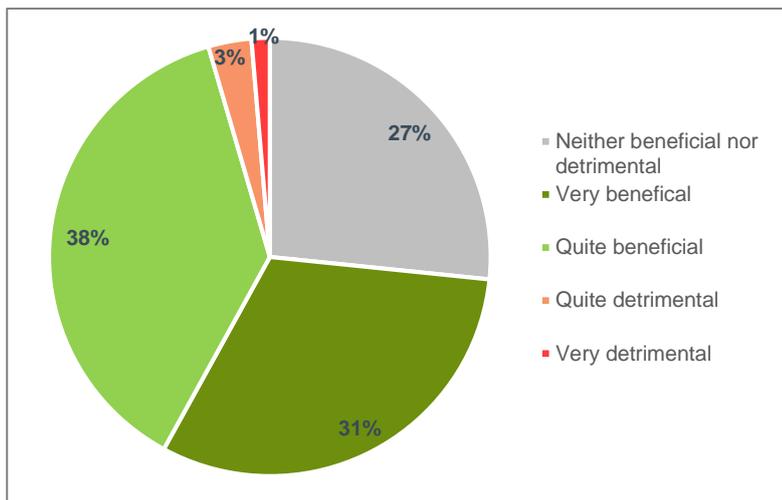
*“I’ve seen our local school doing that [cycle proficiency], but it’s at 1 o’clock in the afternoon. You try doing that at half past 3 when all the cars are there picking kids up it’s a completely different story.”
 (Parent)*

There was little discussion about whether parents are walking or cycling with their children. Some parents in Liverpool said that the 20mph limit had made it more likely for them to walk with their children, but it was unclear whether they had actually walked more.

9.2.4. Views amongst cyclists (nationwide)

Evidence from the nationwide online cyclist survey conducted via Sustrans shows that the majority of cyclists (69%) feel that 20mph limits are beneficial for cyclists, with only 4% describing them as detrimental.

Figure 34. In general, how beneficial would you say 20mph limits are to people who cycle – focusing on roads without physical traffic calming measures?

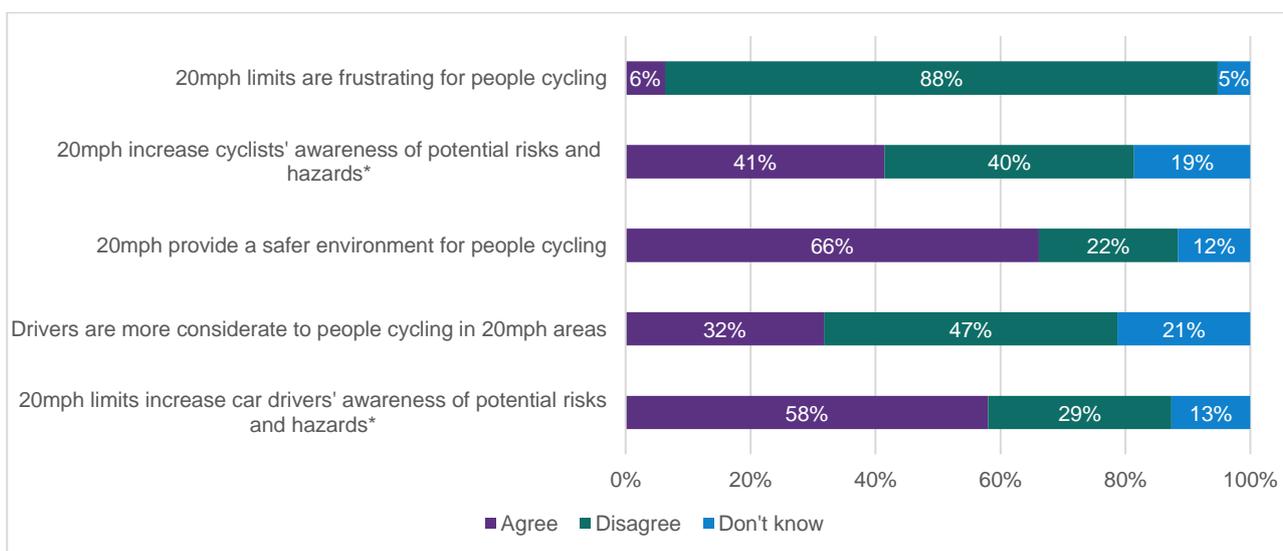


Nationwide online cyclists survey (vis Sustrans). n (sample size) = 1655.

In addition, 66% agreed that the limits create a safer environment for cycling, and 58% agreed that 20mph limits increase car drivers' awareness of potential risks and hazards (e.g. cyclists, children playing, pedestrians on the road). However, only 32% felt that drivers are more considerate to people cycling in 20mph areas, with 47% disagreeing.

Respondents had mixed views about whether 20mph limits increase cyclists' awareness of potential risks and hazard, with 41% agreeing and 40% disagreeing. The majority of respondents (88%) felt that the 20mph limits were not frustrating for cyclists, presumably because most cyclists will be travelling less than 20mph.

Figure 35. Perceptions of existing cyclists about the impact of 20mph limits on the quality of the walking and cycling environment



Nationwide online cyclists survey (vis Sustrans).
 n (sample size): 1,419 to 1,427 (number of responses varied slightly between statements).

9.3. How important are 20mph limits in terms of the perceived quality of the walking environment?

9.3.1. Views of residents

The majority of focus group participants felt that 20mph limits had little or no impact in terms of making the area better or worse for walking. A minority thought that it is now easier to cross the road.

Slower speeds are felt to be important in terms of creating a safe and attractive environment for walking. However, there is not perceived to be any substantial change in speed, and speed is only one of a combination of factors required to improve the environment for walking. Quiet streets, wide pavements, safe crossing points, and feeling safe and secure were also stated to be important factors. So whilst speed is important, slower speeds on their own aren't generally enough to change perceptions and behaviour - but are a move in the right direction.

In the case study areas, there continues to be a range of barriers which discourage walking, including:

- weather;
- difficulties crossing the road due to high traffic flow, the presence of parked cars, and a lack of safe and convenient crossing points;
- poorly maintained paths (including broken slabs and tree roots);
- vehicles parked on the pavement; and
- issues with other road users - impatient drivers, cyclists riding on the path or travelling at high speeds on the road (specific to Brighton), and anti-social behaviour (specific to Middlesbrough, and involving young people riding motorbikes on the pavement).

For many drivers, time constraints, journey distance, and a general preference for driving are also important considerations.

Participants who do walk regularly do so out of necessity or convenience, and did not consider safety to be a key factor in their decision. For example, Brighton (Phase 1) residents who walk regularly noted they did so because of expensive parking in the city centre, rather than because of issues associated with the 20mph limit. Parents in Liverpool reported that they walk because driving often took longer.

No focus group participants said that the 20mph limit had encouraged them or anyone in their household to walk more. As mentioned above, some parents in Liverpool said that the 20mph limit had made it more likely for them to walk with their children, but it was unclear whether they had actually walked more.

9.4. How important are 20mph limits in terms of the perceived quality of the cycling environment?

9.4.1. Views of residents (non-cyclists)

Focus groups were undertaken with drivers (6 groups), non-drivers (1 group), regular cyclists (1 group) and new cyclists (1 group). The views of the seven driver and non-driver groups are considered here, and those of the two cyclist groups in Section 9.4.2. Many participating in the driver and non-driver discussions didn't cycle, and didn't have strong opinions.

Brighton - Brighton was the only area where some participants felt that the 20mph limits had made the area better for cycling, and had contributed to the increase in cycling in the city.

"Well, the cars aren't haring pass you as much, if you're in a cycle lane you don't feel, you know, there's a car passed you at 20 or nearer to 20, it's a bit different to a car coming pass you at 30-35, you know, you sort of get that wobble as the car comes pass, whereas at 20-25..." (Brighton Phase 1 resident)

However, even here, most participants said that the 20mph limit hadn't changed their willingness to cycle, because there were still too many cars driving too fast.

Quieter roads (with less traffic) and feeling safe and secure on the streets were felt to be important requirements, alongside slower speeds. The group agreed that there were sufficient cycle lanes in the area, but felt that the busy roads (with high volumes of traffic, pedestrians, and other cyclists) discouraged cycling. They also felt that the behaviour of both drivers and cyclists was also a deterrent, mentioning drivers parking or driving in cycle lanes, and cyclists (including electric bikes) travelling too fast for the environment, sometimes without lights.

“Just how busy Brighton is, it just puts me off, if I do ever go cycling it will literally somewhere where there’s no cars, because it’s quite nerve racking, you know, you’ve got nothing to protect you and there are people that do drive stupidly and people who just walk out in front of you and it’s too busy for me in case I fall, I know I’ll probably get hit by a car.”

Brighton is believed to have a stronger cycling culture than the other case study areas, and has put substantial investment into cycling infrastructure and promoting cycling. In addition, parking is limited and expensive in the area, and as a result a number of the focus group participants regularly walked or cycled, but mainly walked).

Elsewhere – Elsewhere, virtually no-one commented that the 20mph limits had made the area better for cycling. Participants remained concerned about the volume of traffic on the road, and the likelihood of being hit by a vehicle. The state of the roads was also mentioned, including the risk of potholes causing a fall. Residents in Walsall felt that conditions had improved on the side roads (presumably referring to slower driving speeds), but the main through route was still seen as being too dangerous due to the number and speed of vehicles. One resident in Middlesbrough felt the roads were too narrow, for cycling. Young drivers identified personal preference as a key issue, with some people happy to cycle longer distances, other not, and some people firmly attached to their car.

Most participants felt that there was a need for more cycle lanes, but these need to be in logical and convenient places. Segregated paths away from the road are preferable to on-road lanes. Shared use cycle / footways were unpopular with some participants, due to the potential conflict with pedestrians and children. The number of parked cars was identified as a problem with on-road lanes.

Safe cycle parking at destination was also mentioned.

Young-drivers in Chichester commented that 20mph areas were a good option for people who were new to cycling and wanted to build their confidence on the roads.

Summary – As with walking, slower speeds is just one of the factors needed to encourage cycling. Quieter streets, appropriate cycle infrastructure (including parking) which makes cyclists feel safe and secure, and considerate behaviour from other drivers and cyclists are all important requirements for a safe and attractive cycling environment, alongside slower speeds.

9.4.2. Views of residents (cyclists)

Two focus group discussions were held with cyclists. One with regular cyclists in Brighton and one with new cyclists in Nottingham.

Role of 20mph limits – A number of participants felt that the 20mph limits had made the respective areas better for cycling (due to the slower speeds).

“I think it’s miles better personally if the cars go slower” (Brighton cyclist)

“It certainly encouraged me to get on my bike more, knowing that I’m going through 20 mile per hour area. I feel more comfortable and more confident” (Brighton cyclist)

Cyclists in Brighton discussed the relative importance of slower speeds, versus other factors, in some depth.

- The group felt that both segregated and on-road cycle lanes were essential for encouraging cycling, particularly where children are concerned, and if they had to make one change that would be it. However, slower speeds were also felt to be very important for less confident cyclists, even where there are on-road cycle lanes.

- Width was also felt to be important, to provide a buffer between cyclists and cars. However, most participants said they would rather cycle along a narrow 20mph road rather than a wide 30 mph road. One reason was because they were less likely to feel the pressure of cars trying to overtake on a 20mph road.
- Crossings are also important, to enable cyclists to cross traffic safely and to join up sections of cycle path (even in 20mph limits).
- Participants were more concerned about traffic volume when choosing where to cycle.

A similar, briefer, discussion took place in Nottingham.

- New cyclists in Nottingham commented that they felt safer and more relaxed on 20mph roads, because they did not feel under pressure from cars trying to overtake.
- A designated cycle lane on a 30mph or 40mph road was felt preferable to a 20mph limit on a narrow road.
- Lack of continuity and joined up cycle lanes were felt to be a problem in Nottingham, requiring cyclists to use the roads for part of most journeys. Participants felt that cyclists still needed the right skills and environment to safely reach their destination. The inference is that 20mph limits are important in this respect.

“So if there’s a designated cycle lane in a 40 zone, I would feel better on that, than cycling in a built-up area in a 20 zone, because quite often 20 zones are residential areas and they’re quite tight roads and cars will try and sneak by you and they’ll pass really closely, whereas if you’re cycling on a lane that’s marked you feel like this is my area and that people shouldn’t cross into that with their car.”

In general, slower speeds were felt to have an important role to play, but other factors such as the presence of cycle lanes (segregated and unsegregated), secure parking, safe crossings, lower traffic volumes, and sufficient width, are also important. Better education for drivers on how to behave towards cyclists was recommended, along with the police pulling over drivers passing too close to cyclists or driving aggressively.

Preference for 20mph limit roads / choice of route – In general, participants would choose a 20mph limit over a 30mph limit, all other factors being equal. New cyclists in Nottingham and regular cyclists in Brighton stated that they felt safer cycling in the 20mph areas. They felt less pressure to cycle quickly than on a 30mph road and found that even though many motorists exceed the 20mph limit, they were overall a safer option. However:

- 20mph roads may be avoided if they are congested or narrow.
- Roads with high quality cycle lanes are likely to be favoured, even if they have a higher speed limit.

These factors are likely to be more relevant for less confident riders. Others will just want to reach their destination as quickly as possible.

9.4.3. Views of existing cyclists (nationwide)

Reasons for perceived benefits - Some 31% of cyclists responding to the online survey stated that 20mph limits were ‘very beneficial’ for cyclists. The following section highlights the reasons given for this view.

In summary, many benefits relate to the reduced speed differential between cars and cycles, as well as slower vehicle speeds. These factors are perceived to create a safer environment in general and reduce the severity of injuries, reduce the risk from overtaking, give cyclists more time to manoeuvre, put cyclists under less pressure, and reduce the likelihood of drivers getting frustrated with cyclists. 20mph limits are also perceived to increase driver awareness and observance regarding cyclists, and give both parties more reaction time.

“Keeping the speed difference between cars and bikes low is essential.”

“If 20mph is observed (which it often is not) it is safer for cyclists.”

“More likely a car will see you because they have more time and if you are hit it won’t be as severe.”

“The speed reduction is small but valuable.”

Expanding on this, the following themes were covered by respondents:

- Cars are less likely to overtake, as travelling at a similar speed to cyclists; and less likely to take risks to do so, reducing the likelihood of a collision or near-miss.
- Drivers are less likely to get frustrated with cyclists, as the speed differential is less, and less likely to act in a manner which cyclists may find intimidating.
- 20mph limits increase driver awareness and observance regarding cyclists, and increase reaction time for both parties.
- Creates an environment where drivers are more likely to be considerate to cyclists, giving them more space and time.
- Gives cyclists more time to manoeuvre, for example, when changing lanes or turning right.
- Creates a more relaxed environment for cycling and means cyclists are less likely to feel under pressure from drivers. Cyclists are more likely to fear that they are travelling at a legitimate speed; and less likely to feel like they are holding up the traffic, less likely to be concerned about risks associated with overtaking vehicles, and less likely to fear being injured in a collision.
- Reduces risk of serious injury if speeds and speed differentials are lower.

“They make car drivers less frustrated if they are caught behind cyclists and less likely to close pass, honk or overtake dangerously.”

“Interactions between vulnerable road users and motor vehicles are so much easier to deal with and safer when the vehicles are not travelling at excessive speeds.”

“It’s all about attitude - car drivers need to feel they are in an area where they must take extra care to look out for vulnerable road users.”

“I feel safer in a slower speed limit area as cars seem to pass with room to spare for me on my cycle.”

“Reducing speeds to 20mph in residential areas helps to change the atmosphere and function of the area. Cycling amongst vehicular traffic in a 20mph zone makes me feel safer and less stressed compared to roads with higher speeds.”

“Generally, car drivers don’t attempt to overtake. The 20 mph roads I use are much less stressful than roads with higher limits where drivers attempt to overtake and drive to close behind.”

These factors are all perceived to encourage others to cycle more, and are also seen as beneficial for vulnerable users (particularly children).

“People will feel safer and therefore be more likely to cycle. The sensation of safeness is just as important as a low mortality rate.”

“Lower speeds are good for cyclists and pedestrians, particularly children.”

Reasons why cyclists perceive 20mph limits to be detrimental – Only 4% of cyclists responding to the online survey stated that 20mph limits were ‘detrimental’ for cyclists, but it is useful to examine the reasons why in more detail.

Of the 64 respondents describing 20mph limits as detrimental, 62 provided additional comments clarifying the reason for their response.

A common theme amongst these respondents was lack of compliance which is perceived as reducing or making the intervention ineffective. Other themes contradict the benefits outlined above, with respondents perceiving 20mph limits to increase driver frustration (resulting in aggressive, careless, or distracted driving); increase the likelihood of conflict or fear of a collision, particularly when overtaking (due to the need for vehicles to accelerate and brake aggressively, or because vehicles now take longer to overtake); and create false expectations (with cyclists assuming vehicles to be travelling less than 20mph). A fewer respondents commented that 20mph limits are often implemented in environments where there is little space for cars and cyclists, so the risk to cyclists is high regardless of the speed limit. Others said that the 20mph limit reduced the fitness and time-saving benefits associated with cycling.

“A driver is always compelled to pass a cyclist regardless of speed or allowable speed. That driver will generally have little time to pass when the speeds of him and the cyclist are closely aligned. The result is either fast overtaking, well above 30mph for an instant followed by harsh braking, or a very close pass often against oncoming traffic. The perceived safer environment possibly makes the close pass a more acceptable risk to the motorist. In either case the vehicle generally then slows to a speed slower than that of the bicycle. Following cars repeating the manoeuvre find themselves stuck outside the cyclist or forcing in front.”

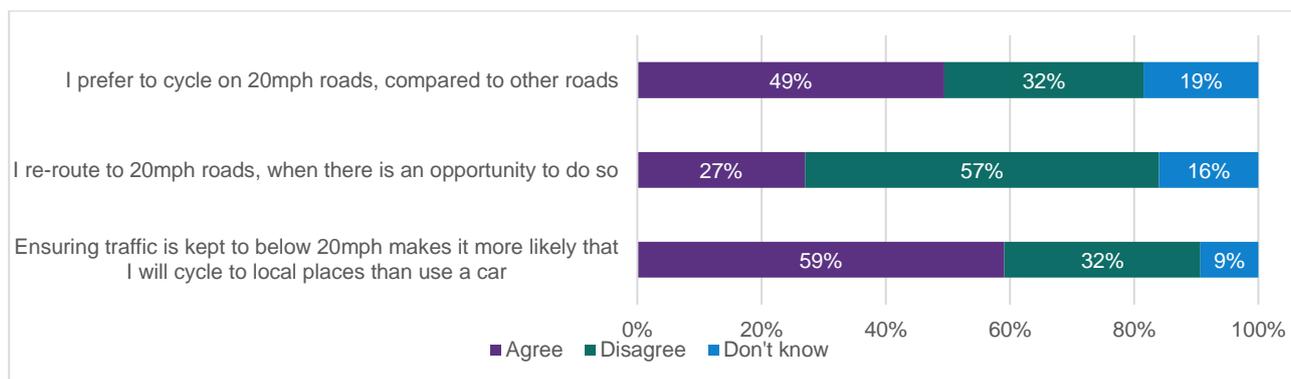
“Drivers concentrate too much on their speed so pay less attention. They also brake too much.”

Preference for 20mph limit roads / choice of route – Around half of respondents (49%) prefer to cycle on 20mph roads. These are mainly regular cyclists, and the proportion may be higher amongst less regular and less confident cyclists. However, only a quarter (27%) re-route to use 20mph roads, suggesting that convenience outweighs preference for 20mph roads. The specific conditions associated with the alternative routes (speed, traffic volume, distance) also appear to be important.

“Yes, I would preferentially use a 20mph limited road but not if it took me a long way out of my way, not if it was v busy. But yes, if the alternative was v fast/dangerous.”

Likelihood of cycling more – Over half (59%) say that keeping the traffic below 20mph means that they are more likely to cycle to local places. These however, are already regular cyclists, and the same may not apply to less regular or inexperienced cyclists.

Figure 36. Self-reported impact of 20mph limits on cycling behaviour



*Nationwide online cyclists survey (vis Sustrans).
 n (sample size): 1,411 to 1,420 (number of responses varied slightly between statements)*

Speed compliance amongst cyclists – Some 70% of cyclists said that they keep their speed to less than 20mph on roads with a 20mph limit, but only 20% say that they cycle more slowly on 20mph roads. The majority are likely to be cycling less than 20mph anyway, and the responses to the second statement suggest that the majority do not adjust their speed according to the speed limit. A number of respondents stated that they cycled to keep fit, and tended to cycle faster.

9.5. Summary and key messages

A summary of the key findings is presented below.

9.5.1. What do residents, drivers, and existing cyclists think?

Overall, 20mph limits are perceived to be beneficial for cyclists and pedestrians:

- 69% of residents agreed that the 20mph limits are beneficial for cyclists and pedestrians;
- 74% of non-resident drivers agreed that the 20mph limits are beneficial for cyclists, and 77% agreed they are beneficial for pedestrians; and
- 69% of existing cyclists (nationwide) agreed that 20mph limits are beneficial for cyclists, and 89% agreed they are beneficial for pedestrians.

Residents in the larger area-wide residential case study areas (72%) are more positive than those in the city centre areas (61%).

Focus group discussions suggest that these views are driven by perceptions about the potential safety benefits of slower vehicle speeds, rather than because drivers have been seen to be more considerate to pedestrians and cyclists.

9.5.2. How important are 20mph limits in terms of the perceived quality of the walking environment?

Views of residents – Focus group participants reported that slower speeds are important in terms of creating a safe and attractive environment for walking. However, respondents did not perceive any substantial change in speed, and speed is only one of a combination of factors required to improve the environment for walking. Quiet streets, wide pavements, safe crossing points, and feeling safe and secure were also important factors. So, whilst speed is important, slower speeds on their own aren't generally enough to change perceptions and behaviour - but are a move in the right direction.

In the case study areas, there continues to be a range of barriers which discourage walking; and for many drivers, time constraints, journey distance, and a general preference for driving are also important considerations.

9.5.3. How important are 20mph limits in terms of the perceived quality of the cycling environment?

Views of residents – As with walking, slower speeds is just one of the factors needed to encourage cycling. Quieter streets (with less traffic), appropriate cycle infrastructure (segregated and unsegregated cycle lanes, safe crossings, sufficient space, cycle parking) which makes cyclists feel safe and secure, and considerate behaviour from drivers and other cyclists are all important requirements for a safe and attractive cycling environment, alongside slower speeds.

Views of cyclists (nationwide) – Many of the benefits identified by respondents to the online survey relate to the reduced speed differential between cars and cycles, as well as slower vehicle speeds. These factors are perceived to create a safer environment in general and reduce the severity of injuries, reduce the risk from overtaking, give cyclists more time to manoeuvre, put cyclists under less pressure, and reduce the likelihood of drivers getting frustrated with cyclists. 20mph limits are also perceived to increase driver awareness and observance regarding cyclists, and give both parties more reaction time.

Around half of respondents (49%) prefer to cycle on 20mph roads. These are mainly regular cyclists and the proportion may be higher amongst less regular and less confident cyclists. However, only a quarter (27%) re-route to use 20mph roads, suggesting that convenience outweighs preference for 20mph roads. The specific conditions associated with the alternative routes (speed, traffic volume, distance) also appear to be important.

10. How have collision and casualty rates changed?

10.1. Introduction

10.1.1. Outline

This chapter examines the impact of new 20mph limits (signed only) on collisions and casualties:

Collision – A ‘personal injury collision’ (referred to here as a ‘collision’) is an incident involving personal injury, which occurs on the public highway (including footways), in which at least one road vehicle is involved and which becomes known to the police within 30 days of its occurrence.

Casualty – For each personal injury collision, there will be one or more casualty(ies), i.e. the person(s) injured in the collision. This can be the driver or passenger(s) in a vehicle, or be vulnerable road users such as cyclists, pedestrians and equestrians.

Casualties are categorised by severity as fatal, serious injury, and slight injury.

It tests the following assumptions set out in the theory of change logic maps in Figures 3-5:

- Reduction in collisions and casualties, including vulnerable road users, on 20mph limit roads. As a result of:
 - a reduction in average speed and top percentile (fastest) speeds;
 - smoother more consistent driving speeds;
 - an increase in driver awareness.
- Potential negative impacts on 20mph limit roads, as a result of complacency amongst pedestrians and cyclists, and driver frustration / lack of attention.
- Potential negative impacts on surrounding 30mph roads, due to drivers trying to make up for lost time or driver frustration / lack of attention.

Geographically coded police data on road casualties, referred to as STATS19 data, is used to examine the number and type of collisions and casualties, before and after implementation of the 20mph limit schemes.

Comparator areas have been identified for each case study, to control for background trends in collisions related to factors such as technology improvements, environment, road type, weather, economic trends, traffic growth, etc. All comparator areas comprise urban 30mph roads in locations with similar geographical characteristics (in terms of urban density and form) to the case study areas. The purpose of the comparator areas is to estimate what would have happened in the case study locations (in terms of change in collisions and casualties), if the 20mph limit schemes had not been implemented. The case study areas are assumed to be affected by the same background trends as the identified comparator areas. The difference between the actual change in collisions in the case study areas, and the estimated background trend, can then be assumed to represent the effect of the 20mph limit (described as the intervention effect).

In order to estimate the ‘intervention effect’, a generalised linear model⁸⁰ has been used. This uses the 30mph comparator areas to adjust for background trends in the collision / casualty data available for each case study. A key strength of the approach, is the ability to make use of all data available for each case study however limited or extensive. The ‘before’ data covers 5 years and leaves a gap of one year prior to implementation of the 20 mph limits in the case study areas, to avoid any changes in behaviour in the run up to implementation. The ‘after’ data covers between 17 and 44 months, depending on the case study in question. No post implementation gap has been left in order to maximise the amount of data available.

The likelihood of being able to detect a change in collisions or casualties with a defined level of probability, depends on the scale of change in the data and the amount of data available (the sample size). The larger the sample size, the greater the likelihood of being able to detect a smaller change.

⁸⁰ A generalised linear model is a version of an ordinary linear regression model that allows for response variables that have error distribution models other than a normal distribution.

Further information on the STATS19 data, the selection of comparator areas, and the analysis approach is provided in Section 3.4.

Changes to the recording of casualties associated with the introduction of the CRASH reporting system mean that it has not been possible to undertake any meaningful statistical analysis by casualty severity as part of this study.

It is worth noting that it has not been possible to examine the change in 'near misses', as there is no robust source of data on 'near misses'. Near misses have an important influence on perceptions of safety, and low numbers of collisions do not necessarily imply a safe environment for road users.

DfT's Contributory Factors data is used to understand more about the nature of collisions in 20mph limit areas (taking into account the dataset limitations outlined in Section 3.4.8).

The following issues are examined in Sections 10.2-10.5 of this chapter:

- How have collision and casualty rates changed in residential case studies?
- How have collision and casualty rates changed in city centre case studies?
- Has there been a change in collision contributory factors?
- Is there any evidence of negative safety impacts on neighbouring roads?

10.1.2. Existing evidence on factors affecting collision and casualty rates

Relationship between vehicle speeds and collisions / injuries – There is an established positive relationship between vehicle speed and injury collisions – the higher the speed, the more collisions and where collisions do occur, the higher the risk of a fatal injury at higher speeds. The spread of speeds, and proportion of vehicles driving above the speed limit is also important.

Finch et al. (2004) looked at the validity of the relationship between vehicle speeds and collisions / injuries from the early 1960s onwards, using data from across Europe. They concluded that a 1 mph reduction in average speed is associated with at 5% reduction in injury collisions.

Taylor et al. (2000) undertook a major programme of research to investigate the impact of traffic speed on the frequency of road accidents. This was based on observed spot speed data on sections of road between major junctions; and driver-based studies, which involved making unobtrusive spot speed measurements of a large sample of car drivers in free-flow conditions on a sample of roads. The following conclusions were drawn:

- On urban roads with low average speeds, any 1 mph reduction in average speed can reduce collisions by around 6%.
- The number of accidents is dependent on both the average speed of traffic and the spread of speed, as well as the proportion of speeders:
 - The faster the traffic moves on average, the more accidents there are: the rise is rapid - the accident frequency rises approximately with the square of the average traffic speed.
 - The larger the spread of speeds around the average speed, the more accidents there are - the accident frequency increases exponentially as the spread of speed increases.
 - Accident frequency rises approximately in proportion to increases in the proportion of speeders.

Elvik (2009) reviewed 115 studies, containing 525 estimates of the relationship between speed and collisions, and concluded that there was good evidence internationally for the effectiveness of reducing the speed and volume of traffic for reducing injury rates. The research also demonstrated that as speeds decline the number of fatal casualties will decrease more than the number of serious casualties.

Wramborg (2005) cites evidence which shows that when collisions between vehicles and pedestrians occurred at 20mph only 5% were killed, whilst half received fatal injuries at 30mph, and 95% were killed at 40mph. Other more recent studies have corroborated this relationship:

- Richards (2010) concluded that the risk of fatal injury to pedestrians struck by vehicles rises very slowly at speeds up to 20mph, increases slightly faster between 20mph and 30mph, and rises most at speeds above 30mph. Nevertheless, about half of all fatalities where a pedestrian is killed by a car occur when

the car is travelling below 30mph – presumably due to the number of pedestrians on these types of roads.

- Kröyer et al. (2014) shows that if impact speed increases from 30 to 40 km/h the risk of fatal injury is about doubled, and the death risk is about 4-5 times higher in collisions between a car and a pedestrian at 50 km/h compared to the same type of collisions at 30 km/h.

This relationship is used by organisations such as the OECD as a basis for advocating 30km/h (~20mph) speed limits in built up areas where there is a mix of vulnerable road users and motor vehicles. It advocates a 'safe system' of road design and speed limits that can accommodate unavoidable human error without leading to death or serious injury.

In terms of the reasons for the relationship, Bellefleur and Gagnon (2011) suggest that increasing speed decreases a driver's field of vision, thus reducing the likelihood that a dangerous situation will be noticed in time. Additionally, increasing speed leads to an increased stopping distance, which means the distance travelled by the vehicle during the time it takes a driver to react plus the vehicle's braking time. This reduces the likelihood that the vehicle will stop in time to avoid a collision or reduce its severity.

Other research undertaken by Wann et al (2011) shows that children under 15 have difficulties seeing that vehicles are approaching at over 20mph. For a given pedestrian crossing time, vehicles traveling faster loom less than slower vehicles, which creates an illusion in which faster vehicles may be perceived as not approaching. Results from perceptual tests of looming thresholds show strong developmental trends in sensitivity, such that children may not be able to detect vehicles approaching at speeds in excess of 20 mph. This creates a risk of injudicious road crossing in urban settings when traffic speeds are higher than 20 mph. The risk is exacerbated because faster moving vehicles are more likely to result in pedestrian fatalities.

Other factors affecting collision and injury rates – Various research shows that there are a number of other factors affecting collisions and the severity of casualties which include traffic volume, road type⁸¹, land use and area type⁸², user type⁸³, and socio-demographic characteristics⁸⁴. These influences have been considered in the selection of comparator areas to control for confounding factors (see Section 3.4).

Trends in collisions and injuries over time – The DfT has published data⁸⁵ to show that the number of collisions per year is reducing, due to improved vehicle technology and other factors. The background trend is therefore an important consideration in any statistical analysis undertaken.

