

# **The state of the evidence on 20mph speed limits with regards to road safety, active travel and air pollution impacts**

**A Literature Review of the Evidence**

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**August 2018**

# 1. Introduction

Interest in signs only 20mph speed limits in the UK commenced around 2000. Scotland was in the vanguard in the UK. One reason for this interest is the ability to address a far larger area through speed limits only than through traffic calmed zones. This makes Limits rather than traffic-calmed zones a considerable attraction for highway authorities with limited budgets. This Review does not specifically address 20mph zones which are physically traffic calmed through various speed reduction measures such as road humps, speed tables, chicanes although some studies include both zones and limits. The impacts of 20mph zones are described in detail by Grundy et al. The effect of 20 mph zones on socioeconomic differentials has been substantial, reducing the gap in the number of casualties between the most and least deprived quintiles of deprivation by approximately 14% compared with what it would otherwise have been.<sup>1 2</sup> Some studies mix results from zones with limits in their results which, arguably, risks confusion as they are significantly different as interventions.

In 2001 a trial in Scotland of 20mph (32kph) speed limits at 78 sites found reductions in speed and casualties, with killed and serious declining from 20% of the total to 14%. The Consultant's report concluded that such limits offer a low cost option for promoting road safety.<sup>3</sup> Overall, results from the attitudinal survey demonstrated strong local support for the schemes and almost three quarters of respondents considered that the experiment had been either 'very' or 'partly' successful.

In England the Department for Transport has been more favourable to the use of 20mph speed limits since the results of the scheme across Portsmouth which they stated was 'a highly successful city-wide trial'.<sup>4</sup> It was also noted by the Department for Transport that 'they [local authorities] can introduce them at a lower cost and with less inconvenience to local residents'.

Internationally, Sweden has been a leading country globally on speed management as a result of its commitment, in its Parliament in 1996, to Vision Zero. This was, and remains, to commit to achieving zero road traffic fatalities and serious injuries. Setting speed limits according to the amount of biomechanical energy humans can tolerate without sustaining permanent injury (sometimes referred to as Vision Zero speed limits). These speed limits are 30 km/h (~20 miles/h) in areas where pedestrians may be struck by motor vehicles.<sup>5</sup> A key aspect of Vision Zero is reducing speed limits and speeds driven. As a result, Swedish municipalities have

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<sup>1</sup> Steinbach, R., Grundy, C., Edwards, P., Wilkinson, P., Green, J. 2010 The impact of 20mph speed limit zones on inequalities in road casualties in London, *Journal of Epidemiology and Community Health*, 65:921e926. doi:10.1136/jech.2010.112193.

<sup>2</sup> Grundy, C. et al 2009. Effects of 20mph traffic speed zones on road injuries in London. 1986-2006: controlled interrupted time series analysis, *British Medical Journal*, 339. b4469.

<sup>3</sup> Burns, A, Johnstone, N., Macdonald, N. 2001 *20mph speed reduction initiative*. Scottish Executive Central Research Unit. Edinburgh.

<sup>4</sup> Department for Transport, 2009 *Government to allow wider use of 20mph schemes without speed humps*. Press Notice. London: DfT.

<sup>5</sup> Elvik, R. 2012. Speed limits, enforcement, and health consequences, *Annual Review of Public Health*, 33: pp. 225–38.

been able to decide to implement 30 km/h themselves since 1998. This has considerably accelerated the implementation. 2000-3000 km of 30 km/h limits are currently in function.<sup>6</sup> Stockholm was one of the first cities in Europe to introduce the 30 km/h limit across a large area of a city. Graz, Austria, is often noted as possibly being the first European city to introduce 30km/h limits, in 1991. This was across approximately 75% of the city road network and other parts of the network had speeds reduced to 50km/h. The trial was part of a city wide plan to promote walking, cycling and public transport use and included education and initially increased police enforcement. The early evidence was that speeds driven had reduced, especially at the higher end of the speed profile. Drivers were reported to show more consideration towards pedestrians. In the 30 km/h street network a significant reduction in NOx was recorded. Overall for the city, there was a slight reduction in vehicle emissions measured. There was also a slight reduction in noise emissions. Public approval for the 30km/h limits rose from 72% before implementation to 80% 6 months post intervention.<sup>7</sup> At the time the evidence was that there were reductions in casualties.<sup>8</sup> More recent analysis suggests that there was a decline in collisions after the implementation which then plateaued to 1996 and then rose slightly at the start of the 2000s before declining again to a level of collisions recorded in 1996.<sup>9</sup>

The literature also notes that determination of speed limits is one of the most controversial and evocative subjects of transport policy.<sup>10</sup> Yet, according to the British Crime Survey, speeding traffic was rated as the most serious problem of 16 social problems, all of which were rated on a scale from 1 (not a problem at all) to 4 (very big problem). Males and females both rated speeding traffic as the greatest problem in local communities. This also held true whether respondents were young, middle aged, or old.<sup>11</sup> In 2010 the British Social Attitudes Survey for the Department for Transport reported that 'the majority (71%) of respondents were in favour or strongly in favour of speed limits of twenty miles per hour in residential streets'.<sup>12</sup> Levels of support for 20mph limits in GB remain consistently high, typically 65% and above.<sup>13</sup>

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<sup>6</sup> See <http://en.30kmh.eu/why-30kmh-20mph/