10.1.3. Change expected in case study areas

The theory of change logic maps (Figures 3-5) assume a reduction in collisions and casualties, including vulnerable road users, on 20mph limit roads, as a result of a reduction in average speed and top percentile (fastest) speeds; smoother more consistent driving speeds; an increase in driver awareness. Evidence presented in earlier chapters shows an improvement in each of these factors, indicating that they are likely to have had a positive influence on the numbers of collisions and casualties.

Change in speed – Evidence presented in Chapter 7 shows that there has been a small reduction in average speed in the case study areas, the speed driven by the fastest drivers (when collision likelihood and severity is highest), and the range of speeds:

- Journey speed data shows that in the predominantly residential case studies, the median speed has fallen by 0.7mph, the 85th percentile speed by -1.1mph, and the 15th-85th percentile speed by -1.3mph. In the predominantly city centre case studies, the median speed has fallen by 0.9mph, the 85th percentile speed by -1.6mph, and the 15th-85th percentile speed by -2.0mph.
- Analysis of instantaneous speeds (based on spot speed data) shows a significant reduction in mean speed in four case study areas (based on unweighted and flow weighted data where available) varying from -0.9mph to -2.3mph; and a significant reduction in a fifth case study area (-1.5mph) based on flow weighted data only. There was no significant change in three case study areas.

⁸¹ E.g. Keep and Rutherford (2013) and Li and Graham (2016), and others cited in these papers.

⁸² E.g. Li and Graham (2016), and others cited in this paper.

⁸³ STATS19 casualty data by road user type.

⁸⁴ E.g. Lawson and Edwards (1991), White et al. (1999), NICE (2010) cited in Cairns et al. (2014), Lowe et al (2011).

⁸⁵ See statistics published at <https://www.gov.uk/government/collections/road-accidents-and-safety-statistics>

The proportion of sites with a mean speed <24mph increased from 59% to 75%, and the proportion with an 85th percentile speed <30mph increased from 70% to 87%.

The results of the comparator analysis indicate that the above changes are partly due to the implementation of 20mph limits but also reflect a general downward trend in speeds on urban roads. Nevertheless, theory suggests that the small reduction in actual speeds is likely to have had a positive influence on reducing the number of collisions and casualties in the case study areas. The above research (e.g. Finch et al. (1994) and Taylor et al. (2000)) shows that a change in mean spot speed of 1mph can be expected to reduce injury collisions by 5-6%. It is reasonable to expect a change of this order in the case study areas, as a result of both the 20mph limits and the background trend. However, the change associated just the 20mph limits is expected to be substantially less.

Smoother more consistent driving speeds – Journey speed data shows that the spread of speeds, indicated by the 15th-85th percentile range, has declined by 1.3mph in residential areas, and by 2.0mph in city centre areas; indicating more consistency in the driving speeds on 20mph limit roads. However, the evidence collected from non-drivers about their own behaviour is not sufficient to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual vehicle level (with less acceleration and deceleration).

Driver awareness – A net proportion (% agree - % disagree) of non-resident drivers (+44%) and resident drivers (+7%) agreed that 20mph limits increase driver awareness of potential risks and hazards (e.g. cyclists, children playing, etc.), possibly an indication of safer and more considerate driving style. The broad proportions were similar in residential and case study areas. The findings suggest that on balance, 20mph limits are perceived to have had a positive influence on driving standards, encouraging a safer and more considerate driving style; and a positive influence on reducing collisions, all other factors being equal.

Change in traffic flow – Collision numbers are also influenced by flow and road standard⁸⁶, and substantial changes in traffic flow can be expected to impact on any relationship between speed reduction and collision rates. The data available is limited, but suggests that background traffic flow has increased in the residential case study areas, and has either increased or remained broadly stable on case study 20mph roads. In general, traffic flow is therefore expected to have had a neutral or dampening effect on any relationship between speed reduction and collision rates. The picture is more complex in the city centre case studies, as discussed later in this chapter.

Evidence on change in traffic flow

Evidence from the GB Road Traffic Count data collected by DfT shows that across the eight residential case study areas with count sites on major roads⁸⁷, average annual traffic flow increased by 2.4%, comparing flows six years before implementation and up to five years post implementation. The analysis does not take into account whether the roads in question have a 20mph limit, and is intended to provide an indication of the background trend in traffic on major A roads in these case study areas. This trend may or may not apply to other roads in the case study areas.

Local authority flow data has been provided for a sample of case study areas only, and is often based on a limited number of count sites only. Data for case studies with more than 10 count sites shows the following changes Walsall (+8%), Brighton Phase 2 (-2%), Winchester City Centre (-2%).

Only 8% of (non-resident) drivers said that they avoided driving in the new 20mph limits, and only 4% of residents felt that there are less vehicles using their road.

10.1.4. Characteristics of ‘before’ collisions in case study areas

Characteristics of ‘before’ collisions are summarised below:

- During the five year ‘before period’ there were 2,393 personal injury collisions and 2,903 casualties in the case study areas⁸⁸.

⁸⁶ As reported earlier, higher classification roads (with higher flow) have much higher collision rates per kilometre than lower road classifications: 7.92 on important strategic roads (FRC1-3), 2.35 on important local roads (FRC4-5), and 0.30 on minor local roads (FRC6-7), based on before data.

⁸⁷ The dataset does not include count sites in the Walsall (Rushall) case study area.

⁸⁸ This compares with 1,437 personal injury collisions and 1,677 casualties in the residential case study areas during the after period, based on between 17 and 44 months of data.

- The majority of injuries were slight (87%), with most of the remaining injuries (13%) categorised as serious. There were three fatal injuries during this period.
- Two fifths of those injured were pedestrians (24%) or cyclists (17%), accounting for a substantial proportion of total injuries. These vulnerable groups are expected to benefit from a safer environment following the introduction of the 20mph limits.
- The majority of those injured were aged 16-74, however, 6% were under 11, 7% were aged 11-16, and 5% were 75 or over. These groups are also identified as vulnerable groups, and 20mph limits are expected to deliver specific safety benefits, for example greater driver awareness, easier crossing, and improved perceptions of personal safety.
- In terms of location, collisions are dispersed across the case study areas, but are often more prevalent at road junctions.
- Higher classification roads (with higher traffic flow) have much higher collision rates per road kilometre than lower classification roads: 7.92 on 'important strategic roads', 2.35 on 'important local roads', and 0.30 on 'minor local roads'.
- The majority of road length in case study areas is in the 'minor local road category', with this category representing over 90% of road lengths in the case study areas overall and for most individual case study areas. The exceptions are Brighton Phase 1 where 10% of road length is on 'important strategic roads' and 16% is on 'important local roads', and Winchester where close to 40% of roads are 'important local roads'; both focus on the city centre and adjacent residential areas.

In terms of contributory factors (and taking into account the data limitations outlined in Section 3.4.8):

- The most common contributory factors on case study area roads are all related to the failure to observe what is happening on the road network: Driver failed to look properly (37%), Pedestrian failed to look properly (17%), Failed to judge other person's speed (15%) (Table 27). Slower speeds provide more time for road users to observe and respond to hazards, and are expected to lead to a reduction in collisions associated with these factors. However, it is also possible that reducing the speed limit may make pedestrians complacent or drivers frustrated, resulting in an increase in 'failed to look properly' incidents or frequency of 'careless/reckless' behaviour.
- Seven of the top ten contributory factors within the case study areas are also present within the list of top ten contributory factors nationally. The exceptions are Pedestrian – Careless/reckless/in a hurry (7%), Disobeyed stop sign/markings (5%), and Stationary or parked vehicles (5%); a reflection of the case study characteristics and the fact that 20mph limits have generally been introduced on minor roads with more pedestrian activity.

Table 27. Contributory factors associated with collisions in case study areas prior to implementation (findings to be treated as indicative only, due to dataset limitations)

Top 10 contributory factors (vehicles unless stated)	Case study areas		GB 2015 Top 10 contributory factors	
	No.	%	Rank	%
Failed to look properly*	528	37%	1	46%
Pedestrian - Failed to look properly*	248	17%	6	9%
Failed to judge other person's speed*	219	15%	2	23%
Poor turn or manoeuvre	171	12%	4	17%
Careless/ Reckless/ In a hurry*	162	11%	3	19%
Pedestrian - Careless/Reckless/ In a hurry*	98	7%	N/A	N/A
Slippery road (due to weather)	87	6%	7	8%
Loss of control*	80	6%	5	13%

Top 10 contributory factors (vehicles unless stated)	Case study areas		GB 2015 Top 10 contributory factors	
	No.	%	Rank	%
Disobeyed Stop sign / markings	77	5%	N/A	N/A
Stationary or parked vehicles	75	5%	N/A	N/A

**Factors most likely to be affected by a change in speed limit are highlighted in pink.*

10.1.5. Perceptions of safety

Perceptions of safety have been covered in previous chapters and show that:

- just over a third of non-resident drivers (36%) felt that it was safer to drive on the roads where 20mph limit had been introduced, particularly in area-wide residential areas;
- 60% of residents felt that the limit provides a safer environment for walking and cycling; and
- 66% of regular cyclists agreed that '20mph provides a safer environment for people cycling'.

However, child safety remains a concern, and only 28% of residents agreed that the street now provides a safer environment for children.

10.2. How have collision and casualty rates changed in residential case study areas?

Theory of Change Hypothesis: Reduction in collision and casualty rate, and a reduction in speed related incidents in residential case studies:

?(Unclear) The comparator analysis indicates that there is insufficient evidence to conclude that there has been a significant change in total collisions, total casualties, pedestrian and child casualties, following the introduction of 20mph limits in residential areas, in the short term. Collision and casualty rates are known to fluctuate from year to year, and the post implementation data currently available may not be indicative of the longer term trend. Repeating the analysis in a couple of years' time, when more case study data is available, may (or may not) show a significant change.

?(Unclear) It has not been possible to draw any conclusions regarding the relative change in fatal injuries, cycle casualties, and older casualties. Further data is needed to enable a conclusion to be drawn about the scale and direction of change for these categories.

?(Unclear) No evidence available on casualty severity, or near misses.

10.2.1. Overview (residential case studies)

Collisions and casualties per year – A summary of the average number of collisions and casualties per year in the residential case studies and corresponding comparator areas is presented in Table 28. Data is presented for the five year before period, and the available after period, along with the percentage change between the two periods (before and after implementation of the change in speed limit).

A number of key observations can be drawn from this table:

- The number of collisions / casualties per year in the case study areas is generally small (typically less than 20).
- There is considerable variability between the case study areas, in terms of the percentage change between the before and after periods. This is not surprising given the small sample sizes and the random nature of collisions.
- The comparator areas are much larger than the case study areas, and consequently there is generally less variability between the different comparator areas.
- While a number of case studies show a greater reduction in collisions / casualties than in the corresponding comparator areas, these results are based on very small case study sample sizes.
- The comparator areas for Liverpool Area 7 and Liverpool Area 2 stand out as showing a substantial reduction in collisions / casualties between the before and after period, of around a third. This is much greater than the reduction recorded in any of the other comparator areas. Much of the north-west comparator area is focused on 30mph roads in Greater Manchester, alongside roads in Liverpool which still have a 30mph limit in place. Collision data shows that the number of collisions per year has declined steadily between 2008 and 2016. The reasons for the decline are unclear, however, discussion with Transport for Greater Manchester identified two factors which may have contributed to the trend:
 - Firstly, the closure of public counters and phone lines at some police stations, making it more difficult for public to report collisions which have not been attended by the police.
 - Secondly, increasing levels of congestion, partly linked to roadworks associated with development and construction sites, which may have reduced speeds and collisions on 30mph roads.
- There is considerable month-to-month variability within each case study area, and statistical modelling (presented below, Table 29) is required to determine the relative change in the case study and comparator areas.

Due to the small number of collisions / casualties recorded at individual case study areas over the period of research (and the random nature of collisions), the remainder of this section is based on the aggregated dataset for all residential case study areas. As discussed later, none of the residential case studies show a significant change in collisions at the individual case study level.

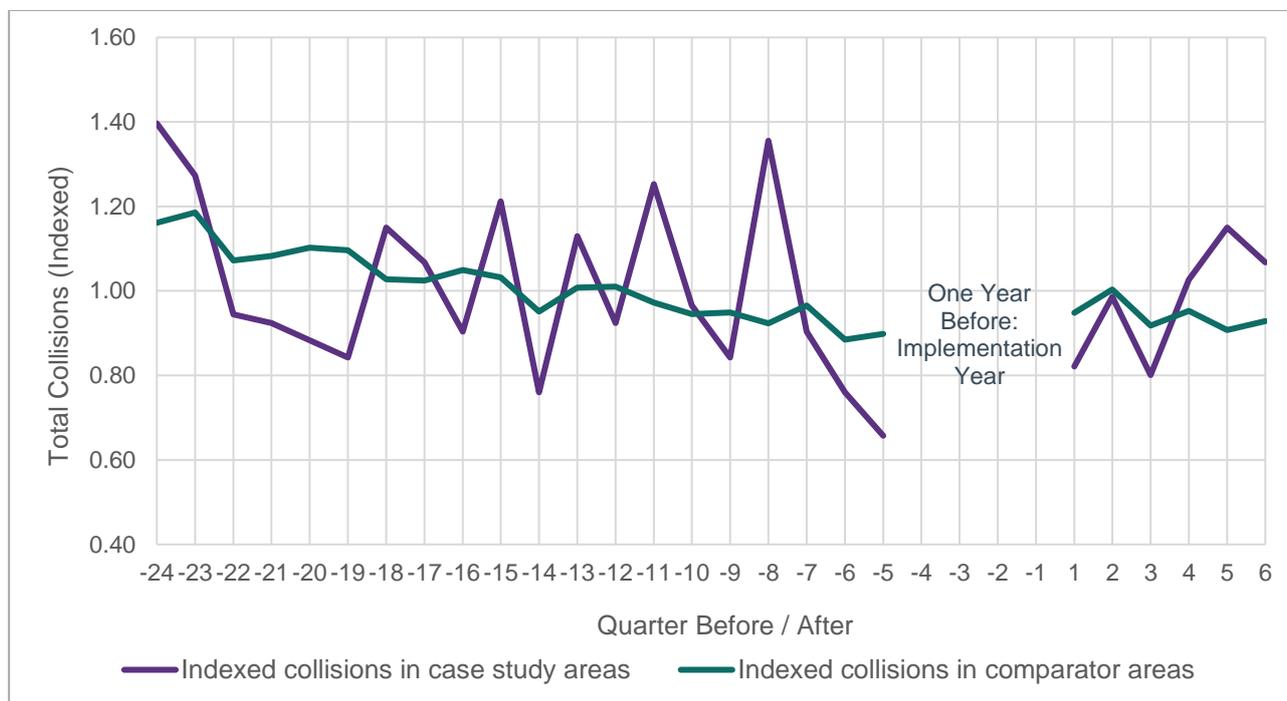
Table 28. Average number of collisions and casualties per year in residential case studies and corresponding comparator areas

	Case study areas			Corresponding comparator areas		
	Average number / yr - before	Average number / yr - after	% Change	Average number / yr - before	Average number / yr - after	% Change
Number of collisions						
Walsall (Rushall) (R-SM1)	1	0	-74%	4,689	4,376	-7%
Winchester (Stanmore) (R-SM2)	4	4	-15%	7,657	7,743	+1%
Liverpool (Area 7) (R-AW1a)	15	14	-7%	6,027	3,983	-34%
Liverpool (Area 2) (R-AW1b)	17	10	-41%	5,641	3,625	-36%
Middlesbrough (R-AW2)	28	21	-26%	1,179	1,037	-12%
Calderdale (R-AW3)	13	11	-20%	3,142	2,548	-19%
Nottingham (Bestwood) (R-AW4)	13	14	+9%	1,259	1,280	+2%
Brighton (Phase 2) (R-AW5)	92	93	+1%	7,837	7,903	+1%
Chichester (R-AW7)	13	14	+13%	7,819	7,869	+1%
All residential areas	196	180	-8%	-	-	-
Number of casualties						
Walsall (Rushall) (R-SM1)	2	0	-85%	6,423	5,925	-8%
Winchester (Stanmore) (R-SM2)	5	6	+16%	9,524	9,506	0%
Liverpool (Area 7) (R-AW1a)	23	18	-20%	8,380	5,458	-35%
Liverpool (Area 2) (R-AW1b)	24	13	-47%	7,806	4,976	-36%
Middlesbrough (R-AW2)	34	25	-26%	1,619	1,409	-13%
Calderdale (R-AW3)	19	15	-21%	4,405	3,413	-23%
Nottingham (Bestwood) (R-AW4)	16	15	-6%	1,595	1,598	0%
Brighton (Phase 2) (R-AW5)	108	107	0%	9,743	9,677	-1%
Chichester (R-AW7)	15	19	+26%	9,726	9,644	-1%
All residential areas	245	218	-11%	-	-	-

The comparator areas are described in Table 11 (Section 3.4.8). Although a number of the case studies are based on the same comparator area (e.g. Liverpool Area 7 and Liverpool Area 2), the timespans are different for each case study and hence the before and after data for the comparator areas differs.
As some comparator areas are used more than once it is not appropriate to sum the rates and compare with the aggregated results for the case study areas.

Overall trend – Figure 37 shows the change in collisions in the aggregated set of residential case study areas and their associated comparator areas over time.

Figure 37. Quarterly indexed collisions for case study and comparator areas – Predominantly residential case study areas



The data is presented on a quarterly basis over the period that all case study areas have in common. This means that there is quarterly data for 6 years before to 1 year before the scheme (spanning five years in total), and from the first quarter after implementation until quarter six after implementation. While some case study areas have more than six post-scheme quarters of data available, others do not and so this period is shown for consistency across all case study areas. The data is indexed to the average value of each dataset to allow the trend to be observed without the comparison being obscured by the fact that the volume of collisions in comparator areas is much higher than in the case study areas.

The comparator data shows a gradual decline during the before period, followed by a levelling off in the after period. We would expect the before trend to be replicated in the case study areas as it is most likely due to factors other than speed limit reductions such as improved vehicle performance and safety, road safety awareness and training, etc. This provides a baseline for the statistical model to consider whether there has been a significant change in collisions in case study areas, in the period following the introduction of 20mph speed limits.

The case study data also shows an overall decline in the before period, followed by a levelling off in the after period. However, the data fluctuates substantially over time due to the small size of the case study areas, seasonality effects, and the random nature of collisions. This makes it difficult to understand the relative change in the after period, requiring use of the statistical model to determine whether the relative difference between the case study and comparator areas is significant.

Statistical analysis – Table 29 shows the results for the statistical analysis for the above residential case study areas. The form of the input data is described in Table 9 (Section 3.4.8).

Table 29. Change in collisions and casualties in residential case studies, relative to comparator areas

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Change in collisions (n = 1575)	-0.5%	-10.4%	+10.4%	0.925	✗
Change in casualties (n = 1936)	-0.8%	-9.7%	+9.1%	0.873	✗
Change in fatal casualties (n = 5)	Poor fitting model				
Change in pedestrian casualties (n = 436)	-7.3%	-24.1%	+13.2%	0.456	✗
Change in cycle casualties (n = 298)	Poor fitting model				
Change in under 16yrs casualties (n = 196)	-4.1%	-23.2%	+19.7%	0.712	✗
Change in over 75yrs casualties (n = 79)	Poor fitting model				

n = combined before and after sample for case study areas

The above changes (relative to the comparator areas) are all non-significant, and should not be reported as changes.

The 'estimated change' has been calculated by the statistical model, based on quarterly data (i.e. covering a 3 month period) for the case study and comparator areas. It therefore differs from the change that might be inferred from Table 28, which is based on the average number of collisions / casualties per year.

As an aide to interpretation:

- The first column shows the categories of casualties and collisions tested.
- The second column shows the estimated change in collisions / casualties across the case study areas following the change in limit, relative to the comparator areas, i.e. collisions are estimated to have fallen by 0.5% more in the case study areas than they did in the comparator areas.
 - *So, for illustrative purposes only, assume that there were 100 collisions in a hypothetical case study area in the before period and the reduction in its comparator area was 10%. The model is estimating that, on average, the reduction in the case study area due to the background trend is 10 collisions (i.e. 10%) reducing the after collisions to 90, with a further 0.45 collisions (0.5%*90 collisions) associated with the introduction of the 20mph limit. In this hypothetical scenario, the number of collisions in the after period is, on average, 89.55, i.e. $100 * (1-0.1) * (1-0.005)$. The model provides an estimate of the real situation, so does not necessarily predict whole numbers of collisions.*

In broad terms, the model uses the ratio of before collisions vs. after collisions in the individual comparator areas to estimate the expected change in the corresponding case study areas in the absence of any '20mph effect', and uses the residual change to estimate the '20mph effect'. Overall, greater weight is given to case study areas with larger numbers of collisions and less to those that have smaller numbers of collisions.
- The third and fourth columns indicate the confidence interval, associated with the observed change. This is the range within which the real change across all 20mph limits with similar characteristics to the case study is believed to lie. In the case of the change in collisions, there is a 95% likelihood that the real change lies between -10.4% (reduction) and +10.4% (increase). Note that the confidence intervals are symmetrical about the estimate on a log scale but are asymmetrical about the estimate when applied to the original (unlogged) scale (as in the table above).
- The fifth column shows the p-value. This is a number between 0 and 1, and is a standard way of indicating the strength of significance of a result:
 - A large p-value (>0.05) indicates weak evidence to reject the null hypothesis that there has been no change relative to the comparator areas.
 - A small p-value (typically ≤0.05) indicates strong evidence to reject the null hypothesis that there has been no change relative to the comparator areas.
 - p-values very close to the cut-off (0.05) are considered to be marginal (could go either way).
- The final column indicates whether the change is statistically significant. If the p-value is >0.05 and confidence interval encompasses both a positive and negative change (as in the case of the change in collisions), then the conclusion is that the change is not statistically significant.

Change in collisions – Relative to the comparator areas, the number of collisions recorded in the residential case studies is estimated to have fallen by 0.5%. However, the confidence interval is wide (-10.4% to +10.4%), and the real change could be either positive or negative.

Change in casualties – Relative to the comparator areas, the number of casualties recorded in the residential case studies is estimated to have fallen by 0.8%. However, the confidence interval is wide (-9.7% to +9.1%), and the real change could be either positive or negative.

In the case of fatal casualties, the model fit was not sufficient to draw any conclusions about the change relative to the comparator areas (i.e. there was a large discrepancy between the observed values and the values expected in the model in question). A larger sample of data is needed enable a conclusion to be drawn about the scale and direction of change.

Change in pedestrian and cycle casualties (vulnerable users) – Relative to the comparator areas, the number of pedestrian casualties recorded in the residential case studies is estimated to have fallen by 7.3%. While this appears to represent a sizeable change, the confidence interval is very wide (-24.1% to +13.2%), and the real change could be either positive or negative.

In the case of cycle casualties, the model fit was not sufficient to draw any conclusions. Again, a larger sample of data is needed enable a conclusion to be drawn about the scale and direction of change.

Change in child and older casualties (vulnerable users) – Relative to the comparator areas, the number of child casualties recorded in the residential case studies is estimated to have fallen by 4.1%. Again, this appears to represent a sizeable change, but the confidence interval is very wide (-23.2% to +19.7%), and the real change could be either positive or negative.

In the case of older people, the model fit was not sufficient to draw any conclusions. Again, a larger sample of data is needed enable a conclusion to be drawn about the scale and direction of change.

Change by road type – The results also show no significant change when disaggregated by road type (Table 30).

Table 30. Change in collisions by road type in residential case studies, relative to comparator areas

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Major strategic roads (FRC 1-3)	+25.3%	-51.7%	+225%	0.643	✗
Important local roads (FRC 4-5)	-12.5%	-28.9%	+7.7%	0.207	✗
Minor local roads (FRC 6-7)	+5.6%	-6.5%	+19.3%	0.376	✗
All roads	-0.5%	-10.4%	+10.4%	0.925	✗

The above changes (relative to the comparator areas) are all non-significant, and should not be reported as changes.

Analysis by case study area – In addition, none of the residential case studies show a significant change in collisions at an individual case study level.

Summary – Based on the above analysis, there is insufficient evidence to reject the null hypothesis that there has been no change in collisions and casualties following the introduction of 20mph limits. In other words, there is insufficient evidence to conclude that there has been a significant change in collisions and casualties following the introduction of 20mph limits in residential areas, in the short term (based on the post implementation data available to date).

Although the absolute number of collisions, casualties, pedestrian casualties, and child casualties (per km, per year) has reduced in the residential areas, there has also been a reduction in the corresponding 30mph comparator areas. There is currently considerable variation in the data across the different case studies and time periods, and statistical analysis indicates that the real changes in the case study areas could be positive or negative.

In all cases, the p-values are large indicating a high level of probability (generally more than 50%) that the relative reductions identified in the case study areas are due to chance, and that there is no meaningful difference between the reduction in the case study and comparator areas. While a number of case studies show a greater reduction in collisions / casualties than in the corresponding comparator areas, these results are based on very small case study sample sizes. The weightings attached to these findings in the statistical model are therefore small, and little confidence can be attached to their significance.

The availability of further 'after' data, showing a similar trend to the data currently available, would reduce the range within which the real change is estimated to lie (represented by the 95th lower and upper confidence limits). However, the estimated change for collision and casualties is only -0.5% and -0.8% respectively, and the amount of additional data required to demonstrate that this scale of impact is statistically significant is very substantial (688,943 records for total collisions and 289,315 records for total casualties!).

This does not mean that repeating the analysis in a couple of years' time, when more case study data is available, will not show a significant change. Collision and casualty rates are known to fluctuate from year to year. Some of the analysis is based on small subsets of the data (particularly for collisions involving pedestrians, cyclists, children and older persons), and the post implementation data currently available may not be indicative of the longer term trend.

The after data for the case study areas shows an increase in collisions in quarters 4-6 (12-18 months after implementation), which is one reason for the non-significant findings. It would be interesting to see what happens after this, when further data is available.

10.3. How have collision and casualty rates changed in city centre case study areas?

Theory of Change Hypothesis: Reduction in collision and casualty rate, and a reduction in speed related incidents in city centre case studies:

✓ *Relative to the comparator areas, the number of collisions and casualties recorded in Brighton Phase 1 is estimated to have fallen by 18% and 20%. Although there is some variability in the data, statistical analysis indicates that there has been a real reduction in collisions and casualties, in the short term. The changes appear to be partly driven by the introduction of 20mph limits on higher flow roads (A and B roads). There has been a significant reduction in collisions across all road types, but the change has been most pronounced on major strategic roads. However, collisions are known to fluctuate over time and further data is required to determine the longer term impacts of the change in the speed limit.*

✓ *There has also been a significant reduction in pedestrian casualties and those over 75 years within the Brighton Phase 1 area, relative to comparator areas.*

?(Unclear) *It has not been possible to draw any conclusions regarding the relative change in fatal injuries, cycle casualties, and child casualties. Further data is needed to enable a conclusion to be drawn about the scale and direction of change for these categories.*

?(Unclear) *No evidence available on casualty severity, or near misses.*

Winchester City Centre and Brighton Phase 1 case studies are both categorised as 'City centre and adjacent residential areas'.

As described above, both case study areas contain a higher proportion of major strategic roads and important local roads than the residential case studies, and a lower proportion of minor local roads. As a result, they have much higher collision rates per kilometre than the residential case study areas (2.45 per km/year in Brighton Phase 1, and 1.11 per km/year in Winchester City Centre, in the before period).

10.3.1. Overview (city centre case studies)

Collisions and casualties per year – A summary of the average number of collisions and casualties per year in the two city centre case studies is presented in Table 31.

The following observations can be drawn from the table:

- Brighton (Phase 1) is the biggest case study area, and the number of collisions and casualties is much greater than elsewhere. There was a substantial reduction in the average number of collisions / casualties per year between the before and after periods (-19% for collisions, -21% for casualties). In contrast there was little change in the comparator area. However, there is considerable month-to-month variability within both datasets, and statistical modelling (presented below, Table 33) is required to draw a firmer conclusion.
- The number of collisions / casualties per year in the Winchester City Centre case study area is much smaller, and more likely to be influenced by the random nature of collisions. Both the case study and comparator area show little change in the average number of collisions / casualties per year.

Table 31. Average number of collisions and casualties per year in city centre case studies and corresponding comparator areas

	Case study areas			Corresponding comparator areas		
	Average number / yr - before	Average number / yr - after	% Change	Average number / yr - before	Average number / yr - after	% Change
Number of collisions						
Brighton (Phase 1) (TC-AW1)	266	217	-19%	7,902	7,867	0%
Winchester City Centre (TC-AW2)	15	16	+1%	7,647	7,816	+2%
All city centre areas	281	233	-17%	-	-	-
Number of casualties						
Brighton (Phase 1) (TC-AW1)	317	250	-21%	9,815	9,650	-2%
Winchester City Centre (TC-AW2)	18	17	-3%	9,510	9,565	+1%
All city centre areas	335	267	-20%	-	-	-

The comparator areas are described in Table 11 (Section 3.4.8). Although Brighton (Phase 1) and Winchester City Centre are based on the same comparator area, the timespans are different for each case study and hence the before and after data for the comparator areas differs.

As some comparator areas are used more than once it is not appropriate to sum the rates and compare with the aggregated results for the case study areas.

Statistical analysis – Table 32 shows the results for the statistical analysis for the two city centre case study areas. The form of the input data is described in Table 9 (Section 3.4.8). The data for the case study and comparator areas has been aggregated on a quarterly basis (i.e. a 3 month period).

Brighton Phase 1 is the only case study area where we have been able to estimate a statistically significant change in collisions, relative to the 30mph comparator area. Relative to the comparator area, the number of collisions is estimated to have fallen by 18.3%. The confidence interval is wide (-25.3% to -10.7%), but does indicate a significant reduction.

Winchester City Centre is a much smaller area. Relative to the comparator area, the number of collisions is estimated to have fallen by 1.2%, however, the confidence interval is very wide and the real change could be either positive or negative.

It should be remembered that the larger the sample size, the greater the likelihood of being able to detect a significant change in collisions and casualties. The total number of before and after collisions in Brighton Phase 1 is 2143; compared with 112 in Winchester City Centre; and 1741 across the aggregated set of residential case studies. The likelihood of being able to detect a real change in Brighton Phase 1 is therefore much greater than elsewhere.

Table 32. Change in collisions in city centre case studies, relative to comparator areas

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Brighton Phase 1 (n = 2143)	-18.3%	-25.3%	-10.7%	<0.001	✓
Winchester City Centre (n = 112)	-1.2%	-33.7%	+47.4%	0.954	✗

n = combined before and after sample for case study areas

The change in Winchester City Centre (relative to the comparator area) is not significant, and should not be reported.

10.3.2. Detailed analysis of the change (in Brighton Phase 1)

Change in collisions and casualties - Table 33 shows that following the introduction of the 20mph limit, central Brighton has experienced a significant reduction in overall collisions and casualties, pedestrian casualties, and casualties aged 75 or over, relative to the comparator area.

Table 33. Change in collisions and casualties in Brighton Phase 1, relative to comparator areas

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Change in collisions (n = 2143)	-18.3%	-25.3%	-10.7%	<0.001	✓
Change in casualties (n = 2516)	-19.7%	-26.0%	-12.8%	<0.001	✓
Change in pedestrian casualties (n = 619)	-29.4%	-40.3%	-16.4%	<0.001	✓
Change in cycle casualties ⁸⁹ (n = 601)	+5.0%	-10.7%	+23.5%	0.556	✗
Change in under 16yrs casualties (n = 93)	-17.0%	-40.0%	+14.9%	0.261	✗
Change in over 75yrs casualties (n = 133)	-50.9%	-66.7%	-27.7%	<0.001	✓

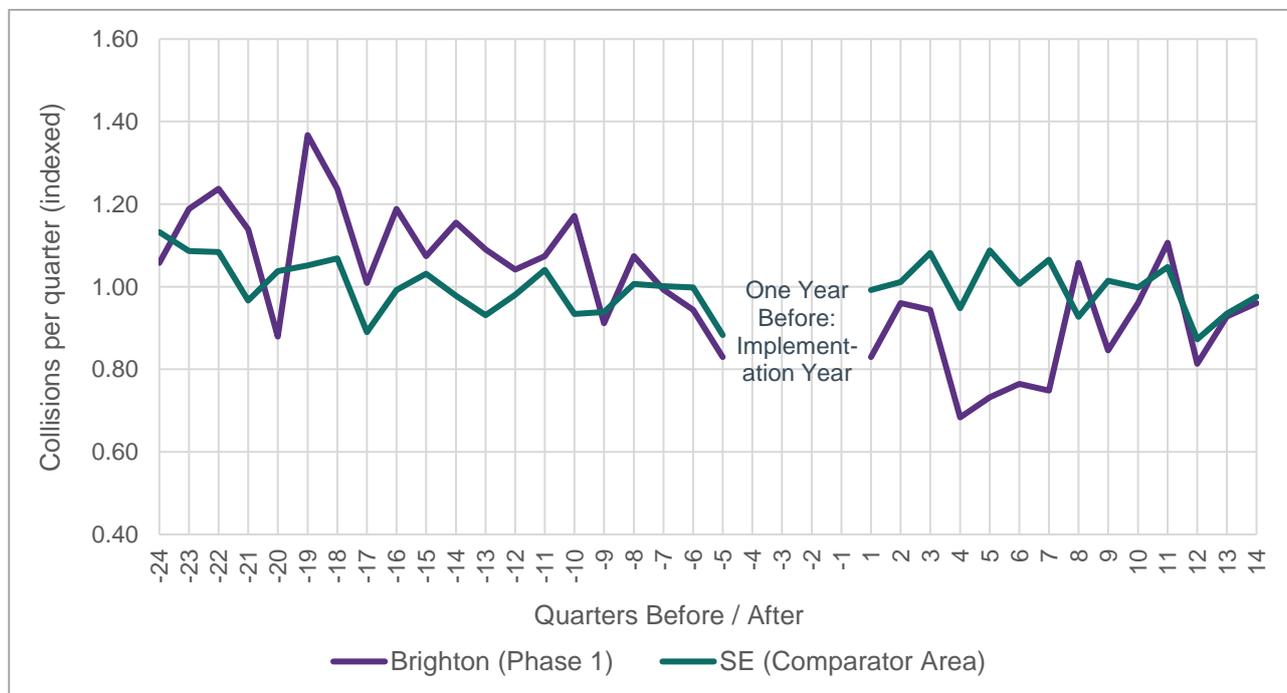
n = combined before and after sample for case study areas

The change in cycle casualties and child casualties (relative to the comparator areas) are all non-significant, and should not be reported as changes.

The 'estimated change' has been calculated by the statistical model, based on quarterly data for the case study and comparator areas. It therefore differs from the change that might be inferred from Table 31, which is based on the average number of collisions / casualties per year.

Relevance of comparator trend - To understand what is driving these findings, Figure 38 shows the collision trend in Brighton over time against the trend in the comparator area (other Urban City and Town locations in the South East).

Figure 38. Quarterly indexed collisions for Brighton Phase 1 case study and comparator area



The data is indexed to the average value of each dataset to allow the trend to be observed without the comparison being obscured by the fact that the volume of collisions in comparator areas is much higher than in the case study areas.

⁸⁹ Cycle count data provide by the Council suggests there has been a 28% in cycling across the wider city (not just the Phase 1 area) since 2008.

The graph shows that the statistical results are a product of a general downward trend in collisions in Brighton (Phase 1) and a more stable trend in the comparator area.

It is interesting to note that the case study area collisions already appeared to be on a downwards trend even prior to the introduction of the 20mph speed limits⁹⁰, suggesting other factors have influenced the trend. The number of collisions dropped further during the second year following implementation (quarters 4 to 7), but then increased. Further data would be required to determine the long term trend.

10.3.3. Role of influencing factors (in Brighton Phase 1)

The above section shows that there has been a significant reduction in overall collisions, overall casualties, pedestrian casualties, and casualties aged 75 or over. To understand what is driving these changes, this section examines the role of influencing factors, including:

- road type;
- potential factors identified in the theory of change logic maps (or intermediate outcomes), including change in speed, smoother and more consistent driving, and driver awareness of risks and hazards; and
- external factors such as change in traffic flow, wider policy, the presence of major road works, and reporting processes.

Change by road type – Analysis by road type (Table 34) shows that there has been a significant reduction in collisions across all road types, but the change has been most pronounced on major strategic roads (-23.7%). As described above, these roads have higher traffic flows and much higher per km collision rates than less strategic routes, and the change on these roads contributes substantially to the overall change reported for Brighton Phase 1.

Table 34. Change in collisions by road type in Brighton Phase 1, relative to comparator area

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Major strategic roads (FRC 1-3)	-23.7%	-35.1%	-10.4%	0.001	✓
Important local roads (FRC 4-5)	-16.1%	-28.3%	-1.8%	0.029	✓
Minor local roads (FRC 6-7)	-15.1%	-26.7%	-1.7%	0.029	✓
All roads	-18.3%	-25.3%	-10.7%	<0.001	✓

Although not as marked, the reduction in collisions on lower order roads in Brighton Phase 1 are also significant (-16.1% on important local roads, and -15% on minor local roads). This contrasts to the experience in other case study areas, comprised predominantly of minor local roads, where there has been no significant change.

Brighton Phase 1 includes the area surrounding the city centre. It is likely that many of the roads categorised as ‘important local roads’ and ‘minor local roads’ have higher flows and hence collision rates than similar grade roads in more residential areas. Although many of the minor roads are residential in nature, their proximity to the city centre makes them key distributor roads (which often include shops, services, and offices) and means that they are likely to be used by through traffic as well as local residents. The potential for conflict is likely to be higher than on minor roads in more residential areas, and the potential for a reduction in collisions therefore more likely. This theory is supported by data on collisions per km by case study area, which shows that on all road types, collision rates are higher in Brighton Phase 1 than the other case study areas.

Actual change in speed – The following evidence shows a small reduction in speed in the Brighton Phase 1 area:

- Analysis of area-wide journey time speeds (based on GPS journey speed data) shows that:
 - In the core city centre area, the median speed fell by 0.8mph, the 85th percentile speed fell by 1.5mph, and the 15th-85th percentile speed fell by 1.6mph.

⁹⁰ The potential reasons for this were discussed with Brighton City Council, but no clear factors were identified.

- In the adjacent residential areas (within Phase 1), the median fell by -1.0mph, the 85th percentile fell by 1.5mph, and the 15th-85th percentile speed fell by 1.9mph.
- The biggest reduction in speed occurred on important local roads (Table 27) - but these roads have not experienced the biggest reduction in collisions.
- Results from spot speeds undertaken at 47 sites with a 20mph speed limit (1 on a major strategic road, 11 on important local roads, and 35 on minor local roads) show an average reduction across the area of 1.6mph (flow-weighted) after 13months, and -1.3mph (flow-weighted) after 26 months, varying from -9.0mph (decrease) to +7.6mph (increase) on individual roads.

Table 35. Change in speed by road type, based on GPS journey speed data (Brighton Phase 1: core city centre + adjacent residential area)

New 20mph limit (signed only)	Major strategic roads			Important local roads			Minor local roads		
	Before, After, Diff			Before, After, Diff			Before, After, Diff		
Speed Limit	30mph	20mph		30mph	20mph		30mph	20mph	
Distance of Roads	6.8kms			14.9kms			52.6kms		
Sample of vehicle kilometres observed	365,776	371,272		210,695	230,866		109,715	130,030	
Compliance	94%	55%	-39%	90%	44%	-47%	97%	72%	-25%
Median Speed (mph)	19.6	18.8	-0.7	22.4	21.0	-1.4	16.1	15.8	-0.3
85 th Percentile (mph)	27.0	25.7	-1.3	28.5	26.8	-1.8	24.1	23.1	-1.0
15 th - 85 th percentile	19.3	17.5	-1.8	15.5	14.5	-1.0	16.2	15.0	-1.2
% Driving <20mph	51%	55%	4%	36%	44%	7%	69%	72%	3%

Whether or not the small change in speed is due to the introduction of 20mph limits, this is expected to have had a positive influence on reducing the number and severity of collisions in the case study areas, all other factors being equal.

Finch et al. (1994) and Taylor et al. (2000) show that a change in mean spot speed of 1mph can be expected to reduce injury collisions by 5-6%. In absolute terms, the number of collisions per km per year fell by 17.4% between the before and after period; more than expected given the 1.3mph reduction in average speed.

Change in driver awareness – A net proportion of non-resident drivers agreed that 20mph limits increase driver awareness of potential risks and hazards (58% agreed, 13% disagreed); but residents were more likely to disagree than agree (30% agreed, 40% disagreed)⁹¹. The results suggest that there are mixed views on whether 20mph limits are perceived to have had a positive influence on driving standards; and there is insufficient evidence to determine whether driver awareness has had a positive influence on reducing collisions, all other factors being equal.

Change in traffic flow – The traffic data available for Brighton Phase 1 for the before and after periods⁹² suggests that a reduction in traffic flow on A roads (-4%) has contributed to the large change in collisions on 'major strategic roads', but is unlikely to be the key driver of change given the scale of reduction in collisions on major strategic roads. On important local roads, the significant reduction in collisions appears to have occurred against a backdrop of little change in traffic (-1%). On minor local roads, the significant reduction in collisions appears to have occurred despite a reported 8% increase in traffic on these roads.

Wider policy – Brighton City Council was asked what other policy initiatives have been introduced in recent years, which might have resulted in a reduction in collisions and casualties, but were unable to identify any other substantial initiatives. In terms of road safety, there has been a small reduction in the road safety

⁹¹ Non-resident drivers sample = 131. Residents sample = 201.

⁹² Evidence from the GB Road Traffic Count data collected by DfT shows a 4.1% reduction in annual traffic flow on major A roads in Brighton Phase 1, comparing average annual flow six years before implementation and four years post implementation. Data was also collected by the local authority over a 7 day period in Jun 2013 (just prior to implementation) and Jun 2015 (just over two years post implementation). Data was collected at 15 sites on important local roads (FRC4-5) and 37 sites on minor local roads (FRC6-7).

budget in recent years, and there is no longer a dedicated road safety team. The Council works well with the Sussex Road Safety Partnership, to reduce road casualties across Sussex.

It was acknowledged that the Council hadn't invested as much in awareness and engagement activities to support the 20mph limit introduction as other locations, citing the marketing approach in Liverpool as an example.

Major works – There were a number of significant road schemes constructed during the period used for the after analysis (May 2013 – Dec 2016). This included a major scheme at Seven Dials (major roundabout) where at least one of the arms of the roundabout was closed between March 2013 and December 2013; road works on Edward Street in 2014 (however, monitoring undertaken by the Council suggested that the traffic impact was not very significant), and major works at Brighton Station in first half of 2015. These may have disrupted the flow of traffic, resulting in lower speeds and hence a lower collision rate. However, various capital schemes were also implemented during the period used for the before analysis.

Reporting processes – The Council were not aware of any changes in the way collisions and casualties have been reported by the police in recent years.

Summary – The evidence currently available suggests that the introduction of 20mph limits on higher flow roads has contributed to the significant reduction in the number of collisions and casualties recorded within the Brighton Phase 1 area, based on 3 years of post implementation data. However, collisions are known to fluctuate over time and further data is required to determine the longer term impacts of the change in the speed limit.

There has been a small reduction in speeds which is expected to have had a positive influence on safety outcomes, but there is mixed evidence on whether drivers in Brighton are now more aware of hazards and risks, and whether this has influenced the number of collisions in the after period. A reduction in traffic flow on A roads has contributed to the larger reduction in collisions on 'major strategic roads', but is unlikely to be the key driver of change given the scale of reduction in collisions on major strategic roads. Changes in traffic flow do not appear to have contributed to the significant reduction in collisions on 'important local roads' and 'minor local roads'.

It is interesting to note that the number of collisions dropped during the second year following implementation (quarters 4 to 7), but then increased in Year 3. It would be interesting to see what happens in Years 4 and 5, and how this affects the long term trend.

10.4. Has there been a change in collision contributory factors?

Theory of Change Hypothesis: Potential negative impacts on safety on 20mph roads, as a result of:

- **complacency amongst pedestrian and cyclists; and**
- **driver frustration.**

?(Unclear) Complacency amongst pedestrian and cyclists - Concerns that reducing the speed limit to 20mph may make pedestrians more complacent are not validated by the collision-based Contributory Factors data, with pedestrian-related factors ('pedestrian failed to look properly', and 'pedestrian careless / reckless / in a hurry') showing no significant change or a small decrease in frequency. However, limitations with the dataset used means that these findings should be treated as indicative only, and further evidence is required to draw a firmer conclusion.

?(Unclear) Driver frustration - Around a quarter of resident and non-resident drivers said that they felt frustrated at times when driving in the 20mph limit; and around half of non-resident drivers agreed that the 20mph limit is frustrating for drivers. There is some evidence from the Contributory Factors database to support concerns that lowering the limit may increase driver frustration and distraction, with a significant increase in the proportion of collisions categorised as 'careless / reckless / in a hurry'. However, limitations with the dataset used means that these findings should be treated as indicative only, and further evidence is required to draw a firmer conclusion.

Table 36 compares the occurrence of the most commonly identified contributory factors in the before and after periods, across all case study areas. The factors identified earlier as being most likely to be affected by speed changes are highlighted. It should be remembered that not all collisions are included in the contributory factors database, and the allocation of factors is largely based on professional judgement (see Section 3.4.8). The findings should be treated as indicative only due to the limitations of the dataset, and further evidence is required to draw firmer conclusions.

Table 36. Contributory factors associated with before and after collisions in case study areas (findings to be treated as indicative only, due to dataset limitations)

Top 10 contributory factors in the before period (vehicles unless stated)	Before		After		Percentage point difference	Stat. Sig.
	Collisions where factor identified	% of all collisions with CFs	Collisions where factor identified	% of all collisions with CFs		
Failed to look properly	528	37%	369	42%	+5%	✓
Ped - Failed to look properly	248	17%	138	16%	-1%	✗
Failed to judge other person's speed	219	15%	166	19%	+4%	✓
Poor turn or manoeuvre	171	12%	103	12%	0%	✗
Careless/Reckless/In a hurry	162	11%	154	18%	+7%	✓
Ped - Careless/Reckless/In a hurry	98	7%	48	5%	-2%	✓
Slippery road (due to weather)	87	6%	18	2%	-4%	✓
Loss of control	80	6%	47	5%	-1%	✗
Disobeyed Stop sign/markings	77	5%	17	2%	-3%	✓
Stationary or parked vehicles	75	5%	30	3%	-2%	✓

**Factors most likely to be affected by a change in speed limit are highlighted in pink.*

Sample size: 1447 before; 898 after.

Both highlighted and non-highlighted factors show percentage point changes in frequency. This demonstrates the difficulty in analysing what impact, if any, has occurred due to the introduction of 20mph.

The following driver-related factors, expected to be less prevalent in 20mph limits where vehicle speeds should be lower, have actually increased after scheme implementation:

- Failed to look properly (+5 percentage points, a significant increase from 37% to 42%); and
- Failed to judge other person's speed (+4 percentage points, a significant increase from 15% to 19%).

Concerns that reducing the speed limit to 20mph may make pedestrians more complacent are not validated, with pedestrian-related factors showing no significant change or a small decrease in frequency:

- Ped - Failed to look properly (no significant change); and
- Ped - Careless/Reckless/In a hurry (-2 percentage points, a small significant reduction from 7% to 5%).

However, the data does provide some tentative evidence to support concerns that lowering the limit may increase driver frustration and distraction, with a significant increase in the proportion of collisions categorised as 'careless / reckless / in a hurry':

- Careless/Reckless/In a hurry (+7 percentage points, a significant increase from 11% to 18%).

Driver frustration and distraction may also explain the increase in 'failed to look properly' and 'failed to judge other person's speed' incidents. However, further evidence is required to confirm these relationships.

None of the factors showed a significant change when analysed separately for residential and city centre schemes.

10.5. Is there any evidence of negative safety impacts on neighbouring roads?

Theory of Change Hypothesis: Potential negative impacts on safety on surrounding 30mph roads.

** GPS journey speed analysis of area-wide journey speeds shows no evidence to suggest that drivers are going faster than previously when leaving the new 20mph limit areas. Safety analysis shows no evidence of collision migration (an increase in collisions on neighbouring roads) in most of the case study areas, with unclear evidence in two case study areas.*

Collision migration (or savings) may occur as a result of positive or negative changes in speed compliance or driver attention when leaving the 20mph road. Analysis of area-wide journey speeds (see Section 7.5) shows no evidence to suggest that drivers are going faster than previously when leaving the new 20mph limit areas. However, driver attention may be higher than previously (due to increased awareness of hazards when driving through the 20mph limit), leading to fewer collisions on surrounding roads; or lower than previously (due to increased levels of frustration), leading to more collisions on surrounding roads.

Further safety analysis has therefore been undertaken to examine any impact on 30mph roads in and around the 20mph limit schemes; using the same methodology as that for the 20mph analysis. Hence, 30mph roads in the vicinity of the case study areas have been entered into a statistical model along with comparator area roads (30mph roads in similar non-case study areas) to control for background changes in collision rates.

Collisions per year – A summary of the average number of collisions per year on 30mph roads in the case study and comparator areas is first presented.

Table 37. Average number of collisions per year on 30mph roads surrounding the case study areas, compared with corresponding comparator areas

	Surrounding 30mph roads			Corresponding comparator areas		
	Average number / yr - before	Average number / yr - after	% Change	Average number / yr - before	Average number / yr - after	% Change
Walsall (Rushall) (R-SM1)	0	1	82%	4689	4376	-7%
Winchester (Stanmore) (R-SM2)	10	12	27%	7657	7743	1%
Liverpool (7) (R-AW1a)	170	138	-19%	6027	3983	-34%
Liverpool (2) (R-AW1b)	89	87	-3%	5641	3625	-36%
Middlesbrough (R-AW2)	2	1	-33%	1179	1037	-12%
Nottingham (Bestwood) (R-AW4)	33	42	25%	1259	1280	2%
Brighton (Phase 2) (R-AW5)	89	94	6%	7837	7903	1%
Chichester (R-AW7)	29	27	-8%	7819	7869	1%
Brighton (Phase 1) (TC-AW1)	5	3	-38%	7902	7867	0%
Winchester City Centre (TC-AW2)	2	3	73%	7647	7816	2%
All areas	429	408	-5%	-	-	-

As some comparator areas are used more than once it is not appropriate to sum the rates and compare with the aggregated results for the case study areas.

Similar observations can be drawn to those in previous sections:

- There is considerable variability between the case study areas, in terms of the percentage change between the before and after periods, which is not surprising given the small sample sizes and the random nature of collisions.
- The comparator areas are much larger than the case study areas, and consequently there is generally less variability between the different comparator areas.
- The comparator areas for Liverpool Area 7 and Area 2 again stand out as showing a substantial reduction in collisions between the before and after periods. (The comparator data is the same as that presented in Table 28, Section 10.2.1).
- In some case study areas (e.g. Brighton Phase 1) there are very few 30mph roads remaining, resulting in a very small number of collisions on these types of roads.

Statistical analysis – Table 38 shows the results of the statistical analysis comparing the change in collision on 30mph roads in case study and comparator areas. It shows a significant increase in collisions observed on neighbouring 30mph roads in the case study areas, of 17.5%, relative to the 30mph comparator areas and based on the data available to date.

Table 38. Change in collisions on surrounding 30mph roads, relative to comparator areas

	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
All case studies	+17.5%	+9.0%	+26.7%	<0.001	✓

However, when this result is separated into the individual case study impacts (Table 39), it is apparent that the only case study areas that show significant results are the two Liverpool case study areas.

Table 39. Change in collisions on surrounding 30mph roads, relative to comparator areas

Case Study Area	Relative weight or contribution to overall result	Estimated Change	95 th Lower Confidence Limit	95 th Higher Confidence Limit	p-value	Stat. Sig.
Walsall	0%	+95%	-73%	+1283%	0.505	✗
Winchester Stanmore	3%	+26%	-21%	+100%	0.337	✗
Liverpool Area 7	35%	+23%	+8%	+39%	0.001	✓
Liverpool Area 2	16%	+51%	+26%	+82%	<0.000	✓
Middlesbrough	1%	-24%	-72%	+109%	0.592	✗
Nottingham	9%	+23%	-4%	+57%	0.104	✗
Brighton Phase 2	27%	+5%	-9%	+21%	0.497	✗
Chichester	8%	-8%	-30%	+19%	0.511	✗
Brighton Phase 1	1%	-38%	-70%	+31%	0.213	✗
Winchester City Centre	1%	+69%	-37%	+354%	0.297	✗

For all case study areas, except Liverpool Area 7 and Area 2, and the change in collisions relative to the comparator areas is not significant, and the figures for individual areas should not be reported.

Both the Liverpool areas show a significant increase in collisions relative to the north-west comparator area. The number of collisions has actually decreased in both case study areas between the before and after periods (Table 37); just not as much as in the north-west comparator area, where a substantial decline has been recorded.

As discussed in Section 10.2.1, the reasons for the decline in the north-west is unclear, however, discussion with Transport for Greater Manchester identified two factors which may have contributed to the trend. Firstly,

the closure of public counters and phone lines at some police stations, making it more difficult for public to report collisions which have not been attended by the police. Secondly, increasing levels of congestion, partly linked to roadworks associated with development and construction sites, which may have reduced speeds and collisions on 30mph roads.

None of the other case study areas show a significant change in collisions on nearby 30mph roads, relative to their comparator areas.

10.6. Summary and key messages

A summary of the key findings is presented below.

10.6.1. How have collision and casualty rates changed in case study areas?

Predominantly residential case study areas – The comparator analysis indicates that there is insufficient evidence to conclude that there has been a significant change in collisions and casualties following the introduction of 20mph limits in residential areas, in the short term (based on the post implementation data available to date).

Although the absolute number of collisions and casualties (per km, per year) has reduced in the residential areas, there has also been a reduction in the corresponding 30mph comparator areas. The analysis indicates a high level of probability (generally more than 50%) that the relative reductions identified in the case study areas are due to chance, and that there is no meaningful difference between the reduction in the case study and comparator areas, at this stage.

Collision and casualty rates are known to fluctuate from year to year. Some of the analysis is based on small subsets of the data (particularly for collisions involving pedestrians, cyclists, children and older persons), and the post implementation data currently available may not be indicative of the longer term trend. Repeating the analysis in a couple of years' time, when more case study data is available may (or may not) show a significant change.

The after data for the case study areas shows an increase in collisions in quarters 4-6 (12-18 months after implementation), which is one reason for the non-significant findings. It would be interesting to see what happens after this, when further data is available.

City centre case study areas – The comparator analysis shows that Brighton Phase 1 is the only case study area where the change in collisions and casualties, relative to the 30mph comparator area is significant. The results show a significant reduction in overall collisions (-18%), overall casualties (-19%), pedestrian casualties (-29%), and casualties aged 75 or over (-51%). However, there is no evidence to indicate a significant change in casualties involving cyclists and under 16s, at this time. There has been a significant reduction in collisions across all road types, but the change has been most pronounced on major strategic roads.

The changes in Brighton Phase 1 appear to be a reflection of the city characteristics; and the blanket implementation of 20mph limits across all roads within the scheme area, including higher flow A and B roads which have typically been excluded from the residential case study schemes.

There has been a small reduction in speeds across all road categories which is expected to have contributed to the reduction in collisions and casualties; but there is mixed evidence on whether drivers in Brighton are now more aware of hazards and risks, and whether this has influenced the number of collisions in the after period. A reduction in traffic flow on A roads has contributed to the larger reduction in collisions on 'major strategic roads', but is unlikely to be the key driver of change given the scale of reduction in collisions on these roads. Changes in traffic flow do not appear to have contributed to the significant reduction in collisions on 'important local roads' and 'minor local roads'.

The evidence currently available suggests that the introduction of 20mph limits on higher flow roads has contributed to the significant reduction in the number of collisions and casualties recorded within the Brighton Phase 1 area, based on 3 years of post implementation data. However, collisions are known to fluctuate over time and further data is required to determine the longer term impacts of the change in the speed limit.

Overall – This study has examined the short-term changes in collisions and casualties across the case study areas.

The evidence available to date shows no significant change in collisions and casualties, in the short term, in the majority of the case studies (including the aggregated set of residential case studies). While a number of individual case studies show a greater reduction in collisions / casualties than in the corresponding comparator areas, these results are based on very small sample sizes and it is not possible to attach any confidence to their significance.

There is some evidence to suggest a positive 20mph impact in one location (Brighton Phase 1), where a blanket 20mph limit was introduced covering both major and minor roads, and where there is sufficient data to indicate a statistically significant change in collisions and casualties relative to the 30mph comparator area. It should be stressed that this represents just one case study, and the extent to which the findings are transferable to other locations is unclear.

In both cases, further data is required to determine the long term impact of 20mph limits. Collision and casualty rates are known to fluctuate from year to year, and the post implementation data currently available may not be indicative of the longer term trend.

Wider evidence on signed only schemes is limited, and tends to be based on short periods of after data. In general, the studies have not compared against background trends or have compared changes against those observed on more major roads.

Wider evidence on safety benefits in 20mph limits

Much of the evidence on the effectiveness of 20mph limits relates to zones, where physical traffic calming measures have been implemented alongside the lowering of the limit. Evidence on signed only schemes is more limited, and tends to be based on short periods of after data, with variable accounting for background trends. The following studies reported reductions in instantaneous spot speeds of 0.5-2.0mph, consistent with that observed in this study. In general, the studies have not adequately accounted for background trends.

- In Graz, Austria (implemented 1992), comparison of one year before and one year after data for the city-wide 30km/hr limit shows a 12% reduction in slight injury collisions and a 24% reduction in serious injury collisions, found to be statistically significant (Wernsperger and Sammer, 1995). However, Fischer (2010) found that as time progressed the number of accidents started to increase and fluctuate. The cause of this fluctuation was not concluded.
- Between 1998 and 2000, a national trial programme of advisory 20mph speed limits was undertaken, involving 75 residential areas across Scotland. Burns et al. (2001) analysed the impact of the advisory limits after they were implemented. Accident data was obtained for 59 sites, and showed a considerable drop (42%) in the number of recorded accidents per year after the introduction of the trial 20 mph scheme (from 31.3 to 18.2), and also a significant reduction in severity, with serious or fatal accidents reduced from 20% to 14% of the total. The 'before' period had an average of 35 months while for the 'after' the average was 15 months. No specific account was made for background trends.
- An early evaluation of the city-wide scheme implemented in Portsmouth in 2008-09 (Atkins, 2010) reported an average speed reduction of 1.3mph (from 19.8mph to 18.5mph). Comparing the 3 years before the scheme was implemented and the 2 years afterwards, the number of recorded road casualties fell by 22% from 183 per year to 142 per year. During that period casualty numbers fell nationally - by about 14% in comparable urban areas. Detailed examination of causation factors did not show any noteworthy change in accidents related to inappropriate speeds or aggressive driving.

Further analysis was subsequently undertaken by Portsmouth City Council in 2014, looking at all injury collisions which occurred in Portsmouth for the three years before the 20mph scheme was implemented (2005-2007) and for the three years after (2009-2011). The analysis shows that in the three-year period prior to the scheme there were a total of 505 collisions. The corresponding figure for the three-year period following implementation is 410 collisions, which equates to a reduction of 19%. Across the rest of Portsmouth's roads during the same period, the number of collisions fell by 10% - from 1,618 to 1,451. However, the risk of collision is known to be higher on non-20mph roads, and only tentative conclusions can be drawn regarding the effect of 20mph limits on casualty numbers.

- A recent evaluation of the area-wide scheme in Bristol (Pilkington, et. al, 2018) compared annual rates of fatal, serious, and slight injuries before and after implementation. The before period comprised between 34 months and 7 years, depending on the area of the city and actual implementation date; while the after analysis was based on between 15 months and 6 years of data. The analysis shows annual rates of fatal, serious, and slight injuries following the introduction of the 20mph speed limits are lower than the respective pre-20mph limit rates. However, no account has been made for background trend over time, and no statistical analysis was undertaken to interpret the results. It cannot therefore be determined whether the observed casualty reductions are related to the speed changes or are greater than the overall trend. Furthermore, the analysis separates out fatal, serious and slight injuries, despite the overall numbers involved being low.

10.6.2. Has there been a change in collision contributory factors?

The most common contributory factors include a mix of those more likely and less likely to be affected by changes in speed. Both types of factors show percentage point changes in frequency, demonstrating the difficulty in analysing what impact, if any, has occurred due to the introduction of 20mph.

Concerns that reducing the speed limit to 20mph may make pedestrians more complacent are not validated by the contributory factors data, with pedestrian-related factors ('pedestrian failed to look properly', and 'pedestrian careless / reckless / in a hurry') showing no significant change or a small decrease in frequency. However, further evidence is required to draw a firmer conclusion.

There is some tentative evidence from the contributory factors data to support concerns that lowering the limit may increase driver frustration and distraction, with a significant increase in the proportion of collisions categorised as 'careless / reckless / in a hurry'. However, limitations with the dataset used means that further evidence is required to draw a firmer conclusion.

10.6.3. Have the new 20mph limits resulted in any collision migration (or savings) to nearby roads?

Collision migration (or savings) may occur as a result of positive or negative changes in speed compliance or driver attention when leaving the 20mph road. Analysis of area-wide journey speeds (see Section 7.6) shows no evidence to suggest that drivers are going faster than previously when leaving the new 20mph limit areas. However, driver attention may be higher than previously (due to increased awareness of hazards when driving through the 20mph limit), leading to fewer collisions on surrounding roads; or lower than previously (due to increased levels of frustration), leading to more collisions on surrounding roads.

Further safety analysis has therefore been undertaken to examine any impact on 30mph roads surrounding the 20mph limit schemes; using the same methodology as that for the 20mph analysis. Hence, 30mph roads in the vicinity of the case study areas have been entered into a statistical model along with comparator area roads (30mph roads in similar non-case study areas) to control for background changes in collision rates.

This analysis shows no evidence of collision migration in most of the case study areas. However, in both the Liverpool case study areas the number of collisions decreased by a significantly smaller amount than the reduction observed in the north-west comparator area, where a substantial decline was recorded. The reasons for the decline in the comparator area is unclear, leading to uncertainty about whether there has been a slower decrease in collisions in the Liverpool case studies as a result of drivers speeding up and/or driving less safely when leaving the 20mph limit.

11. How have route choice and journey times changed?

11.1. Introduction

This chapter examines the impact of new 20mph limits (signed only) on route choice and journey times.

It tests the following assumptions (as set out in the theory of change logic maps in Figures 3-5):

- Some removal of through traffic where rat running is an issue, but widespread nature of scheme and the fact that the majority of traffic is expected to be travelling to/from home means that in most cases there will be few alternative routes available (resulting in limited displacement of traffic). Potential diversion of traffic from 20mph to 30mph roads where some residential roads have been excluded.
- Potential for slower journey times for private and public transport. However, changes generally expected to be small as speeds typically in low 20s pre-implementation, most schemes exclude strategic routes, and roads affected typically form start / end section of trip only.

11.2. How has route choice changed?

Theory of Change Hypothesis: Some removal of through traffic where rat running is an issue, but widespread nature of scheme and the fact that the majority of traffic is expected to be travelling to/from home means that in most cases there will be few alternative routes available (resulting in limited displacement of traffic). Potential diversion of traffic from 20mph to 30mph roads where some residential roads have been excluded.

✓ *Survey evidence supports above hypothesis. Only 8% of (non-resident) drivers said that they avoided driving in the area, and only 4% of residents felt that there are less vehicles using their road.*

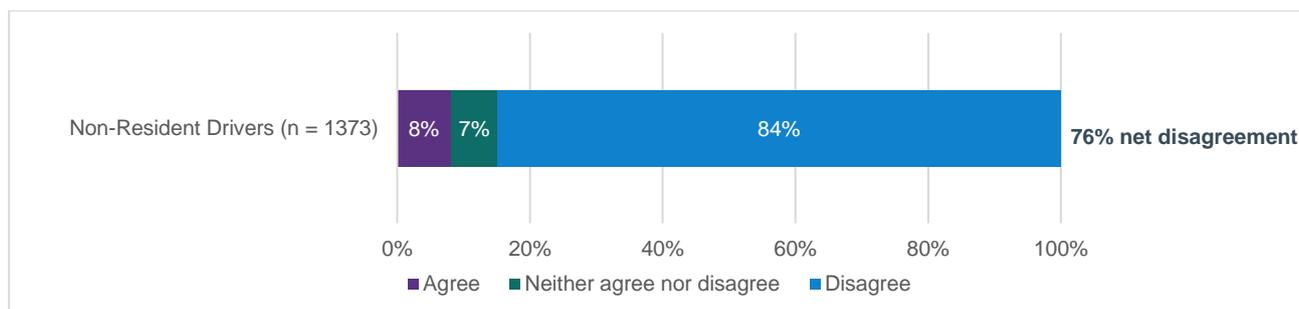
Earlier analysis shows that a substantial proportion of drivers were already travelling at less than 20mph, and the median area-wide speeds have fallen by around 1mph only. Despite the lower speed limit, the 20mph roads still appear to provide a more direct and convenient route, in most cases.

Overall – Despite some evidence of driver frustration, very few drivers go as far as avoiding the area altogether in most locations.

Only 8% of drivers said that they avoided “driving in the area, if possible, following the introduction of the 20mph limit”; while 84% disagreed with the statement. This proportion increases to 19% in Walsall, a small scale residential scheme, where through traffic is known to be an issue and there are likely to be more alternative routes available for certain drivers.

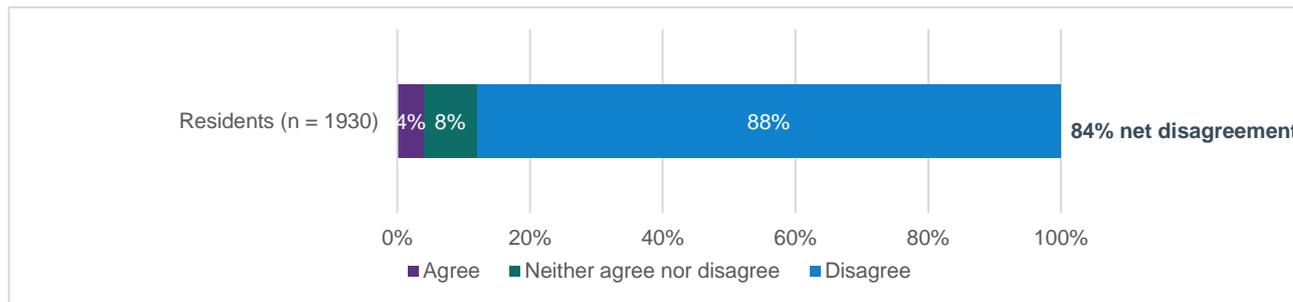
Only 4% of residents in 20mph areas agreed that ‘There are less vehicles using the street where I live’, with the vast majority (88%) disagreeing.

Figure 39. I avoid driving/riding on these streets/ in this area if possible since the introduction of 20mph limits (non-resident drivers only)



Non-resident drivers questionnaire. n = sample size.

Figure 40. There are less vehicles using the street where I live (residents only)



Residents questionnaire. n = sample size.

Feedback from the driver interviews suggests that despite the lower speed limit, the 20mph roads often still provide a quicker option, as they offer a more direct and convenient route, with less traffic – particularly where the limit covers an extensive, continuous area.

*“It’s the quickest route. Although it is 20mph it is the shortest route and there is no congestion.”
(Liverpool Area 2)*

Before speeds in Walsall were higher than elsewhere and close to 30mph. Drivers used to driving at these speeds are likely to view the 20mph limit as particularly slow, which may make other route option seem more attractive even if noticeably longer.

“For me personally, I avoid the road because it’s so inconvenient and difficult to comply with and other people do as well.” (Walsall)

Questionnaires conducted on each of the two parallel roads which have retained a 30mph limit, show that in both locations around two-fifths of residents (41%) agreed that ‘there are more vehicles using the street where I live’. While this suggests that there may have been some displacement of traffic, the corresponding results for the nearby 20mph areas show very little evidence of displacement, with only 4% and 1% of residents agreeing that the number of vehicles has reduced.

The results of the logistic regression analysis show that those who agree ‘20mph is frustrating for drivers’ are 3.8 times more likely than those who do not, to avoid driving / riding through a 20mph street.

Wider evidence on re-routing

Similar results were found in Graz, Austria. In the early 1990s, the travel behaviour of over 10,000 households, on a normal working day, was considered and 230 detailed interviews were undertaken from 100 households. These interviews asked residents to map out the routes and modes used before and after the 30kph speed limit (Wernsperger and Sammer, 1995). Route choice changed very little, with only 1.5% of the trips using a different route after the 30kph speed limit was introduced (Fischer, 2010). Although traffic count data was not reported, it appears that concern that the 30kph speed limits would lead to increased traffic on priority streets and result in congestion, did not occur (Wernsperger and Sammer, 1995).

11.3. How have journey times changed?

Theory of Change Hypothesis: Potential for slower journey times for private and public transport. However, changes generally expected to be small as speeds typically in low 20s pre-implementation, most schemes exclude strategic routes, and roads affected typically form start / end section of trip only.

✓ Journey times are estimated to have increased by 3% in residential areas and 5% in city centre areas – adding less than half a minute to a 2 mile trip and less than a minute to a 5 mile trip (minimal impact).

Impact on car drivers – Evidence from the analysis of journey-based speed data shows that median speeds have reduced by -0.7mph in residential areas and 0.9mph in city centre areas. This equates to a reduction in journey speeds of 3% (based on a before median speed of 21.1mph) and 5% (based on a before median speed of 18.0mph), in the respective areas.

The change in median speeds has been used to estimate the impact on journey times. In 2016, national data shows that 56% of car driver trips were under five miles, and 23% were under 2 miles⁹³. Table 40 shows that over these distances, journey time impacts will be minimal: adding less than half a minute to a 2 mile trip and less than one minute to a 5 mile trip.

Table 40. Calculated change in average journey time for a 2 and 5 mile trip

	Journey times for a 2 mile trip			Journey times for a 5 mile trip		
	Before	After	Diff	Before	After	Diff
Residential case study areas	5.7 mins	5.9 mins	0.2 mins (3%)	14.2 mins	14.6 mins	0.4 mins (3%)
City centre case study areas	6.7 mins	7.0 mins	0.4 mins (5%)	16.7 mins	17.5 mins	0.9 mins (5%)

In most of the case study areas, major roads have been excluded from the limit. The distance travelled on 20mph roads is expected to be substantially less than the 2 or 5 miles assumed above, and hence, the journey time impact will be a few seconds only. Most drivers are unlikely to notice this level of change. Furthermore, a substantial proportion of drivers were already travelling at less than 20mph, and are unlikely to have experienced a change in journey times.

It is also worth pointing out that delay at junctions can have more of an impact on overall journey times than link (junction-to-junction) times; and is unlikely to be affected by the 20mph limits.

There is no evidence from the focus groups that residents are concerned about increased journey times. There may be instances however, where drivers have found that routes previously used as short cuts no longer seem attractive, and are perceived to result in additional journey time (regardless of the actual time difference).

Impact on bus operators – Some concerns were raised by bus operators in residential case study areas, due to the impact on bus reliability and operating costs.

- One bus operator (interviewed post-implementation), reported that they had had to introduce an additional vehicle into the schedule on one particular high frequency service, due to an increase in stop to stop journey times. During the quieter times (evenings and weekends), buses were previously able to travel at 30mph. However, following implementation, the slower speed limit meant that they were unable to maintain their tight timetable, and were required to introduce an additional vehicle.
- In another case study area, the bus operator (interviewed post-implementation) reported challenges in continuing to operate the same number of services, and concerns that this would become more challenging in future with the wider roll out of 20mph limits.

Elsewhere, operator concerns were addressed by retaining a 30mph limit on key bus routes; or concerns reduced over time.

⁹³ National Travel Survey, Table NTS0308 - Average number of trips by trip length and main mode: England, 2016

11.4. Summary and key messages

A summary of the key findings is presented below.

11.4.1. How has route choice changed?

Despite some evidence of driver frustration, only 8% of (non-resident) drivers said that they avoided driving in the area, and only 4% of residents felt that there are less vehicles using their road. Even with the lower speed limit, the 20mph roads still appear to provide a more direct and convenient route, in most cases. The vast majority of drivers do not appear to have changed their route to avoid the new 20mph limit areas.

This is not surprising. The widespread nature of most of the schemes and the fact that the majority of traffic in residential case study areas is expected to be travelling to/from home, means that in most cases there will be few alternative routes available (resulting in limited displacement of traffic). Furthermore, analysis shows that 44% of drivers in residential case studies and 59% in the city centre case studies were already driving below 20mph; and the median area-wide journey speeds have fallen by less than 1mph, resulting in a minimal impact on journey times.

11.4.2. How have journey times changed?

Journey times are estimated to have increased by 3% in residential areas and 5% in city centre areas, based on the observed change in median speed (from GPS journey speed data). This adds less than half a minute to a two mile trip and less than a minute to a five mile trip. Most drivers are unlikely to notice this level of change. Furthermore, a substantial proportion of drivers were already travelling at less than 20mph, and are unlikely to have experienced a change in journey times.

12. How has mode use changed?

12.1. Introduction

This chapter examines the impact of new 20mph limits (signed only) on the use of active travel modes (walking and cycling) and likelihood of mode shift (from using a car or van to walking or cycling).

It tests the following assumptions (as set out in the theory of change logic maps in Figures 3-5):

- Overall increase in use of active travel modes, particularly in large scale 20mph areas that cover a substantial proportion of trip lengths.
- Some existing walkers and cyclists re-route to 'safer' 20mph streets.
- Mode shift from car for some trips, particularly in large scale 20mph areas.

An increase in walking and cycling activity and mode shift away from car use, is assumed to be driven by **perceptions** about the quality of the walking and cycling environment. However, change in mode use is often a process rather than a result of a one-off decision, and readiness to change can be dependent on circumstances of an individual at a particular point in time. In the context of 20mph limits and mode use, changes in behaviour are also likely to be affected by⁹⁴:

- **Structural factors** – Are residents aware that a 20mph limit has been introduced?
- **Attitudes** – Are the benefits of changing travel behaviour recognised and is greater use of sustainable modes seen as the right thing to do?
- **Knowledge and awareness** – Do residents have sufficient knowledge about walking, cycling and public transport options (infrastructure, services, journey times, ease of use, etc.) to use these modes more?
- **Social and cultural norms** – Are friends and peers changing their behaviour?
- **Habit** – Have travel decisions become automatic, with little consideration of the options available for individual trips? Do residents have experience in using different modes?
- **Costs** – Do individuals perceive public transport options to be more expensive, or fail to recognise the cost benefits of walking and cycling?
- **Capability and self-efficacy** – Are residents discouraged from trying new modes, due to perceived lack of skills or resources, or a shortage of time?

In addition, research (e.g. Clark, B et al. 2016) suggests that **major life events**, such as changing job, moving home, birth of a child, or change in the number of adults in a household, can result in travel behaviour changes.

Evidence presented in previous chapters shows:

- good levels of awareness amongst residents (Section 5.12);
- high levels of post implementation support (75%) amongst residents, influenced by consultation and engagement activity (Section 6.2 and 6.4)
- 69% of residents perceive that 20mph limits are beneficial for pedestrians and cyclists (Section 9.2); and
- widespread recognition of the potential safety benefits of 20mph limits for all road users, and moderate recognition of the link to community, environment, and health benefits (Section 5.12, and 6.3).

Residents were not asked about their pre-scheme travel patterns and reasons for travel behaviour choices.

⁹⁴ DfT Enabling Behaviour Change Information Pack.

12.2. Has use of active travel modes changed?

Theory of Change Hypothesis: Overall increase in use of active travel modes, particularly in large scale 20mph areas that cover a substantial proportion of trip lengths.

✓ Some 5% of residents surveyed said that they are walking more, and 2% said that they are cycling more.

✗ There is no significant difference in the results for different categories of case study (small scale residential, area-wide residential, city-centre focused).

✓ A small proportion of households with children reported that their children are cycling locally more often since the introduction of 20mph limits (9% of households for children aged 6-10 years, 6% of households for children aged 11-14, and 6% of households for children aged 15-17).

✓ The limits are expected to reinforce cycling behaviour amongst existing regular cyclists: 59% of those responding to the cyclists' online survey said that keeping the traffic below 20mph means that they are more likely to cycle to local places.

Note - the results are based on self-reported perceptions of behaviour change.

Theory of Change Hypothesis: Some existing walkers and cyclists re-route to 'safer' 20mph streets.

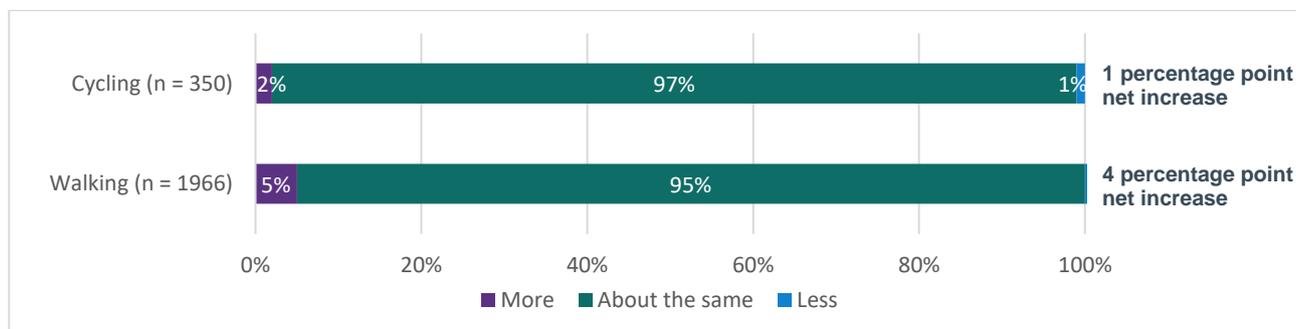
✓ Around half (49%) of existing regular cyclists prefer to cycle on 20mph roads. However, only a quarter (27%) re-route to use 20mph roads, suggesting that convenience outweighs preference for 20mph limits for most regular cyclists. Re-routing to 20mph roads may be higher amongst less experienced and less confident cyclists.

12.2.1. Self-reported levels of walking and cycling

Amongst residents, in general – Section 9.2 shows that the majority of residents (69%) agree that 20mph limits have been beneficial for walking and cycling. In most cases, this has not been translated into an increase in actual levels of walking and cycling; however, there has been a small (but significant) increase in walking and cycling activity:

- Nearly all residents said that they are walking (95%) and cycling (97%) 'about the same' amount as before the 20mph limit was introduced.
- Some 5% said that they are walking more, and 2% said that they are cycling more. Applying a 95% confidence interval suggests that the true range (in the wider population) varies from 4% to 6% for walking, and 0.5% to 3.5% for cycling⁹⁵.
- There is no significant difference in the results for the different categories of case study (small scale residential, area-wide residential, city centre-focused).

Figure 41. Since the introduction of the 20mph limit, are you now walking / cycling more, less or about the same than previously?



Residents questionnaire. n = sample size.

⁹⁵ The questionnaire data provides an estimate based on a sample. The 95% confidence interval is the range of values that one can be 95% certain contains the true mean of the population. This is not the same as a range that contains 95% of the values.

The survey findings also show a small (but significant) increase in levels of cycling amongst children:

- 9% of households with children aged 6 – 10 years stated that they now cycle locally more often since the introduction of 20mph limits (confidence interval = 4.9% to 12.3%);
- 6% of households with children aged 11-14 stated that their children now cycle more often (confidence interval = 2.6% to 9.6%); and
- 6% of households with children aged 15-17 also stated that their children now cycle more often (confidence interval = 2.6% to 10.4%).

Table 41. Do children in this household now cycle locally more often? (More, Less, About the same)

	Number saying 'more'	% saying 'more'	95% confidence interval
Children aged 15-17 (n = 154)	10	6%	2.6% to 10.4%
Children aged 11-14 (n = 181)	11	6%	2.6% to 9.6%
Children aged 6-10 (n = 221)	19	9%	4.9% to 12.3%
Children aged under 6 (n = 228)	5	2%	0.3% to 4.1%

Residents questionnaire. n = sample size.

The above results are based on self-reported perceptions of behaviour change, and may not accurately reflect the real change in the frequency and amount of walking / cycling activity undertaken.

The results suggest that while the introduction of a 20mph limit is perceived as a largely positive measure for pedestrians and cyclists; barriers to walking and cycling remain (see Chapter 9) and the change in actual levels of walking and cycling undertaken by residents in general appears to be small (but significant).

Amongst existing cyclists – As reported in Section 9.4 (Figure 36), over half (59%) of those responding to the cyclists' online survey) said that keeping the traffic below 20mph means that they are more likely to cycle to local places. These however, are already regular cyclists, and the proportion may be higher or lower amongst less regular or inexperienced cyclists.

Again, the results are based on self-reported perceptions of behaviour change, and not accurately reflect the real change in the frequency and amount of cycling activity undertaken.

Re-routing to 20mph roads – Around half (49%) of existing regular cyclists prefer to cycle on 20mph roads. However, only a quarter (27%) re-route to use 20mph roads, suggesting that convenience outweighs preference for 20mph limits for most regular cyclists. Re-routing to 20mph roads may be higher amongst less experienced and less confident cyclists, but it has not been possible to test this.

12.3. Has there been a mode shift away from car?

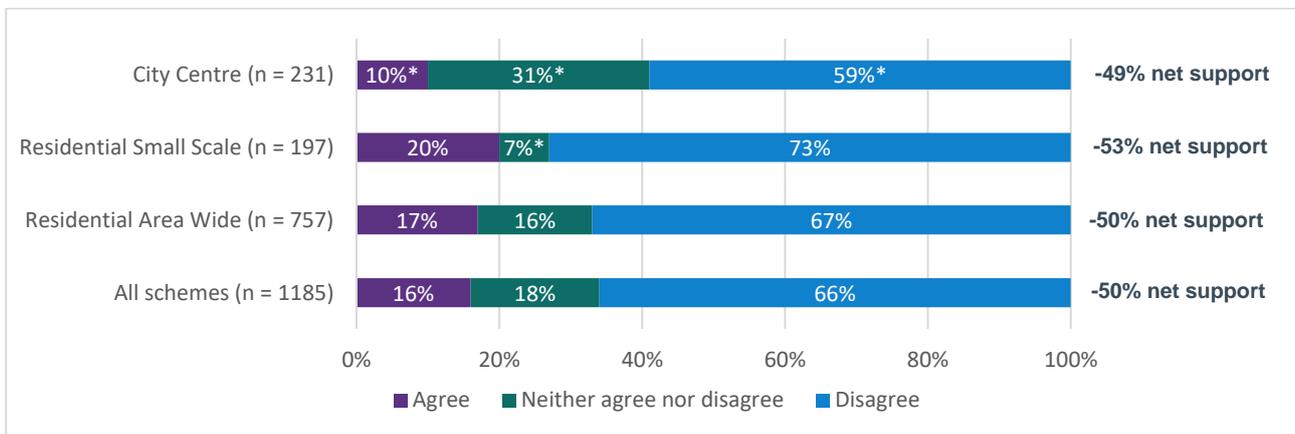
Theory of Change Hypothesis: Mode shift from car for some trips, particularly in large scale 20mph areas.

?(Unclear) A minority of residents said that keeping traffic below 20mph makes it more likely they will walk (16%) or cycle (9%) to local places rather than use the car. Actual mode shift activity is likely to be much less prevalent, but cannot be determined from this data.

Likelihood of mode shift – There was a general view amongst residents that 20mph limits would not encourage them to change modes:

- The majority of residents disagreed that keeping traffic below 20mph makes it more likely that they will walk (64%) or cycle (68%) to local places rather than use the car.
- Some 16% (confidence interval = 13.9% to 18.1%) agreed that they would walk more, and 9% (confidence interval = 7.4% to 10.6%) said that they would cycle more.
- Residents in city-centre-focused schemes were least likely to walk or cycle more.

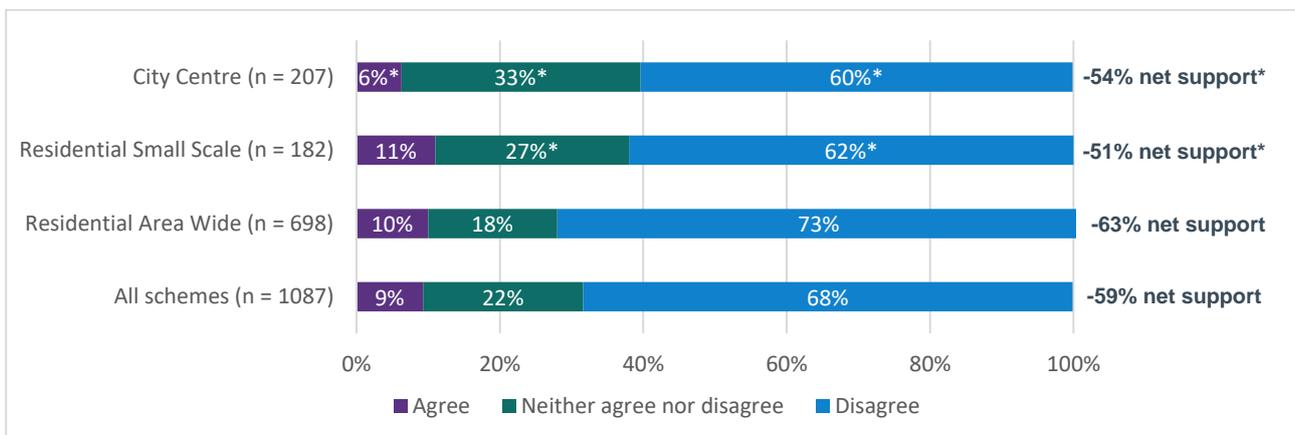
Figure 42. Keeping traffic below 20mph makes it more likely that I will walk to local places rather than use the car (Resident drivers only)



Residents questionnaire. n = sample size.

Significant differences in Residential Area Wide vs Residential Small Scale, and Residential Area Wide vs City Centre results marked with asterix (*).

Figure 43. Keeping traffic below 20mph makes it more likely that I will cycle to local places rather than use the car (Resident drivers only)



Residents questionnaire. n = sample size.

Significant differences in Residential Area Wide vs Residential Small Scale, and Residential Area Wide vs City Centre results marked with asterix (*).

While a small minority would said that they would be more likely to walk or cycle more, the results are based on self-reported intentions. Actual mode shift activity is likely to be much less prevalent, but cannot be determined from this data.

Variation in likelihood of walking more by respondent and area-based characteristics - Variation in likelihood of walking or cycling more by respondent and area-based characteristics was examined using multi-variate regression analysis, applied to the residents' questionnaire data only.

Separate models were developed for each of the following dependent variables:

- % agreeing "Keeping traffic below 20mph makes it more likely that I will walk to local places rather than use the car".
- % agreeing "Keeping traffic below 20mph makes it more likely that I will cycle to local places rather than use the car".

Likelihood of walking

The results show that the likelihood of walking is associated with:

- those who perceive positive outcomes (fewer vehicles driving at excessive speeds, and a safer environment for walking and cycling)⁹⁶;
- those living in areas with wider streets and larger road to house distances (indicating wide pavements / verges)⁹⁷;
- those living in mixed land use areas (residential mixed with retail, leisure or business)⁹⁸; and
- areas with a high number of before accidents⁹⁹.

Likelihood of cycling

The results show that the likelihood of cycling is associated with:

- those aged 17-59 years only (possibly reflecting a wider relationship between propensity to cycle and age).

Case study examples – Mode shift (Box Y)

Portsmouth – Questionnaire surveys were undertaken in 2009 with 1445 residents found that a 'safer environment for walking and cycling' was the main wider benefit perceived by residents – with c.45% agreeing, compared with c.30% disagreeing. This was much higher than for issues relating to congestion, the environment, and the community environment. However, the majority of residents reported no change in mode use before and after the introduction of the 20mph limits. Of those stating a change, just fewer than 30% made a change from car to more sustainable modes of transport, either walking or using public transport. The reasons given for such changes included traffic levels, could no longer drive or moved house or job; rather than specific reasons relating to the lower speed limits.

Calderdale – Doorstep surveys were also carried out with 240 households in Todmorden (in 2015 and 2016) and 500 in Sowerby Bridge (in 2015 and 2017), before and after installation of 20mph speed limits. These areas were implemented as part of Phase 2 of the 20mph limit scheme, and are in a different part of the borough to the Phase 1 case study area considered in this study. The results show:

- Increased cycling in Todmorden for those who already owned/had use of a bike.
- No change in walking patterns in Todmorden; increase in walking in Sowerby Bridge.

No further details are provided (Report to Scrutiny Panel, April 2018).

⁹⁶ Residents who agree that there are 'fewer vehicles driving at excessive speeds' are 1.6 times more likely and those who agree that 'the 20mph limit provides a safer environment for walking and cycling' are 2.3 times more likely than those who do not, to say that 'Keeping traffic below 20mph makes it more likely that I will walk to local places rather than use the car'.

⁹⁷ Residents living in areas where the house to road distance is greater are 3.2 times more likely to say that they are likely to walk more.

⁹⁸ Residents living in areas with mixed land use are 1.8 times more likely to say that they are likely to walk more.

⁹⁹ If the number of casualties per KM of road goes up by 1, the odds of residents saying that they are likely to walk more goes up by a factor of 3.2 (320%).

Nottingham – Surveys of walking and cycling were carried out across the Sherwood area of Nottingham to measure sustainable transport use, with a number of control sites in other areas of Nottingham selected to provide control data. The results show that between Oct/Nov 2012 and Apr/May 2014, there was a 17.5% increase in sustainable transport use across the area; compared with a 11.2% increase in the control areas. No further information is provided on how the data was collected and the robustness of the results. Sherwood is in a different part of the city to Bestwood, the case study area for this study.
(Sherwood 20mph Speed Limit: 12 Month Monitoring Report)

Wider evidence on mode shift

In Graz, Austria, 230 residents were asked to map out the routes and modes used before and after the 30kph speed limit (Wernsperger and Sammer, 1995). 700 trips were described in these interviews however none indicated a change in mode of transport (Wernsperger & Sammer, 1995).

12.4. Summary and key messages

A summary of the key findings is presented below.

12.4.1. Has use of active travel modes changed?

Self-reported levels of walking and cycling – The majority of residents (69%) agree that 20mph limits have been beneficial for walking and cycling. However, in most cases this has not been translated into an increase in actual levels of walking and cycling, with nearly all residents saying that they are walking (95%) and cycling (97%) ‘about the same’ amount as before the 20mph limit was introduced.

Nevertheless, there has been a small (but significant) increase in the proportion of survey respondents stating that they have increased their use of active travel modes. Some 5% of residents surveyed said that they are walking more, and 2% said that they are cycling more, since the introduction of the 20mph limits.

In addition, a small proportion of households with children reported that their children are cycling locally more often since the introduction of 20mph limits (9% of households for children aged 6-10 years, 6% of households for children aged 11-14, and 6% of households for children aged 15-17).

Furthermore, the speed limits are expected to reinforce cycling behaviour amongst existing regular cyclists: 59% of those responding to the cyclists’ online survey said that keeping the traffic below 20mph means that they are more likely to cycle to local places.

The results suggest that while the introduction of a 20mph limit is perceived as a largely positive measure for pedestrians and cyclists; infrastructure-related barriers to walking and cycling remain (see Chapter 9) and the change in reported levels of walking and cycling undertaken by residents in general appears to be small (but significant).

This is perhaps not surprising as research suggests that (in addition to the need to address wider physical aspects of the walking and cycling environment), other personal and psychological factors are important including recognition of the benefits of changing behaviour and perception that it’s the right thing to do from a personal, social, environmental perspective; knowledge about the options available and experience of using these modes; and perceptions about time and cost implications. In addition, change in mode use is often a process rather than a result of a one-off decision, triggered by a specific event (e.g. change of job, moving house, change in life circumstances). While consultation and engagement activities have contributed to high levels of support and awareness of the potential benefits, particularly in some case study areas (Section 6.2 and 6.4), this has not been sufficient to encourage the majority of residents to change their behaviour over the time period covered by this research.

Note - The above results are based on self-reported perceptions of behaviour change, and may not accurately reflect the real change in the frequency and amount of walking / cycling activity undertaken.

Re-routing to 20mph roads – Around half (49%) of existing regular cyclists prefer to cycle on 20mph roads; although only a quarter (27%) re-route to use 20mph roads, suggesting that convenience outweighs preference for 20mph for most regular cyclists. Re-routing to 20mph roads may be higher amongst less experienced and less confident cyclists, but it has not been possible to test this.

12.4.2. Has there been a mode shift away from car?

Likelihood of mode shift – A significant minority of residents said that keeping traffic below 20mph makes it more likely they will walk (16%) or cycle (9%) to local places rather than use the car. Actual mode shift activity is likely to be much less prevalent, but cannot be determined from this data.

Changes may occur over time, as a result of the cumulative effect of other sustainable travel interventions.

13. What impact do 20mph limits have on the community, the local economy, environment and health?

13.1. Introduction

This chapter covers the potential wider impacts of 20mph limits (signed only) associated with changes in driver behaviour, perceptions about walking and cycling, safety, journey time impacts, use of active travel modes and mode shift, described in previous chapters. It covers:

- social and community impacts;
- impacts on the local economy;
- environmental impacts (air quality, greenhouse gas emissions, noise); and
- health benefits.

It tests the following community and local economy assumptions set out in the theory of change logic map in Figures 3-5:

- 20mph designation improves residents' perception of their area as a community environment. More social interaction and community cohesion.
- Potential avoidance of 20mph limit roads means that people are less likely to use local shops and amenities.

No primary data has been collected for environmental benefits, so it has not been possible to test the following assumptions:

- Change in vehicle emissions and air quality.
- Reduction in CO₂ (greenhouse gas) emissions.
- Reduction in noise levels.

These benefits are assumed to occur as a result of: a reduction in average speed and top percentile speeds; a smoother, more consistent driving speeds; a small scale displacement of traffic; and mode shift.

In addition, **no primary data** has been collected for health benefits, so it has not been possible to test the following assumptions:

- Improved health and well-being as a result of overall increase in use of active travel modes, and economic benefits associated with reduced pressure on the NHS.
- Potential offset of health benefits, as a result of an increase in collisions involving pedestrians and cyclists, and increased exposure to vehicle emissions (PM₁₀ and NO_x).

For these sections, the likely impacts are set out, based on existing research and observed changes in influencing factors.

13.2. Have there been any social and community impacts?

Theory of Change Hypothesis: 20mph designation improves residents' perception of their area as a community environment. More social interaction and community cohesion.

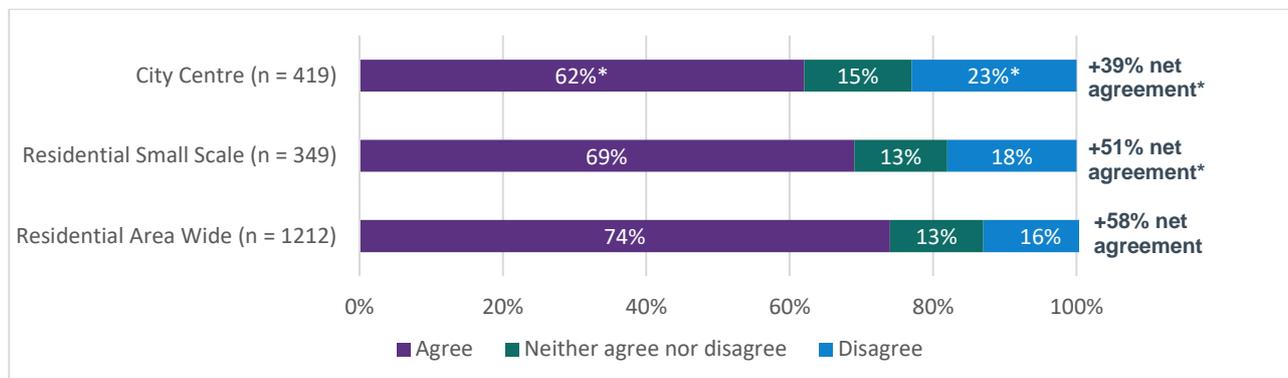
?(Survey evidence partially supports above hypothesis). The majority of residents (70%) agreed that the 20mph speed limit is beneficial for residents. The proportion is higher in residential areas, and amongst non-drivers. Focus group participants also tended to see the 20mph limits as a positive change. However, child safety still appears to be a concern, and other potential benefits relating to social interaction (residents out and about on the street) and community pride do not appear to be recognised by the majority of residents. Some 7% of households with children aged 6-10 years report an increase in outside play.

13.2.1. Residents perceptions of the local environment

Overall – The majority of residents (70%) agreed that the 20mph speed limit is beneficial for residents. Some 16% disagreed, and 13% neither agreed or disagreed.

By area type – The proportion is higher in area-wide residential areas (74%), compared with city centre areas (62% agreement), representing a significant difference (Figure 44). The difference is also significant when net levels of agreement (% agree - % disagree) are compared.

Figure 44. The 20mph limit is beneficial for residents (by area type)

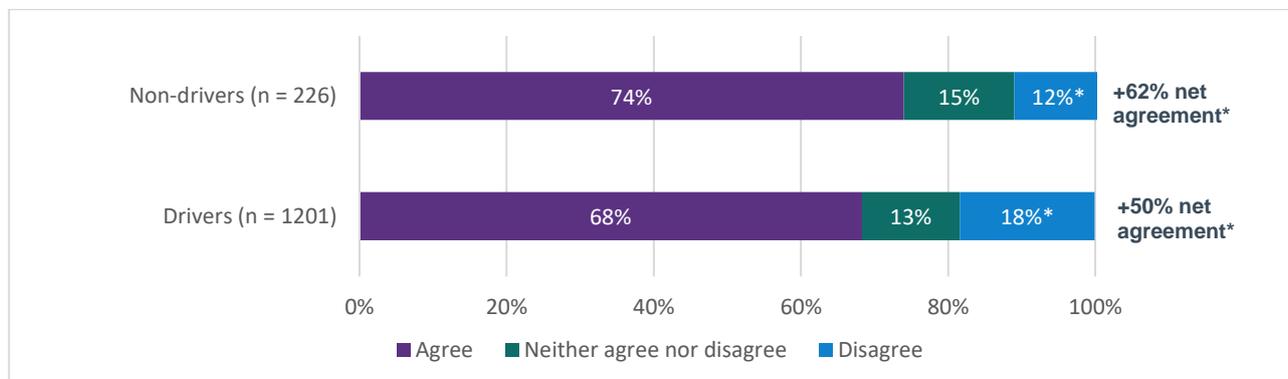


Residents questionnaire. n = sample size.

Significant differences in Residential Area Wide vs Residential Small Scale, and Residential Area Wide vs City Centre results marked with asterix (*).

Drivers and Non-drivers – The proportion is higher amongst non-drivers (74%), compared with drivers (68% agreement) (Figure 45). The difference is significant when net levels of agreement (% agree - % disagree) are compared.

Figure 45. The 20mph limit is beneficial for residents (drivers and non-drivers)



Residents questionnaire. n = sample size.

Significant differences between Drivers and Non-drivers marked with asterix (*).

Case study differences – Residents in Chichester (83%) and Liverpool Area 7 (85%) / Area 2 (80%) were most likely to agree; while those in Brighton Phase 1 (53%) and Calderdale (56%) were least likely – reflecting the results for perceptions about the walking and cycling environment (see Chapter 7).

13.2.2. Why do residents perceive 20mph limits to be beneficial?

The proportion stating that the new limits are 'beneficial' for residents (70%) is similar in magnitude to the proportion saying that 20mph limits are beneficial for cyclists and pedestrians, suggesting that this may be a key factor behind the positive support for the schemes.

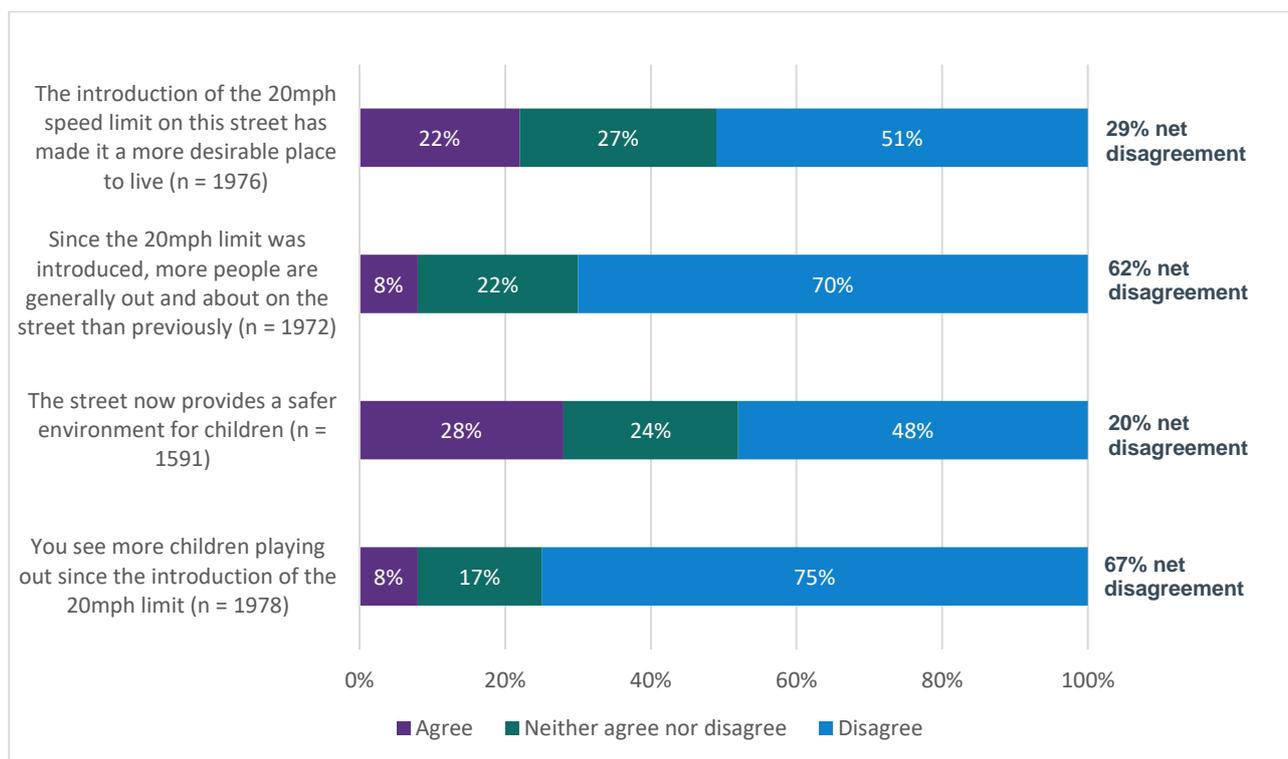
Focus group participants were asked whether there were other ways (besides the impact on walking and cycling) in which the 20mph limit has made the area a better or worse place to live.

The vast majority were unable to identify any other community-related factors, mainly because they had not noticed any substantial difference in the speed of vehicles. However, a small minority mentioned positive factors relating to the feel, attractiveness, and desirability of the area, and issues around social interaction and community feel. One participant felt that it was now safer to back their car out of their driveway as traffic on the road is travelling slower.

None of the focus group participants wanted the 20mph limit to be removed from their area (broadly matching the findings from the questionnaire survey¹⁰⁰), and although most felt that the impact had been negligible or small they tended to see it as a positive change for their area. A 20mph limit was often felt to be suitable and sensible for the area. In general, most participants felt the limit was a good idea in principle, but were disappointed that the limit had not been enforced and had not had more of an impact on speeds.

“If they come and took it away, I wouldn’t like it, I’d rather it stayed.” ... “There’s no need to go faster than 20, is there, really.” (Resident parent)

Figure 46. Social and community impacts



Residents questionnaire. n = sample size.

Desirability and attractiveness of area – A minority of survey respondents (22%) agreed that the introduction of the new limit has made the street a more desirable place to live, but the majority (51%) disagreed with this (Figure 46). This does not necessarily mean that they thought the area had become less desirable, just not more desirable.

In order to obtain further evidence on whether 20mph limits increase the desirability of the area, a small number of estate agents were contacted in the Brighton Phase 2 area, where there is a mix of 20mph and 30mph residential roads of similar character. Three estate agents provided feedback:

- All three estate agents stated that there had been no impact from the 20mph limits at all on house prices/rent or desirability in the area.
- None of the estate agents had experienced buyers requesting either a 20mph or non-20mph road when looking to buy a property.

¹⁰⁰ Only a small proportion of residents surveyed felt that the speed limit on their street should be changed back to 30mph (16%), or that the area-wide limit should be changed back to 30mph (12%).

Respondents felt that it would be very difficult to isolate the impact of 20mph limits on house prices, from the wide range of other influences.

Choice of school – A small proportion of residents with children said that the presence of the 20mph limit had influenced school choice (Table 42). Most notably 9% of households with children under 6 years stated that the presence of the 20mph limit had influenced school choice (confidence interval = 4.7% to 12.9%)¹⁰¹.

The main reasons provided were that the 20mph limits meant that children could walk more safely to school either on their own or accompanied.

Table 42. Has the presence of the 20mph limits in the area influenced choice of school for any children in this household? (Yes, No, Don't know)

	Number saying 'more'	% saying 'more'	95% confidence interval
Children aged 15-17 (n = 154)	5	3%	0.4% to 6.0%
Children aged 11-14 (n = 181)	11	6%	2.6% to 9.6%
Children aged 6-10 (n = 221)	11	5%	1.8% to 8.1%
Children aged under 6 (n = 228)	20	9%	4.7% to 12.9%

Residents questionnaire. n = sample size.

Social interaction and community activity – Only 8% of survey respondents agreed that more people are generally out and about on the street than previously, with the majority (70%) disagreeing (Figure 46).

However, the focus group discussions provided some evidence that the process of introducing the limit did create a sense of community spirit in Liverpool, where there was a very high-profile campaign. In Brighton, focus group participants felt that the scheme gave the community something to talk about when it was introduced, even if most conversations involved complaining about the scheme.

Wider evidence on social interaction impacts

There is a link between traffic volume and levels of social interaction at street level. Appleyard (1969) found that on streets in San Francisco, residents of streets with light traffic had three times as many friends on those streets than those with heavy traffic; and that the way in which streets are seen and understood by residents differs according to traffic volume. These findings have been replicated in various studies, e.g. Hart et al. (2011) in Bristol.

However, the focus of these studies has been on traffic volume. While it is reasonable to expect a similar relationship with traffic speed, further work is needed to confirm this.

Children and play activities – As demonstrated in Section 9.2.3, child safety still appears to be a concern, with focus group participants reporting that the introduction of the 20mph limit had little impact on whether they would allow their children to walk or cycle to schools or other destinations.

A minority of survey respondents (28%) agreed that their street now provides a safer environment for children, with almost half (48%) disagreeing (Figure 46).

The survey findings show a small increase in outside play in the case study areas. Some 8% agreed that there are now more children playing outside (Figure 46). This proportion increased to 26% in Liverpool Area 7.

In addition, 7% of households with children aged 6 – 10 years (Table 43) (confidence interval = 3.5% to 10.1%) stated that they play outdoors more often since the introduction of 20mph limits. Other age groups also show increased levels, albeit for smaller proportions.

¹⁰¹ The questionnaire data provides an estimate based on a sample. The 95% confidence interval is the range of values that one can be 95% certain contains the true mean of the population. This is not the same as a range that contains 95% of the values.

Table 43. Do children in this household play outside more frequently? (More, Less, About the same)

	Number saying 'more'	% saying 'more'	95% confidence interval
Children aged 15-17 (n = 154)	3	2%	-0.2% to 4.1% (no change)
Children aged 11-14 (n = 181)	9	5%	1.8% to 8.1%
Children aged 6-10 (n = 221)	15	7%	3.5% to 10.1%
Children aged under 6 (n = 228)	5	2%	0.3% to 4.1%

Residents questionnaire. n = sample size.

Further discussion with focus group participants identified that parents in general were reluctant to allow their children to play outside. Speed and volume of traffic were cited as reasons in at least three of the groups, but wider issues of personal safety and antisocial behaviour in the area were also key factors and would prevent parents allowing children to play outside even if there was higher compliance with the 20mph speed limit.

“It should have that impact, but it doesn’t.” ... “There are other problems going on in the street” (Resident)

However, the 20mph limit can provide opportunities for more formal outside play (Box Z).

Case study example – Outside play interventions in Chichester (Box Z)

Chichester – A key part of the 20mph initiative was about creating a legacy that residents could continue. Sustainable transport charity Sustrans worked with residents to develop Temporary Play Street Orders (TPSO) allowing temporary closures of streets for play activities, and to give the local community something to lead on. The initial street closure took place in Charles Avenue (identified as one of twelve streets with on-going speeding issues), and evolved into a regular themed event for the first Friday of every month.



Local residents enjoying the street closure

Anti-social behaviour – Speeding traffic is perceived as a major social concern for people across the UK. Poulter and McKenna (2007) report that ‘speeding traffic’ is perceived by residents as the most concerning anti-social behaviour in people’s communities, regardless of their age or gender.

The implementation of an initiative clearly aimed at addressing this issue, may have contributed to the widespread agreement that 20mph limits are beneficial for residents.

Social inclusion and independence – The potential for increased levels of independence and social inclusion for non-drivers may also have contributed to the widespread agreement that 20mph limits are beneficial for residents, and provide the opportunity for improved quality of life. However, this study has found no new evidence to support or reject this theory.

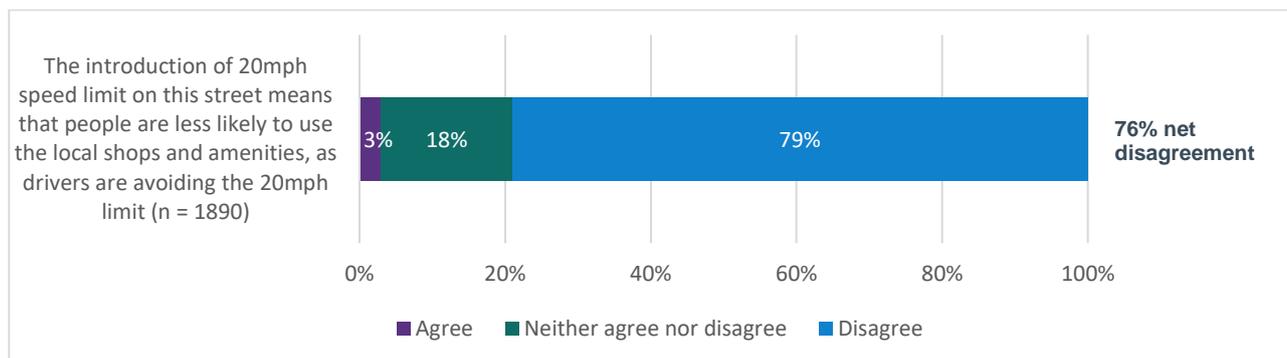
13.3. Have there been any impacts on local shops and amenities?

Theory of Change Hypothesis: Potential avoidance of 20mph limit roads means that people are less likely to use local shops and amenities.

** Very few residents (3%) believe that the limit means that people are avoiding the area and are less likely to use local shops and amenities.*

Section 11.2 shows that 8% of non-resident drivers avoid the 20mph limit roads. This may mean that they are less likely to use local shops and amenities.

Figure 47. Impact on the local economy



Residents questionnaire. n = sample size.

It has not been possible to measure this directly, however, residents were asked whether they thought that the introduction of the 20mph limit meant that people were avoiding the area and less likely to use local shops and amenities. Only 3% agreed with the statement, based on their local observations.

Focus group participants in Brighton felt that the quality of the environment has improved in parts of the city centre, with better shops and cafes, and a more pleasant atmosphere. This isn't thought to be due specifically to the 20mph limit, but the slower speeds add to the overall quality of the environment.

"I just think it's just the area, just in general, Hove and Brighton has just come up a lot, but you know, it is nicer and probably having traffic not whizzing past so quickly. It's better actually." (Brighton resident)

Participants also mentioned that the 20mph limit, alongside cars being banned or restricted from certain areas, has also helped make it *feel* easier to cross the road in the city centre – which again helps create a nicer atmosphere.

13.4. What are the likely impacts on the environment?

Those participating in the non-resident driver interviews, and responding to the online cyclists' and motorcyclists' surveys were found to have mixed levels of appreciation about the potential environmental benefits of 20mph limits. There was considerable uncertainty about the impact of the limits on air quality.

Non-resident drivers - Drivers were asked what impact (positive or negative) they thought 20mph limits had on the local environment. The majority either didn't know, or felt that there would be no impact.

"There can't be much of an impact, cars are still using the road; the speed doesn't make much difference to the environment." (Non-resident driver)

A number of drivers felt that the 20mph limit would have an adverse impact on air quality because vehicles would take longer to travel through the area, and traffic may build up. Others felt that the slower speeds would reduce emissions.

A minority felt that the 20mph limit would reduce noise pollution, which would benefit residents and create a more pleasant environment for walking.

Motorcyclists – Only 15% perceived 20mph limits to be beneficial for the environment, with most (68%) disagreeing.

Cyclists – A high proportion (72%) perceived 20mph limits to be beneficial for the environment, although there was not universal agreement on this point, with 12% disagreeing and 17% responding 'don't know'.

13.4.1. Air quality and greenhouse gas emissions

Traffic emissions are responsible for around a quarter of UK greenhouse gas emissions and affects air quality at the roadside.

The most important greenhouse gases are water vapour and carbon dioxide (CO₂). Methane, nitrous oxide, ozone (O₃) and several other gases present in the atmosphere in small amounts also contribute to the greenhouse effect. Greenhouse gas emissions contribute to global warming, leading to changes in extreme weather-related events such as heat waves and droughts or heavy rainfalls and floods (IPCC, 2007).

Outdoor air pollution has been associated with increases in occurrence and prevalence of particular health problems, such as premature death, cardiovascular and respiratory diseases, and cancer (Bellefleur and Gagnon, 2011). The pollutants with the strongest evidence of health effects are particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂) and sulphur dioxide (SO₂).

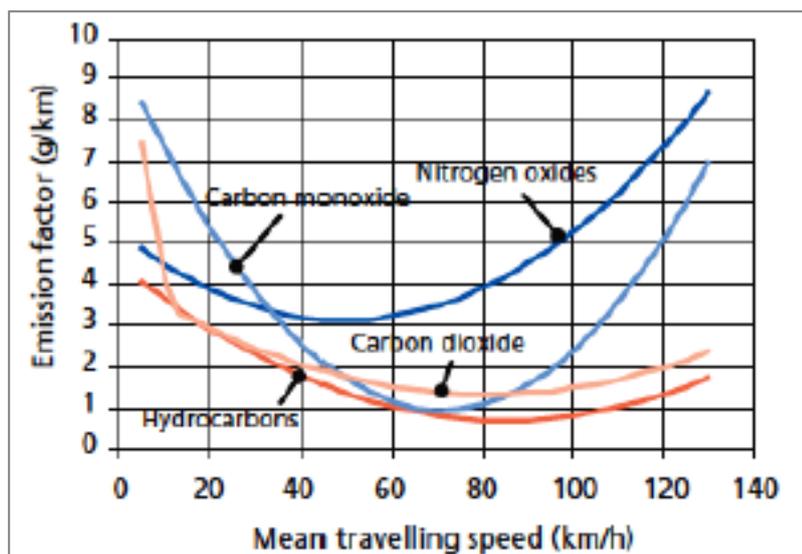
The quantity of vehicle emissions produced by vehicles and affecting climate change and outdoor air quality varies depending on a number of criteria, including speed and consistency of driving speed, traffic volume, and type of vehicles.

The introduction of 20mph limits could have an impact on emissions through the following changes:

- change in vehicle emissions - same number of vehicles going through an area but at slightly reduced speed with potential changes in idling, acceleration, deceleration, and braking;
- mode shift away from cars, in favour of walking and cycling, leading to an overall reduction in motorised vehicle-kilometres;
- emission displacement, where vehicles change route, leading to reduced air quality impacts in the local area but no change to overall emissions.

Change in vehicle emissions – The relationship between vehicle emissions and **vehicle speed** generally follows the same trend as fuel consumption, which appears graphically as a U-shaped curve. Figure 48 shows that both fuel consumption and vehicle emissions are greatest at lower and higher speeds (Bellefleur and Gagnon, 2011).

Figure 48. Relationship between vehicle emissions and vehicle speed



Bellefleur and Gagnon (2011)

The graph shows that vehicle emissions are generally higher at 20mph (32km/hr) than at 30mph (48km/hr).

However, Williams (2013) shows that emissions differ according to **fuel type and engine size**, and concludes that it would be incorrect to assume a 20mph speed restriction would be detrimental to ambient local air quality. Williams evaluated the estimated impact of a 20mph speed restriction on vehicle emissions on six routes in central London (Table 44).

Table 44. Impact of 20mph drive cycle on emissions in central London

Vehicle type	Drive cycle speed limit	NO _x (g/km)	PM ₁₀ (g/km)	CO ₂ (g/km)
PETROL 1.4 – 2.0 litre, EURO IV	30	0.0673	0.00237	266.35
PETROL 1.4 – 2.0 litre, EURO IV	20	0.0726	0.00218	271.95
Impact of 20mph drive cycle		+0.0053	-0.0002	+5.60
Impact of 20mph drive cycle		+7.9%	-8.3%	+2.1%
DIESEL 1.4 – 2.0 litre, EURO IV	30	0.8104	0.01917	203.48
DIESEL 1.4 – 2.0 litre, EURO IV	20	0.7437	0.01758	201.58
Impact of 20mph drive cycle		-0.0667	-0.0016	-1.9
Impact of 20mph drive cycle		-8.2%	-8.3%	-0.9%

The study found:

- A greater range of speeds were observed on 30mph route segments compared to 20mph segments; and average cruise speeds were found to be higher on 30mph routes.
- NO_x emission factors were higher for petrol vehicles over 20mph drive cycles compared to 30mph drive cycles; for diesel vehicles they were lower.
- PM₁₀ emission factors are lower for both petrol and diesel vehicles at 20mph compared to 30mph, with the exception of vehicles with engines in excess of 2.0 litres. The order of magnitude is such that future trends in fleet composition will be important.
- CO₂ emission factors follow the same pattern as NO_x. Emission factors are higher for petrol vehicles over a 20mph drive cycle compared to 30mph cycle (+2.1%); but slightly lower for diesel vehicles (-0.9%).
- Diesel vehicles emit approximately ten times as much NO_x and PM₁₀, in absolute terms than petrol vehicles. So, switching from a 30mph to a 20mph drive cycle results in 0.01g/km of additional NO_x emitted by each petrol vehicle (1.4-2.0 litre), but 0.07g/km less NO_x emissions for every diesel vehicle (1.4-2.0 litre).

Over the past 20 years, the proportion of the licensed car fleet made up of diesel vehicles has grown substantially, from 11% of the fleet in 1997 to 40% by December 2017¹⁰²; partly due to the introduction of vehicle tax rates in 2001 that favoured diesels. Over the same period, the proportion of petrol vehicles declined from 89% to 59%.

However, this is changing. Following the VW scandal¹⁰³, a growing awareness about the higher levels of NO_x and PM₁₀ emitted by diesel vehicles (particularly in real world driving conditions), and the introduction of charges for older diesels (and petrol) vehicles in cities¹⁰⁴, this trend has started to revert. By the end of Dec 2017, diesel vehicles accounted for 42% of new car registrations, compared with 51% in 2012¹⁰⁵.

¹⁰² Vehicle Licensing Statistics (Table VEH023). Licensed cars at the end of the year by propulsion / fuel type, Great Britain from 1994. Department for Transport statistics.

¹⁰³ In 2015, when the Environmental Protection Agency in the US found Volkswagen deliberately cheated in emissions tests, with its diesel models polluting up to 40 times above legal limits. The VW Group had to recall more than 11 million cars worldwide, including in excess of 1.2 million in the UK, and the Group is facing billions in US lawsuits.

¹⁰⁴ Older vehicles driving in central London now need to meet minimum Euro emission standards or pay an extra daily charge. This is in addition to the Congestion Charge. The T-Charge (officially known as the Emissions Surcharge) operates in the Congestion Charge zone and is part of TfL's commitment to tackling air pollution in London.

¹⁰⁵ Vehicle Licensing Statistics (Table VEH0253). Cars registered for the first time by propulsion / fuel type, Great Britain from 2001 Q1. Department for Transport statistics.

All other factors being equal, a relative increase in the proportion of petrol vehicles (compared with diesel vehicles) in 20mph limit areas will result in a relative reduction in absolute NOx and PM10 emissions, and a relative increase in CO₂ emissions; but the benefits of a 20mph drive cycle over a 30mph cycle become less favourable. However, longer term, improvements in combustion engine technology and vehicle efficiency (vehicle weight, tyres, etc) and an increase in the proportion of hybrid and electric vehicles in the fleet, will lead to reduced vehicle emissions per mile.

Vehicle emissions are also influenced by **variability or consistency of driving speed**, as vehicles use more fuel to accelerate (Boulter and Webster, 1997, cited in Grundy C et al., 2008). Schemes that promote steady speeds can improve tailpipe emissions (TRL - Lawton et al 2012).

Particular matter associated with **brake and tyre wear** is also important. Williams (2013) refers to one European study¹⁰⁶ that demonstrated the inverse linear relationship between mean speed and emissions of tyre and brake matter. This suggests that where roads have a lower average speed, brake and tyre emissions would also be lower. However, it does not directly address the phases of vehicle operation that are linked to brake and tyre wear emissions (acceleration, braking and cornering). Williams (2013) calculate that high positive 'vehicle specific power' (associated with strong acceleration) would be expected to correlate to higher tyre wear rates per unit time; and high negative 'vehicle specific power' (associated with strong decelerations) would be expected to lead to increased brake wear rates as well as increased tyre wear rates. The study concludes that the smaller proportion of time spent decelerating on a 20mph road would suggest that tyre and brake wear would also be less at the lower speed limit in mass per unit distance terms.

Finally, the specific geometry of the street, orientation, vegetation, and wind, etc. can affect the rate at which emissions disperse, and hence the ambient air quality. Narrow streets with high-rise buildings can trap emissions, while wide open streets can aid dispersion.

Mode shift – A key factor determining the impact of 20mph limit schemes on carbon emissions and air quality, is the extent to which the intervention achieves mode shift away from cars and reduces the overall vehicle kilometres undertaken.

Evidence from Chapter 12 shows that a significant minority of residents interviewed in the case study areas said that keeping traffic below 20mph makes it more likely they will walk (16%) or cycle (9%) to local places rather than use the car. Actual mode shift activity is likely to be less prevalent, but cannot be determined from this data.

Displacement of traffic – Displacement of traffic, as a result of vehicles changing route to avoid 20mph limits, is expected to lead to a reduced emissions and enhanced air quality in the local area, but no change to overall emissions.

Evidence from Chapter 11, shows that 8% of (non-resident) drivers said that they avoided driving in the case study area, and only 4% of residents felt that there are less vehicles using their road. Even with the lower speed limit, the 20mph roads still appear to provide a more direct and convenient route, in most cases. The vast majority of drivers do not appear to have changed their route to avoid the new 20mph limit areas.

Estimated impact in case study areas – No primary data on vehicle emissions has been collected as part of this study. The relevant factors in the case study areas (measured as part of this study) are:

- the change in average speed and top percentile speeds has been small (median journey speeds have reduced by 0.7mph in residential areas and -0.9mph in city centre areas; 85th percentile speeds have reduced by -1.1mph and -1.6mph respectively);
- displacement of traffic appears to have been small, with 8% of non-resident drivers saying that they avoid 20mph limits;
- journey speed data shows that the spread of speeds, indicated by the 15th-85th percentile range, has declined by 1.3mph in residential areas, and by 2.0mph in city centre areas, indicating more consistency in the driving speeds on 20mph limit roads. However, the evidence collected from non-drivers about their own behaviour is not sufficient to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual vehicle level (with less acceleration and deceleration); and
- actual mode shift is unclear, but is expected to be small.

¹⁰⁶ <http://emissionsanalytics.com/>

The net impact is estimated to be small, but the direction of travel cannot be certain.

In terms of the impact on greenhouse gas emissions, the relevant factors in the case study areas (measured as part of this study) are:

- the change in average speed and top percentile speeds has been small (see above); and
- actual mode shift is unclear, but is expected to be small.

Again, the net impact is estimated to be small, but the direction of travel cannot be certain.

Wider evidence on air quality impacts in 20mph limits

Relatively few studies have directly monitored the impact of 20mph limits on air quality.

In Graz, Austria, 30kph (18.6mph) limits were introduced across most of the city in the 1990s. 170 test drives (totalling over 2,000 km) along roads in Graz were used to measure the speed, distance, and time of the journey, such that the emissions from each individual vehicle, at speeds of 50 km/h and 30 km/h, could be investigated.

The largest proportion of vehicle emissions come from priority roads. Given the 50kph speed limit was retained on these roads and that there was no change in mode or substantial change in route choice, there was no noticeable difference in the level of emissions on these roads (Wernsperger & Sammer, 1995).

Streets where the speed limit was reduced to 30kph accounted for only 5-8% of all gases emitted. The changes on those streets were positive and negative, depending on the emission considered (3.8% increase in CO, 0.5% increase in HC). The only really significant change identified was a 24% reduction in nitrogen dioxide emissions, assumingly due to steadier driving conditions. When applied to the whole city, this equated to a 1.9% reduction in nitrogen dioxide (Wernsperger & Sammer, 1995; Fischer, 2010).

Overall, it was concluded that the level of exhaust emissions had hardly changed, with no recognisable increases and a very slight reduction in nitrogen dioxide emissions (Wernsperger & Sammer, 1995).

13.4.2. Noise levels

Although there are fewer reported health effects as consequence of increased noise levels than those associated to air pollution, Bellefleur and Gagnon (2011) state that an increase in noise annoyance can result in deterioration to the quality of life for local residents. Noise can result in several short and long term health complications, for example sleep disturbance, cardiovascular problems, hearing impairment, as well as poorer work and school performance (WHO Regional Office for Europe, 2014¹⁰⁷). Furthermore, Bellefleur and Gagnon (2011) also state noise disturbance can lead to fatigue and feelings of depression and obesity.

Influencing factors – Bellefleur and Gagnon (2011) report that a range of traffic calming studies have concluded that the following five situations can influence the level of motorised noise within an area, these include:

- a change in vehicle speeds;
- a change in speed variations;
- a change in traffic volume;
- the implementation of textured materials; and
- the introduction of vertical deflections (i.e. speed humps).

Vehicle noise increases with speed (Bellefleur and Gagnon, 2011). However, increasing the magnitude and frequency of accelerations and decelerations, tends to also increase the noise generated. This is particularly the case if frequent changes down to 2nd gear are required (Pharoah and Russell, 1989).

Pharoah and Russell (1989) also report that where speed reductions of less than 10kph have been achieved, for example in various schemes in Danish villages, there has been little impact on noise levels.

Substantial changes in traffic flow are required to have a noticeable impact on noise levels. DMRB Vol 11, Section 3¹⁰⁸ states that a change of 1 dB $L_{A10,18h}$ is considered perceptible in the short term and 3 dB $L_{A10,18h}$ in the long term (15 years after scheme opening). A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a

¹⁰⁷ <http://www.euro.who.int/en/health-topics/environment-and-health/noise>

¹⁰⁸ <http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section3/hd21311.pdf>

25% increase or 20% decrease in traffic flow, assuming other factors remain unchanged, and a change in noise level of 3 dB $L_{A10,18h}$ is equivalent to a 100% increase or 50% decrease in traffic flow.

Estimated impact in case study areas – No primary data on noise levels has been collected as part of this study. However, the impact is estimated to be negligible, given that:

- the change in average speed and top percentile speeds has been small (median journey speeds have reduced by 0.7mph in residential areas and -0.9mph in city centre areas; 85th percentile speeds have reduced by -1.1mph and -1.6mph respectively); and
- displacement of traffic appears to have been small, with 8% of non-resident drivers saying that they avoid 20mph limits.

It has not been possible to collect evidence to assess whether 20mph limits have resulted in smoother, more consistent driving at an individual vehicle level (with less acceleration and deceleration).

The focus group discussions identified a few isolated examples where participants felt traffic noise had reduced, but most participants did not comment or had not noticed a difference.

Wider evidence on noise impacts in 20mph limits

- In Graz, Austria, noise was measured at 11 locations (on the pavement one metre from the kerb) before and after the 30 km/h speed limit. Traffic counts and average speed were also recorded during the measurements, to allow the sound level to be calibrated between the before and after studies and ensure the sound levels recorded were comparable.

At 9 of the 11 locations there was less traffic. At the other two measurement locations, the energy equivalent continuous sound level (Leq) and the peak level (I01) were measured.

The results at these two sites showed that noise reduced by 0.9 -1.9 decibel (Leq). On the basis that one dB represents a change in noise that is just perceptible, the noise environment at one of the sites was considered to have improved. The peak noise levels at the two sites reduced by 0.9-2.5 dB, which suggests a reduction in the subjective disturbance from traffic noise. These reductions in noise reflect both reductions in speed and less acceleration (due to drivers driving at a steadier speed). Overall it was concluded that noise pollution has slightly decreased. (Wernsperger & Sammer, 1995).

- In Bristol's Inner South and Inner East pilot areas (Bristol City Council, 2012) modelling analysis shows that the introduction of 20mph limits resulted in a small reduction in road traffic noise, shortly after implementation. This change is likely to be imperceptible by residents and is described as of negligible effect at all modelled receptors. The small reduction in noise reflects the small changes in traffic speed that are observed from traffic surveys undertaken before and after the introduction of the scheme. The model may not capture the full benefit of the scheme in terms of noise reduction as it is not sophisticated enough to capture the effect of smoother driving behaviour which may result from the scheme.

A questionnaire survey was also undertaken, which showed that 10% of residents perceived that there had been a reduction in traffic noise since the introduction of the new 20 mph speed limit.

13.5. What are the likely impacts on health?

Active travel – Existing evidence suggests that if 20mph limits can help achieve modal shift and increase levels of active travel it would have a substantial benefit for public health.

The benefits of walking and cycling are well documented. NICE (2012) states that increasing how much someone walks or cycles may increase their overall level of physical activity, leading to associated health benefits. These include:

- reducing the risk of coronary heart disease, stroke, cancer, obesity and type 2 diabetes;
- keeping the musculoskeletal system healthy; and
- promoting mental wellbeing.

The health benefits vary according to the intensity, duration and frequency of activity. Age is also an important consideration when assessing the health impacts of changes to physical activity.

The Department of Health (2011) recommended that adults should do at least 150 minutes of moderate physical activity such as walking every week, and that children should be active for at least an hour every day. The report also recommends that the amount of time spent being sedentary (sitting) should be minimised. It has been estimated that 37,000 lives a year could be saved if everyone met these guidelines (De Moor, 2013).

Hillsdon, et al (1995) identified walking as the exercise most likely to result in sedentary adults increasing and sustaining activity levels; and it is more likely than other forms of exercise to become part of their routine.

Exposure to vehicle injury – 20mph limits are expected to result in an overall reduction in the number and severity of injuries from vehicle collisions, as a result of a reduction in speed (although this study has not been able to confirm this based on the data currently available for analysis).

However, there is also a possibility that greater use of active travel modes will result in increased exposure to vehicle collisions and an increase in injuries amongst these road users, as casualty rates for pedestrians and especially cyclists are much higher than for car occupants¹⁰⁹ (although this study has found no evidence of this).

Exposure to vehicle emissions – Another potential risk associated with active travel is increased exposure to emissions. Recent research by Kumar et al. (2018) found that cyclists and pedestrians were more likely to be affected by air pollution than those travelling by bus or car. Previous studies have suggested that car drivers may face the most exposure to air pollution during daily travel. In 2015, another study (Goel and Kumar, 2015) suggested that drivers were particularly at risk of harm from particulates when stopping and starting at traffic lights. However, the latest study focused on the amount of pollutant particles left in someone's respiratory system, rather than simple exposure concentration.

The impact in any particular location is likely to depend on the ambient levels of emissions. In many 20mph limits the volume of traffic will be low, and air quality may be better than in busier urban areas.

Estimated impact in case study areas – No primary data on health has been collected as part of this study. However, a small positive impact (improvement) is estimated, given that:

- 5% of residents said that they are walking more and 2% of residents said that they are cycling more, following the introduction of the 20mph limits.

There is no evidence that the introduction of 20mph limits has resulted in an increase in pedestrian collisions. The collision data for residential areas shows no significant change, while the data for Brighton Phase 1 (city centre scheme) shows a significant reduction in pedestrian collisions, relative to the comparator area.

No primary data on air quality has been collected as part of this study.

¹⁰⁹ Reported Road Casualties Great Britain 2016 reports 1,863 pedestrian casualties and 5,353 cycle casualties per billion passenger miles, compared with 262 for car occupants.

13.6. Summary and key messages

A summary of the key findings is presented below.

13.6.1. Have there been any social and community impacts?

The majority of residents (70%) agreed that the 20mph speed limit is beneficial for residents. The proportion is higher in area-wide residential areas (74%), and amongst non-drivers (74%). Focus group participants also tended to see the 20mph limits as a positive change. However, child safety still appears to be a concern, and other potential benefits relating to social interaction (residents out and about on the street) and community pride do not appear to be recognised by the majority of residents. Some 7% of households with children aged 6-10 years and 5% of households with children aged 11-14 reported that their children play outdoors more often since the introduction of 20mph limits.

13.6.2. Have there been any impacts on local shops and amenities?

Very few residents (3%) believed that the new speed limit means that people are avoiding the area and are less likely to use local shops and amenities.

13.6.3. What are the likely impacts on the environment?

No primary data on air quality, greenhouse gas emissions and noise levels has been collected as part of this study.

13.6.4. What are the likely impacts on health?

No primary data on health has been collected as part of this study.

14. How do outcomes compare with 20mph zones and older limits?

14.1. Introduction

This chapter examines how outcomes of 20mph (signed-only) limits, which form the main focus of this research, compare with those of new 20mph limits (with existing physical traffic calming measures), and with older 20mph limits (with calming and signed only). It focuses on levels of support, perceived benefits / dis-benefits, speed compliance and change in speed, based on findings for the case study areas.

Note, that 20mph limits with physical traffic calming measures are also referred to as '20mph zones'.

This study has not collected any new primary evidence on safety outcomes (impact on collisions and casualties) or wider impacts (e.g. air quality, noise emissions). However, reference is made to previous research, where relevant.

14.2. How does support for 20mph limits and zones compare?

14.2.1. Views of drivers

Feedback from the in-depth interviews undertaken with non-resident drivers suggests that limits are more popular than zones amongst most drivers, mainly because road humps (in 20mph zones) are perceived to cause damage to vehicles.

Most participants felt that road humps provide a more effective means of slowing down motorists, primarily due to fear of vehicle damage, and because they prevent vehicles building up speed.

"I really think speed humps would improve my area, rather than just the signs"

However, they can result in frequently changing speeds when vehicles speed in between and after the humps, and erratic driving if vehicles try to swerve around humps which do not span the whole road. They are also seen as limiting access for emergency vehicles, and are perceived to increase air pollution.

Chicanes were also felt to provide an effective means of slowing down motorists by preventing vehicles building up speed, and requiring drivers to concentrate. They can also be designed to provide additional pavement space, and / or parking spaces. However, participants felt that they are only effective when a vehicle is approaching in the opposite direction, requiring drivers to give way. They can also result in motorists rushing to get through in time, can increase the likelihood of conflict with cyclists, can be difficult for large vehicles to negotiate, and can cause congestion.

"I don't think chicanes will help. People driving fast can still drive through them, and the traffic that they do slow down can cause congestion, when you need to keep the traffic flowing"

14.2.2. Views of motorcyclists

Evidence from the nationwide online motorcyclist survey shows that while 49% perceive 20mph limits to be 'detrimental' for riders, a higher proportion (66%) described traffic calmed 20mph limits as 'detrimental'.

The most frequently mentioned reasons relate to the following themes:

- Speed bumps and cushions can be dangerous to ride over – speed bumps can be slippery when wet or paint has worn off, and can destabilise a motorbike increasing the likelihood of an accident.
- Tendency for riders to weave around bumps to avoid having to ride over them, which can create pinchpoints and uncertainty, and increase the likelihood of a collision.
- Can result in conflict and aggressive driving, due to other vehicles not giving priority, and conflict when both lanes of traffic are trying to avoid the calming measures.

“Humps can make drivers think you’ve flashed them to pull out. Humps that sit in the middle of the lane force motorcyclists in to the path of oncoming vehicles. Priority calming is ignored by vehicles when bikes approach.”

“De-stabilise the bike, therefore forced to weave around obstructions and onto poor quality surfaces or oncoming traffic.”

“If it’s speed bumps that are a full length of the road, they are uncomfortable, especially on a sports bike. If it is a chicane it causes congestion as traffic has to stop.”

14.2.3. Views of cyclists

Evidence from the nationwide online cyclist survey shows that 20mph zones are less popular with cyclists, than 20mph limits. The proportion describing each type of intervention as beneficial was 57% and 69% respectively; but the proportion reporting 20mph zones as ‘detrimental’ is substantially higher (23% vs 4%).

In general, 20mph zones are perceived to be better at enforcing compliance and reducing speeds.

“I think cars tend to go a lot slower where you’ve got road humps, I just think it’s a fact, so from that point of view, its positive”

However, they are also seen as creating unsafe conditions for cyclists, due to a combination of reasons:

- Drivers concentrating on negotiating traffic calming and paying less attention to other hazards.
- Sharp acceleration and braking close to cyclists.
- Drivers altering their position on the road without sufficient regard for cyclists.
- Creating pinch points for cyclists and drivers, and bringing the two into regular conflict.
- Cyclists trying to avoid traffic calming features (creating potential conflict).
- The white markings associated with traffic calming can be slippery in wet conditions.
- Some cyclists have difficulties signalling while negotiating traffic calming measures.
- Road humps can be uncomfortable to ride over.

“Drivers are bad enough without speed bumps, they’re even worse with them. They concentrate more on the bumps and less on other road users hence more near misses.”

“Humps, cushions and pinch points create safety hazards for all cyclists and the behaviour of vehicle drivers can be erratic or inconsiderate as a result of navigating these obstructions to their path.”

“Not given room at chicanes and speed humps. People speed passed you and then brake hard in front of you before the speed humps.”

Many respondents commented that the specific design of the traffic calming measures was crucial in terms of determining whether the measures benefit cyclists or not.

“Measures which push cyclists and motor traffic into potential conflict (i.e. poorly placed humps) are very detrimental for people on bicycles. Measures tackling the road design that discourage motorists from feeling they are enabled to drive at speed are very beneficial.”

“All depends if the physical traffic calming measurements are well designed to make it safer for cyclists.”

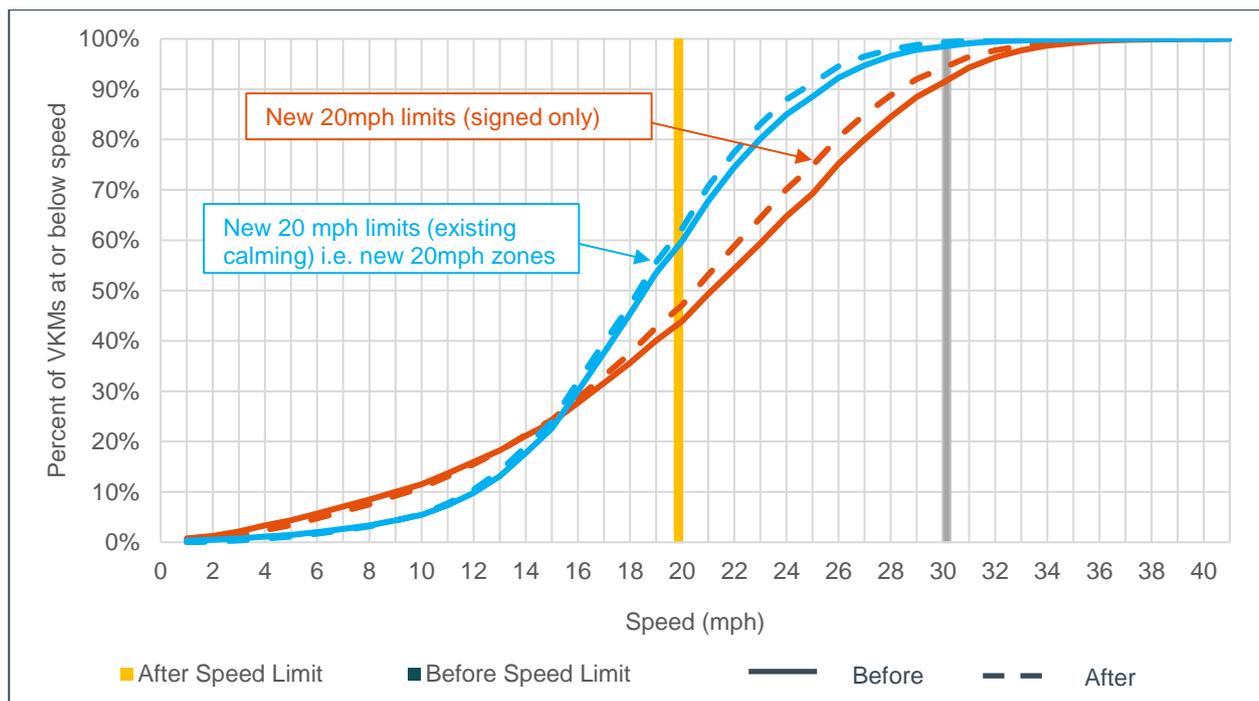
“Calming measures should not impede cyclists - e.g. speed humps should have breaks for cyclists.”

14.3. How do speeds compare in 20mph limits and zones?

14.3.1. How have speeds changed in new 20mph limits, with and without calming?

Some case study roads where the speed limit changed from 30mph to 20mph already had traffic calming in place, in the form of speed humps / tables or chicanes. These are referred to as 'new 20mph roads (existing calming)', and have essentially become new 20mph zones. Figure 49 compares speed outcomes on new 20mph limits, with and without existing calming.

Figure 49. New 20mph limit roads (signed vs calmed) – Cumulative speed distribution (residential areas only), based on GPS journey speed data



Pre-dominantly residential areas only	New 20mph limit (signed only)			New 20mph limit (existing calming) (i.e. zones)		
	Before, After, Diff			Before, After, Diff		
Speed limit	30mph	20mph		30mph	20mph	
Road length	450.5km	450.5km		28.8km	28.8km	
Vehicle kilometres (VKMs) observed	952,551	1,136,370		47,559	56,661	
Compliance	91%	47%	-44%	98%	62%	-36%
Median Speed (mph)	21.1	20.5	-0.7	18.6	18.3	-0.2
85th Percentile (mph)	28.1	27.0	-1.1	24.0	23.5	-0.6
15th-85th percentile	16.6	15.2	-1.3	10.6	10.2	-0.4
%<20mph	44%	47%	+3%	60%	62%	+3%
Major strategic roads	5.3km (1%)			0.0km (0%)		
Important local roads	52.4km (12%)			7.4km (26%)		
Minor local roads	392.8km (87%)			21.4km (74%)		

Post implementation of 20mph limits, there is a higher level of compliance in already traffic calmed roads (62%) than on roads with no traffic calming (47%).

However, comparison of the before and after scenarios suggests that speeds have reduced less on roads where physical traffic calming is already in place. The results for new 20mph limits (with existing calming) show a smaller reduction in median speed (-0.2 vs -0.7mph), 85th percentile speed (-0.6 vs -1.1mph) and the 15th-18th percentile range (-0.4mph vs -1.3mph).

Speeds were already lower on roads with existing calming, prior to the change in limit, e.g. 18.6mph vs. 21.1mph for the median speed. This is despite calmed roads comprising a higher proportion of important local roads, which typically have higher traffic flows, and higher speeds.

It appears that the presence of physical measures (road humps, chicanes) has already encouraged drivers to change their behaviour and to adopt slower speeds, leaving little scope for a further reduction in response to the lowering of the speed limit.

14.3.2. How have speeds changed in new 20mph limits, compared with older limits and zones?

Almost all of case studies had the some pre-existing 20mph limits (signed only and with calming) in place prior to the implementation of the main area-wide scheme; often located outside schools. These roads did not experience a change in limit over the course of the research, but driver behaviour may have been influenced by the introduction of a new 20mph limit over the wider area.

The following paragraphs compare speed changes in the new 20mph (signed only) limits, which form the main focus of the study, with the changes observed on older 20mph limits (signed only and with calming) over the same time span, to identify any associated effects.

Comparison with older 20mph limits (with calming) – Figure 50 compares speed outcomes on new 20mph (signed only) limits with the change observed on older 20mph limits (with calming) (also referred to as older 20mph zones).

Older 20mph limits (with calming), demonstrate a higher level of ‘after’ compliance than the new 20mph limits (66% vs 47%). This could be because compliance improves over time, and the older 20mph zones have had their speed limit in place for longer. Alternatively, it could be that the new 20mph roads have characteristics which mean that drivers are instinctively less likely to slow down (e.g. wider, straighter, busier roads, etc.).

There has been little change in speed on these roads over the course of the research, with the median changing by +0.2mph. However, speeds were already low (17.0mph median speed), and around two-thirds of drivers were already travelling at less than 20mph.

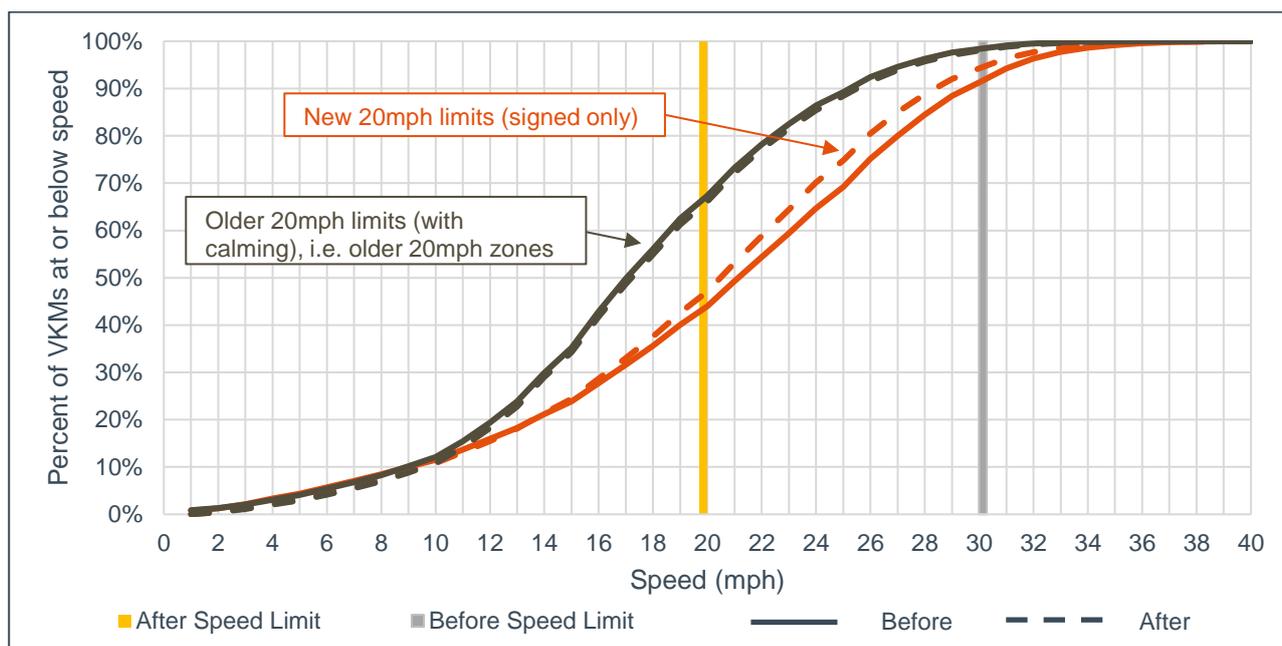
It appears that extending the area covered by 20mph limits has not changed driver behaviour in existing (older) 20mph zones.

Comparison with older 20mph limits (signed only) – Figure 51 compares speed outcomes on new 20mph (signed only) limits with the change observed on older 20mph limits (signed only)

Older 20mph limits (signed only), also demonstrate a higher level of ‘after’ compliance than the new 20mph limits (68% vs. 47%). Again, this could be because the older 20mph limits (signed only) have had their speed limit in place for longer; or it could reflect the characteristics of the roads.

Over the period of research, the older 20mph limits (signed only) show a similar reduction in speed to that observed on new 20mph limits (signed only), at least in terms of the higher end speeds (e.g. -1.3mph vs -1.1mph based on the 85th percentile speed). This is despite the fact that the speed limit has been 20mph throughout the period, and the fact that speeds were already low on these roads (e.g. 16.5mph vs 21.1mph based on the median speed).

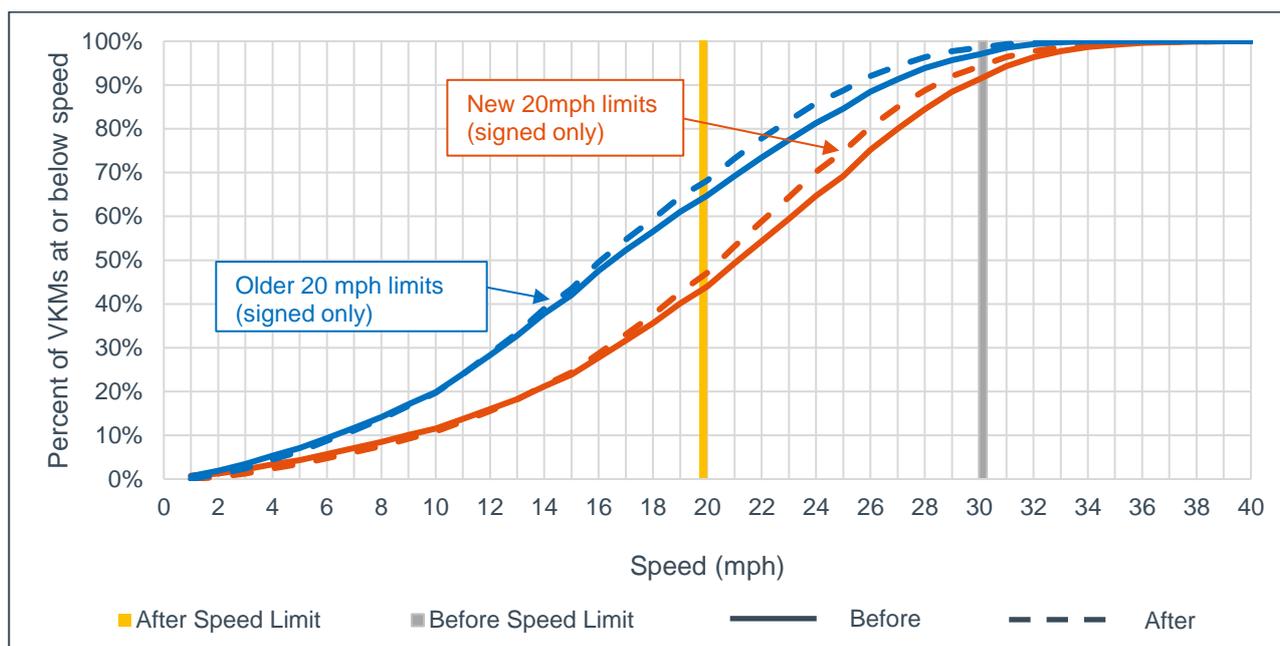
Figure 50. New 20mph limits (signed only) vs. existing 20mph limits (with calming) – Cumulative speed distribution (residential areas only), based on GPS journey speed data



Pre-dominantly residential areas only	New 20mph limit (signed only)			Older 20mph limit (with calming)		
	Before, After, Diff			Before, After, Diff		
Speed limit	30mph	20mph		20mph	20mph	
Road length	450.5km	450.5km		171.7km ^(a)	171.7km ^(a)	
Vehicle kilometres (VKMs) observed	952,551	1,136,370		166,594	185,047	
Compliance	91%	47%	-44%	67%	66%	-1%
Median Speed (mph)	21.1	20.5	-0.7	17.0	17.2	+0.2
85th Percentile (mph)	28.1	27.0	-1.1	23.6	23.9	+0.3
15th-85th percentile	16.6	15.2	-1.3	12.8	12.7	-0.1
%<20mph	44%	47%	+3%	67%	66%	-1%
Major strategic roads	5.3km (1%)			1.2km (1%)		
Important local roads	52.4km (12%)			7.1km (4%)		
Minor local roads	392.8km (87%)			163.4km (95%)		

a. 78% of old 20mph limits (with calming) are in Liverpool Area 2, with most of the remaining roads located in Liverpool Area 7, Middlesbrough and Brighton City Centre.

Figure 51. New 20mph limits (signed only) vs. older 20mph limits (signed only) – Cumulative speed distribution (residential areas only), based on GPS journey speed data



Pre-dominantly residential areas only	New 20mph limit (signed only)			Old 20mph limit (signed only)		
	Before, After, Diff			Before, After, Diff		
Speed limit	30mph	20mph		20mph	20mph	
Road length	450.5km	450.5km		15.7km ^(b)	15.7km ^(a)	
Vehicle kilometres (VKMs) observed	952,551	1,136,370		53,292	59,291	
Compliance	91%	47%	-44%	65%	68%	+3%
Median Speed (mph)	21.1	20.5	-0.7	16.5	16.1	-0.4
85 th Percentile (mph)	28.1	27.0	-1.1	25.1	23.8	-1.3
15 th -85 th percentile	16.6	15.2	-1.3	16.8	15.4	-1.5
%<20mph	44%	47%	+3%	65%	68%	+3%
Major strategic roads	5.3km (1%)			0.9km (6%)		
Important local roads	52.4km (12%)			2.2km (14%)		
Minor local roads	392.8km (87%)			12.6km (80%)		

a. Predominantly located in Chichester (42%) and Brighton Phases 1 and 2 (56%).

Summary – While extending the area covered by 20mph limits has not changed driver behaviour on older 20mph limits (with calming), it appears that there has been some speed reduction on older 20mph limits (signed only). It is possible that the presence of calming (road humps, chicanes) and the nature of the associated roads (which are nearly all minor local roads) has already encouraged drivers to reduce their speed as much as they are willing to do so, in the absence of more proactive enforcement.

However, on older 20mph limits drivers may have been encouraged to reduce their speeds further, in line with their behaviour on new 20mph limits. The sample size for older 20mph limits is smaller than for the other categories of road, and further evidence is needed to support this conclusion.

Existing evidence on speed outcomes in 20mph zones

Existing research (Webster, D and Mackie, A, 1996; Webster, D and Layfield, R, 2003; Allott and Lomax, 2001) suggests that 20mph zones can achieve substantial reductions in average speed, of around 9-10mph. This evidence is largely based on schemes which are small scale (typically covering a few kms of road length), have a before speed well above 20mph (typically around 25mph), and were implemented in the 1990s and early 2000s primarily to address location-specific safety issues. These schemes are therefore very different to the signed only schemes being considered here, which are large area-wide initiatives, with lower before speeds (closer to 20mph), and have been introduced to deliver an area-wide change rather than address location-specific issues.

14.4. How do safety outcomes compare in 20mph limits and zones?

This study has found no evidence to indicate a significant change in collisions and casualties across the nine residential 20mph area-wide limits, relative to the change in the 30mph comparator areas. Brighton Phase 1, a city-centre focused scheme, is the only case study area where the change in collisions and casualties, relative to the 30mph comparator area is significant (-18% for collisions, -19% for casualties).

The study has not examined safety outcomes in newly implemented 20mph zones, so cannot provide any new evidence on the relative impact of new 20mph limits and zones on safety.

Previous research suggests that 20mph zones can result in substantial reductions in average speed of around 9mph, and sizeable reductions in collisions. However, the scale and character of the 20mph zones and limits being compared differs substantially. The evidence is largely based on schemes which are small scale (typically covering a few kilometres of road length), have a before speed well above 20mph (typically around 25mph), and were implemented in the 1990s and early 2000s primarily to address location-specific safety issues.

Existing evidence on safety outcomes in 20mph zones

- Webster and Mackie (1996) researched the before and after speeds of 20mph zones across England, implemented in the early 1990s. At the time of the study, 200 schemes had been installed in the UK, and 82 had been granted permanent status. The most quoted reason for applying for authorisation (required at the time) was accident reduction. The average length of road included within zone areas was 2.5km. About 80% were in residential areas, with the remainder in shopping and commercial areas.
Of the 200 zones considered within the study, before and after speed data had been collected for 32 schemes. This showed an average reduction in speed of 9.3mph, from 25.2mph to 15.9mph). The report also found that traffic flow reduced by 27% within zones and increased by 12% outside the zones, although data was only available for 19 schemes, and not necessarily the same schemes as those included in the speed data analysis. Comparison of before and after accident data for 72 schemes showed that the average annual accident frequency fell by 60%, and child pedestrian and cyclist accidents fell by 70% and 48% respectively. There was a 6.2% reduction in accidents for each 1mph limit.
- Webster and Layfield (2003) undertook a similar study of 20mph zones in London. Initial contact with the London Boroughs indicated that the number of 20mph zones being installed in London had increased from 5 per year (up to 1999) to over 30 per year by 2002, with 137 zones in place at the time of the study. Most of the zones were in residential areas, with over half containing schools and colleges. The average length of road in each zone was 3.4km.
Before and after speed data was only available for 14 of the schemes, and showed average traffic speed reductions of 9.1mph following implementation. Accident data was obtained for 78 schemes. Before periods of five years were used, and the average length of the after periods was about 3 years. Allowing for background changes in accident frequency on unclassified roads in London, the installation of 20mph zones in London was found to have reduced the frequency of injury accidents within the zones by about 42% and reduced the frequency of injury accidents involving fatal or serious injury (KSIs) by about 53%.
Data for 38 zones suggested that little, if any, accident migration had taken place from the 20mph zones.

- There was widespread introduction of 20mph zones in Hull since 1994, and by 2003, there were 120 zones covering 500 streets. Brightwell (2003) undertook an uncontrolled before and after review of casualty statistics covering the seven-year period between 1994 and 2001 which showed an accident reduction of 14% in Hull, compared to an increase of 1.5% in the rest of Yorkshire and Humberside. Furthermore, the zones experienced a 56% reduction in total collisions and a reduction of 90% in fatal and serious injuries. The biggest reductions were child pedestrian casualties, which fell by 74% over the seven-year period.
- A major review of road casualties in London between 1986 and 2006 was published by Grundy et al. (2009). They found that during this time the introduction of London-based 20mph zones was associated with a 42% reduction in road casualties, after adjustment for underlying time trends. They found that 20mph zones were particularly effective in preventing fatal or serious injuries to children, which were reduced by half (50.2%). They also established that there was a small reduction in casualties among cyclists, with a reduction of 16.9%.

The analysis further showed that the reduction in road injuries in 20mph zones occurred at a greater rate than the overall trend of reduction in casualties in London. The publication noted that this was not attributable to any regression-to-the-mean effect, and that there had been no displacement in the accident risk to roads close to the 20mph zones. The paper acknowledges that the research cannot wholly attribute the outcomes to the introduction of the scheme as many other measures may have also had an effect.

14.5. How does use of active travel modes compare in 20mph limits and zones?

An umbrella review of the effects of 20mph zones and limits by Cairns et al. (2014) found mixed evidence regarding walking and cycling levels:

- Kirby (2001) assessed 20 mph zones in Hull, and found that 25% of residents reported walking or cycling more and 60% felt that more children played outside as a result of the scheme.
- However, studies by Webster et al. (2006) and Babbie (2001) found no significant changes in cycling, walking or children playing outdoors, and a study by Social Research Associates (2001) reported a negative effect of 20 mph zones with unanticipated declines in walking and cycling.

Morrison et al. (2004) used a randomly selected sample of the local community and pedestrian counts to determine the effect of a 20mph zone on one road, six months before and six months after the implementation. They found that after the introduction of the traffic calming scheme 20% of respondents said that they walked in the area more as a result of it. There were smaller percentages of respondents who said that they cycled or allowed children to play, walk, or cycle as a result of the traffic calming scheme.

14.6. How do environmental outcomes compare in 20mph limits and zones?

14.6.1. Air quality

Section 10.4 shows that air quality in 20mph limits can be affected by vehicle speeds, driver behaviour, and volume of traffic.

Existing evidence suggests that vehicle emissions in 20mph zones may be adversely affected by changing vehicle speed and acceleration rate (Boulter and Webster, 1997, cited in Grundy C et al., 2008). Although vehicle emissions are usually less at lower speeds, emissions may increase in 20mph zones as vehicles use more fuel to accelerate between calming measures.

Relatively few studies have attempted to quantify the energy and environmental impact of traffic calming measures, and the results are mixed results with regards to the impact on emissions (greenhouse gases and air quality).

- Pharoah (1991), cited in Ahn and Rakha (2009), found that traffic calming measures with smooth and low speed driving in a high gear may result in relatively low emissions and that the effect of traffic calming strategies on air quality depends on how the scheme influences both the average speed of

traffic and the amount of speed variation. While some studies found that traffic calming measures benefit air quality, several concluded they increase vehicle fuel consumption and emissions.

- Litman (1999), cited in Ahn and Rakha (2009), studied the benefit and cost of traffic calming measures and concluded that traffic calming strategies that reduce traffic speeds and smooth traffic flow can generally reduce air pollution, while those that increase the number of stops may increase emissions. He also found that when traffic calming reduces vehicle speeds from 50 km/h to 30 km/h for an “Easy Driver,” savings in CO, HC, NOx, and fuel consumption in the range of 13%, 22%, 48%, and 7%, respectively, are achievable. In the case of the “Aggressive Driver” savings in CO, HC, and NOx in the range of 17%, 10%, and 32%, respectively are observable with increases in vehicle fuel consumption in the range of 7%.
- TRL research undertaken by Boulter et al. (2001), also considered the effect of traffic calming measures on air quality. The evidence reported that the mean emission rates of carbon monoxide, hydrocarbons, nitrogen oxide, and carbon dioxide from petrol non-catalyst, petrol catalyst, and diesel cars increased by up to 60% following the introduction of traffic calming measures. However, it was estimated by TRL that the increased emission rates were not expected to lead to poorer local air quality.
- Daham et al. (2005), cited in Ahn and Rakha (2009), simulated braking and acceleration events to mimic speed humps by driving a normal road using an on-road emission measurement device. He found that speed humps increase HC, CO, NOx, and CO₂ emissions by 148%, 117%, 195%, and 90%.
- According to Williams (2013), measures with the least detrimental impact on vehicle emissions are those that induce the least variation in speed. Emissions were monitored on 10 routes with a range of different traffic calming methods (vertical deflection, horizontal deflection and psychological). Vehicles were often seen to exhibit a greater variability in speed on links with vertical deflection than those without; however, the impact of such traffic calming features was not thought to be as large as that of other traffic management features, such as pedestrian crossings and signalized junctions. Williams (2013) also shows that a higher proportion of time spent accelerating and decelerating, is likely to be associated with increased particulate matter associated with tyre and brake wear.

14.6.2. Noise levels

Bellefleur and Gagnon (2011) show that vehicle noise increases with speed; however, increasing the magnitude and frequency of accelerations and decelerations tends to also increase the noise generated. This type of driving is characteristic of areas with traffic calming, and the type of measure implemented can have very different effects on noise levels. Grundy et al (2008) state that slower moving traffic tends to be quieter, however the constant braking and acceleration between traffic calming measures can increase noise and disturb local residents.

Pharoah and Russell (1989) state that a scheme with measures that allow the constant use of 3rd gear will result in lower noise levels than a more severe scheme that require frequent changes to 2nd gear (which may be more common if traffic calming is in place). The higher average speeds achieved with the former would have to be traded off against the higher noise of the latter. Where speeds have been reduced from 50 to 30kph, typical reductions in noise levels of between 4-5 dBA have been measured.

Additionally, the types of vehicles using the road may also have varying effects, noise surveys in Slough and York (Taylor et al. 1997, cited in Grundy et al., 2008) found that traffic calming measures reduced vehicle noise for light vehicles but heavier vehicles tend to be noisier. However, Bellefleur and Gagnon (2011) state that on traffic calmed roads, cars tend to generate more noise as a result of slowing down and speeding up as a result of a varied road layout, than heavy vehicles. This is supported by Kennedy et al., (2005) who state vehicles having to travel around vertical deflections can generate increased noise and vibration.

14.7. Summary and key messages

A summary of the key findings is presented below:

14.7.1. How does support for 20mph limits and zones compare?

20mph zones (with physical traffic calming measures) are seen as a more effective means of slowing traffic down (by focus group participants, drivers interviewed, and respondents to the cyclists and motorcyclists' surveys). However, they are less popular amongst drivers, motorcyclists and cyclists, than 20mph limits for a range of reasons, including concern about vehicle damage and the safety implications of variability in driving speed and vehicle position on the road.

14.7.2. How do speeds compare in 20mph limits and zones?

Some case study roads where the speed limit changed from 30mph to 20mph already had traffic calming in place, in the form of speed humps / tables or chicanes. These have essentially become new 20mph zones. In addition, almost all of case studies had the some pre-existing 20mph limits (signed only and with calming) in place prior to the implementation of the main area-wide scheme; often located outside schools. These roads did not experience a change in limit over the course of the research, but driver behaviour may have been influenced by the introduction of a new 20mph limit over the wider area.

Post implementation of 20mph limits, there is a higher level of compliance on already traffic calmed roads (62%), older 20mph limits (with calming) (66%), older 20mph limits (signed only) (68%); than on new 20mph (signed only) roads (47%).

Extending the area covered by 20mph limits has not changed driver behaviour on adjacent older 20mph limits (with traffic calming), but it appears that there has been some reduction on adjacent older 20mph limits (signed only). It is possible that the presence of calming (road humps, chicanes) and the nature of the associated roads (which are nearly all minor local roads) has already encouraged drivers to reduce their speed as much as they are willing to do so, in the absence of more proactive enforcement.

However, on older 20mph limits (signed only) drivers may have been encouraged to reduce their speeds further, in line with their behaviour on new 20mph limits. The sample size for older 20mph limits is smaller than for the other categories of road, and further evidence is needed to support this conclusion.

14.7.3. How do safety outcomes compare in 20mph limits and zones?

Previous research also shows that 20mph zones can result in sizeable reductions in collisions and casualties when compared with the 20mph limits in the case study areas. For example, Webster and Mackie, 1996, reported a 60% reduction in collisions (no allowance made for background trends); Webster and Layfield, 2003, reported a 42% reduction in injury accidents (after allowing for background changes in accident frequency on unclassified roads); Brightwell, 2003, reported a 56% reduction in annual collisions (no allowance for background trends); and Grundy et al., 2009, reported a 42% reduction in casualties (after adjusting for background trends). However, the scale and character of the 20mph zones examined differs substantially from the 20mph area-wide limits implemented in the case study areas.

14.7.4. How does use of active travel modes compare in 20mph limits and 20mph zones?

Existing research provides mixed evidence regarding the impact of 20mph zones on walking and cycling levels.

14.7.5. How do environmental outcomes compare with those in 20mph zones?

Existing research suggests that relative to 20mph limits, 20mph zones have an adverse effect on air quality and noise levels due to vehicles accelerating and braking more frequently, resulting in higher tailpipe emissions, braking dust and tyre wear, and noise emissions. As on all roads, the impact can be exacerbated by high traffic flows and is heavily dependent on the vehicle types using the road in question.

15. Conclusions and considerations for decision-makers

15.1. Introduction

This study substantially strengthens the evidence base on perceptions, speed and early safety outcomes associated with 20mph (signed only) limits. It is the only major UK study to date to consider multiple case study areas and provide a national view. It combines evidence from 12 case study schemes comprising over 700kms of new 20mph (signed only) limits and uses data from comparable locations where 20mph limits have not been introduced to control for background trends. It brings together a wide range of qualitative and quantitative material, to provide robust evidence on observed and perceived outcomes following the implementation of 20mph (signed only) limits.

Feedback from over 5,400 questionnaires with a range of road users is used to identify perceptions about 20mph limits and changes in personal driving / riding behaviour. Analysis of speed outcomes is based on over 18 million vehicle kilometres of journey speed data from in-car GPS devices, and spot speed (instantaneous speed) data from over 400 locations. Just under 4,000 collisions have been analysed to examine early safety outcomes in 20mph limit areas. Evidence on mode use impact is based on self-reported behaviour change identified through questionnaire surveys and an investigation of associated factors.

This study has not sought to collect primary data on wider impacts relating to the local economy, the environment (greenhouse gas emissions, air quality, noise) and health. Existing empirical evidence is weak, inconclusive, or complex (particularly regarding air quality) and there remains an evidence gap regarding the impact of 20mph limits on these areas.

In summary, this study provides substantial new evidence on the implementation of 20mph limits, their effectiveness in a range of contexts, and lessons and considerations for policy and decision-makers. The key findings and conclusions in relation to each of these issues are set out below.

15.2. How have the revised guidelines on local speed limits been implemented?

In 2013, DfT provided revised guidelines on the setting of local speed limits (DfT Circular 01/2013). The guidance says that authorities can set 20mph speed limits in areas where local needs and conditions suggest that the current limit is too high. Traffic authorities are asked to have regard to this guidance, but it is not mandatory. Instead, it is about empowering local highways authorities and local people to make decisions that take into account local circumstances and needs. The key themes set out within the guidance are identified in Table 45, along with a summary of the local authority response. In general, local authorities have responded positively to the guidance and largely followed the guidelines set out in the document.

Table 45. Local authority response to Circular 01/2013 in case study areas

Guidance theme	Local authority response
<p>Consider more 20mph limits, over a larger number of roads where mean speeds are already at or below 24 mph on a number of roads (para 97)</p>	<p>Substantial growth in area-wide limits in recent years, covering larger areas and often entire urban areas.</p> <p>Over the last few years a large and growing number have implemented area-wide 20mph limits. In 2016, the Department for Transport asked all local authorities to provide details of the length of road with a permanent 20mph limit (signed-only or with physical calming) in their local authority area. Across the 39 authorities responding, the length of 20mph road had increased from 1,474kms in 2010 to 4,787kms in 2015, an increase of 225%¹¹⁰.</p>

¹¹⁰ The local authorities with the greatest coverage of 20mph limits were: Sefton (800kms in 2015); Wigan (750kms in 2015); Nottingham (580kms in 2015); Southwark (336kms in 2015); Camden (258kms in 2015). Some authorities with greater coverage may not have responded.

	<p>A survey by Brake in June 2015¹¹¹ estimated that 21% of councils in Great Britain had introduced widespread signed-only 20mph limits or made a commitment to do so, and a further 36% had limited trials in place. However, 43% had no area-wide limits in place or plans for such schemes. This proportion is believed to have decreased in recent years, but further data is required to confirm this.</p> <p>Knowledge gained through the course of this research suggests that the majority of 20mph limits implemented are focused on residential areas, but a substantial number of town and city centre schemes have also been implemented.</p> <p>However, not all local authorities are implementing 20mph limits.</p> <p>Although a substantial proportion of local authorities have implemented area-wide 20mph limits, some have chosen not to (estimated at less than half, based on the above evidence). Feedback from three case study authorities which have made a decision not to implement 20mph limits suggests that these decisions have been driven by lack of definitive proof about the tangible benefits of schemes, and opposition from the local community and local councillors. The Councils concerned were not able to provide evidence to clearly demonstrate the scheme rationale, objectives and outcomes, and ultimately were not able to secure buy-in from key stakeholders.</p>
<p>Most appropriate where the mean speed is already at or below 24mph (para 95)</p>	<p>The majority of 20mph limits have been implemented on roads with average vehicle speeds below 24mph.</p> <p>Circular 01/2013 suggests that where mean speeds exceed 24mph the introduction of signage only is unlikely to lead to compliance, and 20mph limits are therefore most appropriate where the mean speed is already at or below 24mph.</p> <p>Spot speed data shows that 86% of roads in the pioneering Portsmouth scheme (which formed the basis for the guidance set out in Circular 01/2013) had a mean before speed below 24mph. The rest of the case studies were implemented more recently and typically included a lower proportion of roads with before mean speeds below 24mph, varying from between 20% and 72% and equating to 59% overall. However, the number of sites surveyed in these areas was substantially less than in Portsmouth and known to be biased towards sites where higher speeds were expected. The actual proportion with a before mean speed below 24mph, taking all roads into account, is therefore likely to be higher.</p> <p>Some authorities reported that they had decided to include streets with higher limits to avoid isolated 30mph roads and to provide consistency in signage and road user perceptions. Others deliberately excluded streets with average speeds of more than 24mph or with known speeding issues.</p>
<p>Consider introducing 20mph limits on major streets (as well as residential streets) where foot and cycle movements are important and this outweighs the disadvantage of longer journey times for motorised traffic (para 84)</p>	<p>Major streets excluded from a number of schemes</p> <p>The area-wide residential case studies considered within this study typically exclude major streets such as strategic routes (A and B-class roads), key bus routes, distributor roads, and streets with non-residential frontages. In some of these locations, the road's function and the mix of traffic it carries means that motor traffic is the primary consideration.</p> <p>However, the two city centre case study schemes both comprise a blanket 20mph limit, which includes more strategic A and B-class roads with higher traffic flows, giving more importance to pedestrian and cycle movements across the entire area. It is interesting to note that in these particular case studies, the average before speed was less than in the residential case study areas¹¹².</p>
<p>Speed limits should encourage self-compliance. No expectation of additional police enforcement beyond their routine activity, unless this has been explicitly agreed (para 85)</p>	<p>Low levels of police enforcement across most of the case studies</p> <p>The limits have generally been implemented on the basis that they should be self-enforcing, with no expectation of additional police enforcement. Consequently, evidence provided by the case study authorities (interviews with police and local authority officers) suggests that, most of the time, the level of enforcement has been low across the case study areas.</p> <p>Community-based initiatives (e.g. community speed watch, and education interventions for offenders) and vehicle activated signs have been implemented in a few locations, but have been sporadic and small scale, often hampered by resource constraints. One example of a more proactive approach to police enforcement is Operation Hawmill in Calderdale which resulted in 34 tickets being issued for speeding on 20mph limit roads over a 6 month period.</p>

¹¹¹ Brake (2015); *GO20 Towards changing the default urban speed limit to 20mph*. Information was requested from all 206 local traffic authorities in Great Britain, of which 122 replied.

¹¹² It appears that the presence of congestion, pedestrian and cyclists, crossing points, parking and buses, may have influenced the speed at which drivers were able or chose to drive in city centre areas, with 59% already driving at less than 20mph.

15.3. How effective have 20mph limits been?

Level of support – The study shows that 20mph limits are generally supported and there is little call for the limit to be changed back to 30mph; even though most residents and users do not perceive vehicle speeds to have changed. Local residents and other road users generally perceive the 20mph limits as beneficial for local residents, pedestrians and cyclists. From a driver perspective, they make driving at a slower speed more acceptable. (See Section 6.3, and 7.6)

Speed outcomes – Journey speed analysis (based on in-car GPS data) shows that in the case study areas, the majority of drivers are travelling less than 24mph (i.e. at speeds close to 20mph): 70% in residential areas and 86% in city centre areas. This represents a small increase on the before situation: 65% in residential areas and 79% in city centre areas. The nature of the roads where the limits have been introduced means that in many cases lower speeds were already 'self-enforced'. Reducing the speed limit to 20mph has helped reinforce this process.

Following the introduction of 20mph limits (signed only) the median speed has fallen by just under 1mph, with faster drivers reducing their speed more. The evidence suggests that this is partly due to the implementation of 20mph limits, but also reflects background trends in speed on urban roads.

- In residential case study areas, the introduction of 20mph limits is estimated to have resulted in a 0.8mph reduction in median speeds and a 1.1mph reduction in 85th percentile speeds¹¹³ on 'important local roads'¹¹⁴.
- In city centre case study areas, the analysis shows a 0.6mph reduction in median speeds and a 1.0mph reduction in 85th percentile speeds.

These figures are in addition to a small background reduction in speeds which appears to have occurred on urban roads with similar characteristics to the case study areas.

These findings are broadly consistent with previous research¹¹⁵ which reports reductions in mean speed of 0.5mph-2.0mph based on instantaneous spot speed data¹¹⁶, and with variable accounting for background trends. The modest scale of speed reduction is not surprising, as a substantial proportion of drivers were already travelling at speeds close to 20mph prior to the introduction of the new limits. The fact that faster drivers have reduced their speed more is encouraging as other research shows that higher speeds are associated with increased safety risk (more collisions, increased severity, and perceptions that the environment is not safe for vulnerable users. (See Sections 7.1, 7.2 and 7.3)

The study has shown that the speed at which people drive is influenced more by the look and feel of the road, than whether a 20mph or 30mph limit is in place. It appears that some roads where 20mph limits have been implemented are naturally 'self-explaining roads' where drivers 'instinctively' drive more slowly (because their length provides less opportunity to build-up speed, visibility may be limited, drivers do not feel that they have sufficient space to drive faster or feel that it is appropriate to do so, and because they serve local start/end destinations only). In other cases, the look and feel of the road naturally encourages higher speeds. In many cases the implementation of a 20mph limit has simply formalised existing behaviour.

The challenge is how to change driver attitudes and behaviour in other locations. Evidence from this study (and others¹¹⁷) shows that bigger speed reductions occur on faster roads, with higher volumes of traffic and providing a locally important strategic function. Circular 01/2013 encourages authorities to consider introducing 20mph limits on more major streets where foot and cycle movements are important, but also advises that where average speeds exceed 24mph, the introduction of signage only is unlikely to lead to 20mph compliance. This study supports this advice and confirms that on faster roads more needs to be done to achieve compliance and maximise the benefits. Even on these types of roads the actual reduction in speeds has been small, with lowering the speed limit using signs alone leading to a reduction in speed of

¹¹³ The 85th percentile speed is the speed that 85 percent of vehicles do not exceed. Only 15 percent of vehicles go faster than this speed, and 85 percent go at or below this speed. It is regularly used in traffic engineering as a standard to set safe speed limits and in the design of roads.

¹¹⁴ Case study roads have been classified as 'minor local roads', 'important local roads', and 'major strategic roads' using TomTom's Functional Road Classes, which provides a proxy for the size, nature and purpose of each road.

¹¹⁵ E.g. Burns A, et al. (2001), Atkins (2010), Bristol City Council (2012), Edinburgh City Council (2013), and Pilkington et al. (2018).

¹¹⁶ Spot speed surveys generally record higher average and 85th percentile speeds as they measure instantaneous speed at a specific location.

¹¹⁷ Pilkington et al. (2018).

about 1mph. Without supporting measures to encourage compliance, there is a risk that non-compliance with the speed limit becomes the norm.

Introducing physical traffic calming or changing the design of the streets represents one approach to improving compliance. However, more realistically it needs to be about changing how drivers think about driving in residential areas and locations with significant pedestrian and cycle activity. This is likely to require high profile and integrated engagement activity. 20mph schemes have the potential to deliver a range of transport and other benefits (particularly relating to health and community). This provides an opportunity for scheme promoters to work and engage with a range of policy and interest groups to reinforce messages about the rationale and potential benefits of 20mph limits. The most effective schemes are likely to be those which are based on a broad integrated policy agenda (involving health, environment, urban planning, emergency services, education, community representatives, etc.). Longer-term 20mph schemes which are supported by complementary transport, health, environment and community policy and interventions are likely to deliver greater benefits.

Enforcement – Although 20mph limits are intended to be self-enforcing, policy makers need to acknowledge that the most common area of concern amongst the public was around compliance, with most focus group and survey participants of the opinion that stronger enforcement measures are needed if 20mph limits are to be effective. There is a widespread view amongst the public that 20mph limits are not enforced, and the likelihood of being caught exceeding the limit is very small. This is one of the reasons why bigger reductions in speed have not been observed in scheme areas. (See Sections 8.2, 8.3 and 8.4)

Feedback from the case study authorities suggests that what the police say about enforcement is can be important in terms of how 20mph limits are perceived by the local community. (Section 5.11)

Early safety outcomes – There is an established positive relationship between vehicle speed and injury collisions¹¹⁸ – the higher the speed, the more collisions and where collisions do occur, the higher the risk of a fatal injury at higher speeds. The spread of speeds, and proportion of vehicles driving above the speed limit is also important.

However, based on the evidence available to date, this study has found no significant change in collisions and casualties, in the short term, in the majority of the case study areas (including the aggregated set of residential case studies). While some individual case study areas show a reduction in collisions / casualties when background trends are accounted for, these results are based on very small sample sizes and it is not possible to attach any confidence to their significance.

There is some evidence to suggest a positive 20mph impact in one case study location (Brighton Phase 1), where a blanket 20mph limit was introduced covering both major and minor roads, and where there is sufficient data to indicate a statistically significant change in collisions and casualties. It should be stressed that this represents just one case study, and the extent to which the findings are transferable to other locations is unclear.

The road safety data analysed for this study was based on between 17 and 42 months of data after the introduction of the 20mph limits, reflecting the different implementation dates for the various case study schemes. Further data is required to determine the long-term impact of the limits. Collision and casualty rates are known to fluctuate from year to year, and the post implementation data currently available may not be indicative of the longer-term trend. (See Sections 10.2 and 10.3)

Walking and cycling – Feedback from local residents and road users suggest that slower speeds are one of a combination of factors required to improve the environment for walking and cycling. In the case study areas, there continues to be a range of barriers which discourage walking and cycling. Time constraints, journey distance, and a general preference for driving remain important considerations. However, there are encouraging signs of a small (but significant) increase in use of active travel modes, based on self-reported evidence. In the case study areas, 5% of residents surveyed said that they are walking more and 2% said that they are cycling more since the introduction of the 20mph limits. Further changes may occur over time, as a result of the cumulative effect of other sustainable travel interventions or changes in individual circumstances. (See Sections 9.2-9.3, and 12.2)

Integration with other policy areas – This study has primarily focused on the impacts associated with introduction of a 20mph limit through signage and engagement activities only; and in the absence of any

¹¹⁸ Taylor et al. (2000), Finch et al. (2004), Elvik (2009), Richards (2010), Kröyer et al. (2014).

physical calming measures or changes to the landscaping or design of streets. It has not been possible, within the timescales of the study, to consider the longer-term role of 20mph limits as part of an integrated approach to address transport, community, environment and health objectives. In this context, the success of the Healthy Streets¹¹⁹ approach in London, which has been integrated into all aspects of Mayoral policy, will be of particular interest. This seeks to make London a greener, healthier and more attractive place through policy making and delivery at a street-level, network-level, and development-level. Slower speeds are at the heart of the approach, creating streets which are more attractive for people to walk, cycle and spend time in.

15.4. Impact of new vehicle technologies

It is important to note that the impact of new vehicle technologies has not been considered in this evaluation study. The introduction of the following technologies could have a significant impact on vehicle speeds (and compliance with speed limits), vehicle emissions and noise:

- Driver assistance or override systems (and autonomous vehicles in the longer term) are likely to lead to much stronger compliance with speed limits.
- Comprehensive Vehicle Tracking (linked to insurance premium) is also likely to encourage stronger compliance with speed limits.
- Further improvements in combustion engine technology and vehicle efficiency (vehicle weight, tyres, etc) and increased proportion of hybrid and electric vehicles in the fleet, leading to reduced vehicle emissions per mile and traffic noise. In July 2017, the Government announced plans to end the sale of all new conventional petrol and diesel cars and vans by 2040, as part of The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations, produced by DEFRA and the Department for Transport¹²⁰.

15.5. Lessons and considerations for national decision-makers

National guidance – Based on the findings of this study, the guidance set out in DfT Circular 01/2013 (summarised in Section 2.1) remains broadly valid. This states that where there is expected to be a positive effect on road safety and a general favourable reception from local residents, traffic authorities should consider implementing area-wide 20mph limits on:

- major streets where there are, or could be significant numbers of journeys on foot, and/or where cycle movements are an important consideration, and this outweighs the disadvantage of longer journey times for motorised traffic; and
- residential streets where the streets are being used by people on foot and on bicycles, there is community support, and the characteristics of the street are suitable;

and, on the assumption that the limits are generally self-enforcing and that there should be no expectation on the police to provide additional enforcement beyond their routine activity, unless this has been explicitly agreed.

However, consideration should be given to encouraging traffic authorities to work with relevant partners from the police, health, environment, urban planning, education, and the local community to deliver 20mph limits as part of an integrated approach to addressing transport, community, environment and health objectives.

The guidance also needs to recognise the concern amongst the public regarding the apparent lack of enforcement, and the general view that the likelihood of being caught exceeding the limit is very small. Where a more proactive enforcement approach by the police is not practical, authorities should be encouraged to consider alternative approaches (e.g. community-based initiatives, use of vehicle activated signs, etc.), which may still require low level involvement of the police.

It is acknowledged that the current guidance is likely to lead to a mix of approaches across the country in terms of speed limits in built up areas, which creates a challenge in terms of embedding a culture of slower speeds in residential and pedestrian environments, and achieving driver compliance where 20mph limits are

¹¹⁹ Healthy Streets for London: Prioritising walking, cycling and public transport to create a healthy city (TfL, Feb 2017)

¹²⁰ <https://www.gov.uk/government/news/plan-for-roadside-no2-concentrations-published> (Accessed 17/04/2018).

in place. There may therefore be broader reasons for strengthening the guidance whilst recognising that authorities retain the responsibility for setting speed limits on their roads.

National awareness campaigns – Changing how drivers think about driving in residential locations and areas of high pedestrian and cycle activity is crucial to the success of 20mph limits; and ensuring the non-compliance with the speed limit becomes the norm. Local authorities have a key role to play here and can engage directly with the local community. However, national publicity (for example, as part of DfT's *Think!* road safety speed campaign) could also help highlight the benefits of 20mph limits and reinforce messages about driving at an appropriate speed in residential areas.

Further analysis of safety outcomes – This study has found no significant safety outcome (in terms of collisions and casualties) in residential areas, based on the post implementation data available to date. Due to the small sample sizes and variability in the data, the statistical analysis undertaken to date indicates that the real change could be positive or negative. In addition, it has not been possible to draw any conclusions regarding the relative change in fatal injuries, cycle casualties, and casualties involving older people.

In the case of both the residential and city centre case studies, further data is required to determine the long-term impact of 20mph limits. Collision and casualty rates are known to fluctuate from year to year, and the post implementation data currently available may not be indicative of the longer-term trend.

It is therefore recommended that the safety analysis is updated once five years of data becomes available for each of the case study areas, i.e. once the 2020 STATS19 data has been published. This would be in line with standard evaluation good practice as undertaking a five year post-implementation evaluation is the standard approach for monitoring the impact of major transport schemes.

Further evidence on walking and cycling – This study has found a small (but significant) increase in walking and cycling activity. However, the results are based on self-reported perceptions of behaviour change and may not accurately reflect the real change in the frequency and amount of walking / cycling activity undertaken. In addition, there appears to be a lack of robust evidence from other studies to demonstrate the impact of 20mph limits on walking and cycling levels. Given the central role of walking and cycling in delivering health and environmental benefits, further evidence is needed regarding the strength of the relationship.

This will be a challenge as change in mode use is influenced by a range of factors and may occur over time rather than as a one-off decision. Long-term analysis of the relationship between walking and cycling activity nationally and the roll out of 20mph limits, may identify a relationship, but would need to take account of external and extraneous factors.

Is 20 plenty for health? Evaluation of the 20mph speed limit networks in Edinburgh and Belfast on a range of public health outcomes.

The NHS National Institute of Health Research has commissioned a major study into the health impacts of 20mph limits based on schemes in Edinburgh and Belfast. The study will run until 2020 and is intended to provide evidence on the impact of 20mph speed limits on safety and levels of physical activity, using surveys and before and after counts. The study is being undertaken by the University of Edinburgh and Sustrans.

Clarity on the role of 20mph limits and air quality – The relationship between speed and air quality is complex and influenced by a mix of factors including vehicle type, brake and tyre wear, variability and consistency of driving speed, traffic volume, and the nature of the road environment. Given the current focus on air quality and the need for action in many local authority areas to meet the requirements of the National Air Quality Plan and EU Air Quality Directive requirements, further clarity on the role that 20mph limit schemes could play would be beneficial.

National database of speed limits – One of the key challenges for this study was the lack of a definitive national database of speed limits identifying the location of all 20mph limits. This would provide the Department for Transport with a greater understanding of the coverage of 20mph limits, and would enable more detailed investigation of national trends and datasets. For example, the rate of collisions and casualties on 20mph limit roads (compared with high limits) at a national level, links between levels of walking and cycling activity (as monitored in the Active People Survey) and the roll out of 20mph limits nationally, the role of 20mph limits in Air Quality Management Areas, etc.

Speedmap

Speedmap is a long-term project with the aim of producing a network-independent national speed limit map for the UK. It has been developed in recognition of the need for an accurate map to support innovation in road safety – without being tied to a costly proprietary mapping solution.

15.6. Lessons and considerations for local decision-makers

Lessons and considerations for local decision-makers are set out in Sections 4.4 and 5.13, covering the following themes:

- clarity around strategic case, objectives and outcomes;
- integration with complementary transport, health, environment and community policies and interventions;
- tailoring the scheme design to local circumstances;
- signage requirements;
- the importance of effective consultation and engagement;
- engagement with young drivers;
- appropriate skillsets;
- management of public expectations;
- revenue cost; and
- monitoring.

Appendix A. Bibliography

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Appendix B. Summary of case studies

B.1. Scheme descriptions

Detailed descriptions of the case study schemes and reasons for scheme implementation are provided in Tables B.1 and B.2.

Table B1. Detailed description of case study schemes

a) Small-scale (predominantly residential and schools)

ID	20mph Typology	Area-wide / Standalone	Geography	Description
<p>R-SM1 Metropolitan unitary authority A Walsall (Rushall)</p>	<p>Predominantly residential and schools Small area bounded by two classified roads, a local distributor road, and green space. Predominantly semi-detached housing dating from 1920s, with some new areas. Most, but not all, have off-street parking.</p>	<p>Small scale standalone scheme (i.e. not area-wide) Covers all residential areas within scheme boundary. All minor roads.</p>	<p>Large city Population > 400,000 Length of new 20mph (signed only) road = 5.8kms</p>	<p>This is one of five residential 'pilot' 20 mph speed limit schemes implemented in the borough since January 2014. A further 10 areas are being considered depending on the outcomes of the pilot schemes. The cost of this pilot scheme was £21,000, primarily funded through the Local Transport Plan. Operates 24 hours a day, 7 days a week. There is an industrial area to the east of the scheme, and two routes through the estate are used as 'rat-runs'. There are some pre-existing traffic calming measures and one pre-existing 20mph limit, from previous local safety initiatives. Population within scheme area estimated at a couple of thousand.</p>
<p>R-SM2 Large county authority A Winchester (Stanmore)</p>	<p>Predominantly residential and schools Self-contained residential area, less than a km from the City Centre 20mph scheme (but separated by a 30mph area). Wide roads with on-street parking, houses often set back behind grass verges. Some Council housing.</p>	<p>Small scale standalone scheme (i.e. not area-wide) – <i>although other small residential pilot schemes have been implemented elsewhere in the City, along with a City Centre scheme.</i> Covers all residential areas within scheme boundary. All minor roads.</p>	<p>Medium town / city Population c.115,000 Length of new 20mph (signed only) road = 13.5kms</p>	<p>One of a programme of 20mph pilot schemes being implemented across the County to create a better environment in residential areas. Implemented in July 2014. The total scheme cost was approximately £60,000, funded through the Local Transport Plan. The area covered by the scheme has a population of c.4,500, and it is one of the less affluent parts of the City.</p>

b) Area-wide (predominantly residential and schools)

ID	20mph Typology	Area-wide / Standalone	Geography	Description
R-AW1a Metropolitan unitary authority B Liverpool (Area 7) (City centre periphery)	Predominantly residential and schools Area includes part of pedestrianised City Centre, office blocks on periphery of city centre, along with flats (1950s/60s style tower blocks and modern blocks). Mixed housing further out, including significant areas of older style terraced housing, narrow roads, and on-street parking (significant parts covered by pre-existing 20mph zones).	Part of area-wide scheme covering whole of the city. Excludes classified 'A' and 'B' roads, main bus routes with high frequency services, distributor roads, industrial estates, roads with no residential frontages, and roads which are wider than one carriageway. However, 20mph limits have been introduced on some shopping streets classified roads or main bus routes, due to the high levels of pedestrian activity.	Large city Population > 400,000 Length of new 20mph (signed only) road = 52kms (Area 7) Length of new 20mph (signed only) road = 84kms (Area 2)	A city-wide 20mph scheme has been implemented, covering the majority of the city's residential roads (approximately 70% of the city's streets). The city was been split into seven areas, using 'A' roads as natural dividers. Implementation began in 2013 , with the last area completed in 2016. Area 6 (covering the City Centre) was the first area to be implemented in early 2013. Area 2 (Area B) followed in April 2014, and then Area 7 (Area A) in January 2015 – reflecting the severity of accident rates in different areas. The scheme cost £1.7 million , part-funded by the City Council and the Primary Care Trust (£400,000). The PCT also paid £265,000 for a programme of perception surveys and community engagement work on slower speeds. Operates 24 hours a day, 7 days a week. All areas contain some existing traffic calming measures and 20mph zones from previous safety campaigns. <i>Note – A child road fatality occurred in Area B in Summer 2015, generating significant publicity and public concern about vehicle speeds in the area. This road was excluded from the sample area for the residents' questionnaire.</i>
R-AW1b Metropolitan unitary authority B Liverpool (Area 2)	Predominantly residential and schools Largely self-contained residential areas bounded by main roads, further away from the city centre. Mainly terraced and semi-detached suburban housing built last century. Mix of road widths and on- / off-street parking.	A small number of non-residential roads have had 20mph limits introduced, to promote them as quiet cycling routes (these often run parallel to busier main roads). Advisory 20mph signs have been introduced where schools are located on main roads.		
R-AW2 Urban unitary authority A Middlesbrough	Predominantly residential and schools Area to the north comprises terraced housing, narrow roads and on-street parking; area to the south comprises newer housing estates, wider roads, off-street parking, and cul-de-sacs; central area comprises mixed housing.	Area-wide scheme covering half of town/city. But excludes strategic routes, those fronted by non-residential uses, residential streets with no direct frontage, wider roads and those with speeding problems.	Large industrial town Population c.170,000 Length of new 20mph (signed only) road = 97kms	The Council has established 20mph speed limits on 44% of the total road network in the town, mainly focused on residential areas, over two phases (comprising 49 discrete areas) between March 2012 and June 2013. The total scheme cost was approximately £140,000, which was funded through the Local Transport Plan. Operates 24 hours a day, 7 days a week. Outside the main scheme area, 20mph flashing lights operate during school hours only. Other schools are covered by the main 20mph scheme. A number of roads were covered by existing 20mph zones and other traffic calming measures, prior to the introduction of the 20mph limit – mainly in older residential areas around the town centre.

<p>R-AW3 Metropolitan unitary authority C Calderdale (Phase 1)</p>	<p>Predominantly residential and schools Siddall is part of the built up area of Halifax. It comprises a combination of older style terraced housing on narrow streets (some time cobbled), and newer areas, but generally with limited off-street parking. Saville Park, Manor Heath, and Skircoat Green are all suburbs to the south-west of Halifax centre. They comprises a range of different housing and environment types. Southowram is a small settlement / village, just over 2kms from the centre of Halifax, but not part of the continuous built up area. It comprises a range of different housing and environment types.</p>	<p>Part of area-wide scheme The Council originally intended to exclude major A roads, but pressure from Councillors and residents have led to some being included (e.g. outside schools).</p>	<p>Large urban area Population 200,000 Length of new 20mph (signed only) road = 76kms</p>	<p>A borough-wide 20 mph scheme has been implemented in 5 phases, commencing June 2015 (Phase 1). Phase 2 implementation commenced September 2015, with Phase 3 implemented in 2016 / 2017. Phase 4 was implemented in 2016/17 and Phase 5 in 2017. Overall the cost of the roll out of 20mph was £821k. £502k from the West Yorkshire Local Transport Plan (split £347k capital and £155k revenue), and £319k from the council's Public Health t Department via a ring fenced Public Health funding. Operates 24 hours a day, 7 days a week. Area-wide 20mph limits have been introduced in seven areas of the Borough in recent years, prior to the main phased approach.</p>
<p>R-AW4 Urban unitary authority B Nottingham (Bestwood)</p>	<p>Predominantly residential and schools Largely semi-detached properties, town houses with three or four residences each, or terraced housing built in 1930s and 50s (+ some newer), self-contained estates and cul-de-sacs, linked by wide distributor roads. Roads generally wide, with some on-street parking. Includes large council estate, with high levels of crime.</p>	<p>Part of area-wide scheme covering whole of the city. Wider distributor roads excluded, except near schools and community facilities.</p>	<p>Large city Population > 400,000 Length of new 20mph (signed only) road = 60kms</p>	<p>A city-wide 20mph scheme has been implemented across 10 residential areas and the city centre. Implementation started in April 2012, with this scheme being the third area to be implemented in April 2014. The remainder of the areas were implemented over the following year. The total scheme cost was approximately £1.7 million. Operates 24 hours a day, 7 days a week. Some pre-existing limits outside schools.</p>
<p>R-AW5 Urban unitary authority C Brighton (Phase 2)</p>	<p>Predominantly residential and schools Newer housing in more suburban areas, comprising a mix of ages and styles. Many roads have on-street parking.</p>	<p>Part of area-wide scheme covering whole of the city. Excludes main roads and key arterial routes; but some A and B roads included on the basis of flow, speeds, casualties, and layout. Further roads / areas were excluded following consultation with residents. Approx. two-thirds of residential roads in Phase 2 are 20mph.</p>	<p>Large town / city Population c.280,000 Length of new 20mph (signed only) road = 160kms</p>	<p>In 2010, the Council recommended the implementation of 20mph limits covering the whole of the administrative boundary. Due to the size of the project, and availability of funds, the implementation of the scheme was staggered and delivered in three separate phases. Phase 1, comprising the city centre, was implemented in April 2013; Phase 2, key residential areas, was implemented in June 2014; and Phase 3 covering, remaining outlying residential areas, was implemented in June 2015. An overall budget of £1.5 million was secured for the whole scheme, although latest figures suggest an actual spend has been lower. Operates 24 hours a day, 7 days a week. There were a small number of pre-existing 20mph limits and zones in the city prior to the above scheme.</p>

<p>R-AW6 Urban unitary authority D Portsmouth</p>	<p>Predominantly residential and schools A significant proportion of the city's residential area comprises a closely packed network of terraced housing (19th century or earlier), with narrow roads and a high volume of on-street parking.</p>	<p>Area-wide scheme covering most of the town/city. Excludes strategic routes.</p>	<p>Large town / city Population c.200,000 (high density) Length of new 20mph (signed only) road = 341kms</p>	<p>The scheme covers over 90% of the roads in the city which previously had a speed limit of 30mph. It was implemented pre-2010, in several phases due to its size. The scheme cost £656,000 (including £35,000 for monitoring), primarily funded through the Local Transport Plan. Operates 24 hours a day, 7 days a week. A small number of streets have 20mph zones.</p>
<p>R-AW7 Large county authority B Chichester</p>	<p>City centre + residential and schools Many of the roads are older character with high levels of on-street parking. City Centre streets are narrow, reflecting the City's roman origins, and there is a clear distinction between residential and non-residential roads. Elsewhere, the street layout comprises self-contained communities, which are generally not conducive to rat running.</p>	<p>Area-wide scheme covering most of the town/city. Excludes main and strategic roads (e.g. A and B roads).</p>	<p>Small town / city (historic settlement) Population c.25,000 Length of new 20mph (signed only) road = 67kms</p>	<p>The scheme was proposed in 2010 and implemented in July 2013. It covers the majority of residential streets in the city which previously had 30mph limits. The city centre was already subject to a 20mph limit, which was introduced in 2001. The scheme cost £100,000, funded from Section 106 developer contributions. The Council also supported an education and awareness campaign to raise awareness and support for the scheme amongst the local community. Operates 24 hours a day, 7 days a week.</p>

c) Area-wide (city centre and adjacent residential areas)

ID	20mph Typology	Area-wide / Standalone	Geography	Description
TC-AW1 (Phase A) Urban unitary authority C Brighton (Phase 1)	City centre and adjacent residential areas Historic city centre. Adjacent residential areas comprise predominantly terraced housing with on-street parking. Roads typically narrow, but wider roads in regency style areas.	Part of area-wide scheme covering whole of the city. Excludes main roads and key arterial routes; but some A and B roads included on the basis of flow, speeds, casualties, and layout.	Large town / city (popular tourist destination) Population c.280,000 Length of new 20mph (signed only) road = 108kms	See R-AW5.
TC-AW2 Large county authority A Winchester (City Centre)	City centre and adjacent residential areas Covers historic city centre and adjacent residential areas, bounded by the old city walls. Residential areas typically comprise historic terraced housing, very narrow streets, and some on-street parking where the road has sufficient width. Designated conservation area.	Small scale standalone scheme (i.e. not area-wide) – although other small residential pilot schemes have been implemented elsewhere in the City. Covers all roads within scheme boundary, including a number of B roads which circulate the pedestrianised centre.	Medium town / city (historic settlement and tourist destination) Population c.115,000 Length of new 20mph (signed only) road = 14kms	The scheme was implemented in September 2014 as part of a Local Sustainable Transport Fund package. The total scheme cost was approximately £90,000. Operates 24 hours a day, 7 days a week. Includes some pre-existing 20mph limits around the most historic areas of the City Centre, and there are also some pre-existing 20mph zones on a small number of historic residential streets very close to the City Centre.

Appendix C. Case study questionnaire results

C.1. Introduction

The following sections present the questionnaire results for individual case studies, grouped by theme.

The results are based on the following sample sizes: residents = 1993, residents living on adjacent streets = 177, drivers = 1256.

The results for individual case studies should be treated as **indicative only**, due to the small sample sizes for individual locations.

Statistical reliability

Any figures taken from a sample of a population should not be taken as a precise indication of the actual figures for that population. The reported figures are estimates, within a small margin of error, of the actual figures. The margin of error varies with sample size – the larger the sample is, the lower the error will be. It also varies with the proportions answering: the margin of error is smaller for a 90% or 10% result than for a 50% result.

In order to illustrate the use of varying sample sizes and their effect on the statistical significance of results, the table below outlines the degree of statistical error broadly associated with example sample sizes of 500 and 1,000, and the actual sample sizes for the various questionnaires undertaken.

Table D1. Statistical error associated with questionnaire sample sizes (at 95% confidence level)

Sample size	50% giving the same response	40% or 60% giving the same response	30% or 70% giving the same response	20% or 80% giving the same response	10% or 90% giving the same response
500 (example)	± 2.6%	± 3.5%	± 4.0%	± 4.3%	± 4.4%
1000 (example)	± 1.9%	± 2.5%	± 2.8%	± 3.0%	± 3.1%
1256 (drivers' questionnaire)	± 1.7%	± 2.2%	± 2.5%	± 2.7%	± 2.8%
1993 (residents' questionnaire)	± 1.3%	± 1.8%	± 2.0%	± 2.2%	± 2.2%

A sample size of 1000 ensures a maximum margin of error for a given proportion response rate of ±3.1%. In other words, if the proportion of the sample supporting 20mph limits is 50%, then there is a 95% likelihood that the true proportion within the total population is within ±3.1% (46.9% to 53.1%). The margin of error reduces to ±1.9% if the sample proportion reduces to 10% or increases to 90%. It increases if the sample is reduced (as a result of disaggregation of results), to a maximum of ±4.4% if the sample size reduces to 500, for example.

C.2. Support for 20mph Limits

Table 2. Support for 20mph Limits, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
What was your view on whether the street should have a 20mph speed limit just before it was introduced - % good idea, % bad idea	71% 13%	69% 19%	76% 13%	76% 0%	84% 3%	79% 5%	59% 21%	73% 14%	63% 23%	76% 7%	59% 19%	74% 6%
What is your overall view now on whether this street should have a 20mph speed limit - % good idea, % bad idea	75% 12%	64% 23%	75% 10%	90% 1%	88% 3%	88% 4%	62% 25%	69% 20%	71% 15%	82% 7%	58% 22%	72% 7%
The whole 20mph speed limit area needs to be changed back to 30mph limit - % disagree, % agreeing	76% 12%	59% 26%	81% 12%	93% 2%	93% 2%	85% 5%	60% 20%	77% 18%	70% 20%	78% 4%	65% 16%	74% 10%
Since the introduction of 20mph limits on your street, are you now more or less supportive of their introduction - % more supportive, % less	48% 8%	46% 12%	42% 4%	79% 1%	73% 4%	60% 4%	27% 8%	48% 20%	39% 12%	47% 1%	31% 18%	38% 6%
Average score - Residents	-	60%	69%	85%	85%	78%	52%	67%	61%	71%	53%	65%
20mph is an appropriate speed for THIS street - % agreeing, % disagreeing	78% 14%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit makes it more acceptable to drive at a lower speed - % agreeing, % disagreeing (drivers only)	72% 11%	-	-	-	-	-	-	-	-	-	-	-
The nature of these streets means that vehicles tend not to drive fast and so a 20mph limit is not needed - % agreeing, % disagreeing	13% 76%	-	-	-	-	-	-	-	-	-	-	-
Traffic calming measures (e.g. road humps, speed activated signs) should be introduced to encourage compliance - % agreeing, % disagreeing	46% 41%	-	-	-	-	-	-	-	-	-	-	-
Traffic calming measures (e.g. road humps, speed activated signs) should be introduced to encourage compliance - % agreeing, % disagreeing (drivers only)	44% 45%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit on this scheme should only apply during off-peak periods - % agreeing, % disagreeing	6% 83%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit on this scheme should only apply during peak periods when there is a lot of traffic using the road - % agreeing, % disagreeing	12% 78%	-	-	-	-	-	-	-	-	-	-	-

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Non-resident drivers												
What is your overall view now on whether this street should have a 20mph speed limit - % good idea, % bad idea	66% 21%	64% 25%	73% 6%	82% 10%	86% 6%	82% 14%	64% 24%	63% 24%	47% 42%	66% 18%	39% 43%	62% 20%
The whole 20mph speed limit area needs to be changed back to 30mph limit - % disagree, % agreeing	67% 21%	55% 30%	74% 11%	83% 9%	83% 6%	77% 14%	59% 29%	64% 28%	52% 40%	73% 15%	52% 35%	70% 19%
Since the introduction of 20mph limits on your street, are you now more or less supportive of their introduction - % supportive, % not supportive	66% 21%	61% 23%	77% 5%	86% 7%	86% 4%	82% 15%	57% 29%	67% 21%	47% 45%	70% 18%	36% 46%	61% 20%
Average score - Drivers	-	60%	75%	84%	85%	80%	60%	65%	49%	70%	42%	64%
20mph is an appropriate speed for THIS street - % agreeing, % disagreeing	67% 23%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit makes it more acceptable to drive at a lower speed - % agreeing, % disagreeing	69% 15%	-	-	-	-	-	-	-	-	-	-	-
The nature of these streets means that vehicles tend not to drive fast and so a 20mph limit is not needed - % agreeing, % disagreeing	28% 58%	-	-	-	-	-	-	-	-	-	-	-
Traffic calming measures (e.g. road humps, speed activated signs) should be introduced to encourage compliance - % agreeing, % disagreeing	38% 52%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit on this scheme should only apply during off-peak periods - % agreeing, % disagreeing	7% 82%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit on this scheme should only apply during peak periods when there is a lot of traffic using the road - % agreeing, % disagreeing	23% 67%	-	-	-	-	-	-	-	-	-	-	-
Average score - Residents and Drivers	-	58%	68%	79%	79%	77%	54%	63%	53%	70%	50%	62%

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C.3. Awareness of 20mph Limits

Table D3. Awareness of 20mph Limits, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 1)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
The majority of residents are aware that a 20mph limit applies - % agreeing	73%	84%	76%	58%	69%	70%	84%	70%	72%	78%	79%	69%
There is sufficient signage to inform road users that a 20mph speed limit applies - % agreeing	55%	38%	62%	47%	66%	50%	82%	48%	59%	63%	43%	57%
Traffic calming measures should be introduced to increase awareness of the speed limits - % disagree, % agreeing	44% 40%	40% 48%	31% 55%	30% 57%	41% 44%	48% 37%	64% 21%	41% 47%	52% 36%	27% 52%	37% 38%	38% 39%
Average score - Residents	-	54%	56%	45%	59%	56%	77%	53%	61%	56%	53%	55%
Non-resident drivers												
There is sufficient signage to inform road users that a 20mph speed limit applies - % agreeing	56%	53%	59%	61%	59%	46%	79%	45%	61%	42%	68%	45%
Traffic calming measures should be introduced to increase awareness of the speed limits - % disagree, % agreeing	40% 48%	45% 42%	32% 50%	58% 39%	39% 49%	55% 30%	49% 41%	50% 39%	49% 44%	39% 48%	60% 27%	50% 32%
Average score - Drivers	-	49%	46%	60%	49%	51%	64%	48%	55%	41%	64%	48%
Average score - Residents and Drivers	-	52%	51%	52%	54%	53%	70%	50%	58%	48%	59%	51%

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C.5. Driver response

Table D4. Driver response, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
Compliance:												
I comply with the speed limit most of the time on these streets - % agreeing (drivers only)	78%	68%	86%	-	-	86%	81%	82%	74%	72%	64%	91%
Change in speed:												
The average speed of vehicles has reduced - % agreeing	22%	19%	18%	36%	22%	35%	21%	7%	34%	19%	9%	22%
Less vehicles are driving at excessive speeds for the area - % agreeing	24%	18%	21%	34%	27%	35%	20%	11%	43%	19%	12%	24%
Since the introduction of the 20mph speed limit I am more likely to drive through this area at a slower speed than previously – % agreeing (drivers only)	69%	47%	85%	79%	57%	76%	78%	77%	68%	67%	63%	76%
Change in speed average	-	28%	41%	50%	35%	49%	40%	32%	48%	35%	28%	41%
Driver awareness, risk, frustration / stress:												
The 20mph limit increases drivers awareness of risks and hazards - % agreeing	42%	25%	53%	48%	61%	40%	44%	27%	51%	36%	30%	46%
The 20mph limit increases drivers awareness of risks and hazards - % agreeing (drivers only)	44%											
Since the introduction of the 20mph limit on THIS street, have you noticed any evidence of driver frustration? - % saying 'no, never'	56%	25%	64%	50%	68%	60%	56%	47%	62%	52%	67%	-
Do you find that since the introduction of the 20mph limit you feel frustrated? - % saying 'no, never'; yes, regularly (drivers only)	74% 7%	65%	79%	91%	89%	84%	60%	59%	71%	76%	77%	63%
Do you find that since the introduction of the 20mph limit you find you have to drive slower than you would like? - % saying 'no, never'; yes, regularly (drivers only)	66% 9%	48%	73%	82%	84%	74%	45%	59%	65%	75%	52%	69%
The 20mph limit makes it more acceptable to drive at a lower speed - % agreeing, % disagreeing	73% 10%	-	-	-	-	-	-	-	-	-	-	-
The 20mph limit makes it more acceptable to drive at a lower speed - % agreeing, % disagreeing (drivers only)	72% 11%	-	-	-	-	-	-	-	-	-	-	-
Driver awareness, etc. average	-	41%	67%	68%	76%	65%	51%	48%	62%	60%	57%	59%
Avoidance of area / displacement of traffic:												
There are less vehicles using the street where I live - % agree, % disagree	4% 88%	5% 88%	1% 91%	15% 70%	2% 91%	4% 86%	1% 89%	1% 98%	12% 82%	2% 92%	2% 91%	1% 94%
Average score - Residents	-	46%	65%	59%	55%	66%	57%	54%	62%	56%	50%	64%

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Non-resident drivers												
Compliance:												
I comply with the speed limit most of the time on these streets - % agreeing	83%	85%	82%	89%	96%	94%	82%	80%	78%	87%	57%	84%
Change in speed:												
The average speed of vehicles has reduced - % agreeing	32%	28%	21%	42%	35%	28%	24%	25%	45%	41%	28%	39%
Less vehicles are driving at excessive speeds for the area - % agreeing	34%	27%	24%	45%	35%	36%	23%	31%	40%	42%	36%	38%
Since the introduction of the 20mph speed limit I am more likely to drive through this area at a slower speed than previously –% agreeing	74%	74%	83%	81%	74%	82%	79%	82%	62%	82%	57%	62%
Change in speed average	-	43%	43%	56%	48%	49%	42%	46%	49%	55%	40%	46%
Driver awareness, risk, frustration / stress:												
The 20mph limit increases drivers awareness of risks and hazards - % agreeing	64%	44%	59%	84%	81%	59%	61%	61%	66%	73%	58%	62%
The 20mph limit is frustrating for drivers - % disagreeing, % agreeing	48% 36%	24% 42%	50% 29%	55% 30%	56% 21%	45% 40%	32% 55%	30% 54%	22% 68%	33% 67%	20% 69%	38% 49%
Do you find that since the introduction of 20mph limit you feel frustrated? – % saying 'no, never'; yes, regularly	75% 9%	61%	85%	87%	92%	88%	77%	66%	47%	88%	57%	78%
Do you find that since the introduction of 20mph limit you find you have to drive slower than you would like? – % saying 'no, never'; yes, regularly	49% 14%	31%	84%	-	-	60%	52%	50%	37%	54%	30%	50%
I comply with the limit most of the time, but find myself more likely to drive above the speed limit when I get onto faster roads – % disagreeing, % agreeing	41% 44%	18% 62%	44% 37%	54% 33%	62% 26%	38% 50%	31% 53%	46% 39%	42% 43%	22% 57%	58% 28%	28% 53%
The 20mph limit makes it more acceptable to drive at a lower speed - % agreeing, % disagreeing	69% 15%	-	-	-	-	-	-	-	-	-	-	-
Driver awareness, etc. average	-	36%	64%	70%	73%	58%	51%	51%	43%	54%	45%	51%
Avoidance of area / displacement of traffic:												
I avoid driving/riding on these streets/ in this area if possible since the introduction of 20mph limits – % agreeing, % disagreeing	8% 84%	19% 71%	3% 88%	4% 90%	2% 85%	12% 84%	8% 87%	8% 86%	14% 75%	5% 89%	11% 83%	6% 84%
Average score – Drivers	-	55%	63%	72%	72%	67%	58%	59%	57%	65%	47%	61%
Average score - Residents and Drivers	-	50%	64%	65%	64%	67%	58%	56%	59%	60%	48%	62%

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C.6. Perceptions about walking and cycling

Table D5. Perceptions, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
The 20mph limit is beneficial for cyclists and pedestrians – % agreeing	69%	69%	65%	80%	79%	69%	55%	59%	72%	83%	52%	70%
The introduction of the 20mph limit provides a more pleasant environment for walking and cycling – % agreeing	51%	53%	57%	38%	46%	60%	50%	42%	64%	68%	36%	53%
The introduction of the 20mph limit provides a safer environment for walking and cycling – % agreeing	60%	69%	61%	47%	54%	65%	54%	55%	45%	76%	70%	62%
Drivers are more considerate to pedestrians – % agreeing	21%	15%	21%	23%	24%	25%	11%	15%	36%	24%	12%	24%
Drivers are more considerate to cyclists – % agreeing	17%	14%	16%	16%	17%	18%	8%	13%	25%	22%	10%	21%
Average score - Residents	-	64%	61%	55%	60%	65%	53%	52%	60%	76%	53%	62%
Non-resident drivers												
The 20mph limit is beneficial for pedestrians – % agreeing	77%	68%	74%	93%	87%	89%	71%	68%	72%	83%	64%	78%
The 20mph limit is beneficial for cyclists – % agreeing	74%	68%	75%	87%	86%	86%	70%	65%	67%	82%	58%	78%
Average score - Drivers	-	68%	75%	90%	87%	88%	71%	67%	70%	83%	61%	78%
Average score - Residents and Drivers	-	66%	68%	73%	73%	76%	62%	59%	65%	79%	57%	70%

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C.7. Safety

Table D6. Safety perceptions

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
<u>Residents</u>												
The street now provides a safer environment for children – % agreeing	28%	27%	38%	-	-	33%	31%	21%	41%	29%	12%	24%
<u>Non-resident drivers</u>												
It is safer to drive on these streets/in this area since the introduction of 20mph limit – % agreeing	36%	23%	28%	57%	46%	41%	28%	22%	42%	42%	25%	45%
The introduction of the 20mph limit provides a safer environment for walking and cycling – % agreeing	60%	69%	61%	47%	54%	65%	54%	55%	45%	76%	70%	62%
Average score - Drivers		46%	45%	52%	50%	53%	41%	39%	44%	59%	48%	54%

C.8. Use of active travel modes

Table D7. Use of active travel modes, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
Since the introduction of the 20mph limit, are you now walking more, less or about the same than previously? – % residents walking more	5%	5%	8%	3%	4%	6%	2%	3%	9%	6%	1%	5%
Since the introduction of the 20mph limit, are you now cycling more, less or about the same than previously? – % residents cycling more	2%	2%	1%	0%	3%	4%	1%	2%	6%	3%	1%	2%
Average score - Residents	-	4%	5%	2%	4%	5%	2%	3%	8%	5%	1%	4%

C.9. Mode shift

Table D8. Mode shift, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
Keeping traffic below 20mph makes it more likely that I will walk to local places rather than use the car – % residents agreeing	16%	24%	14%	28%	20%	28%	9%	16%	14%	9%	7%	13%
Keeping traffic below 20mph makes it more likely that I will cycle to local places rather than use the car – % residents agreeing	9%	12%	10%	8%	9%	19%	2%	6%	15%	6%	5%	10%
Average score - Residents	-	18%	12%	18%	15%	24%	6%	11%	15%	8%	6%	12%

C.10. Wider impacts

Table D9. Wider impacts, by case study

	All Case Studies	R-SM1 Walsall	R-SM2 Stanmore	R-AW1a Liverpool (Area 7)	R-AW1b Liverpool (Area 2)	R-AW2 Middlesbrough	R-AW3 Calderdale	R-AW4 Nottingham	R-AW5 Brighton Ph 2	R-AW7 Chichester	TC-AW1 Brighton Ph 1	TC-AW2 Winchester
Residents												
The 20mph limit is beneficial for the local residents – % agreeing	70%	67%	71%	85%	80%	73%	56%	63%	68%	83%	53%	72%
The street now provides a safer environment for children – % agreeing	28%	27%	38%	-	-	33%	31%	21%	41%	29%	12%	24%
You see more children playing out since the introduction of the 20mph limit – % agreeing	8%	11%	6%	26%	7%	15%	5%	5%	3%	11%	2%	2%
Since the 20mph limit was introduced, more people are generally out and about on the street than previously – % agreeing	8%	12%	8%	16%	8%	13%	2%	4%	5%	10%	3%	4%
The introduction of 20mph speed limit on this street means that people are less likely to use the local shops and amenities, as drivers are avoiding the 20mph limit - % agreeing	3%	7%	4%	7%	3%	4%	2%	1%	2%	0%	0%	2%
The introduction of the 20mph speed limit on this street has made it a more desirable place to live - % agreeing	22%	21%	23%	29%	35%	27%	17%	11%	27%	23%	9%	25%



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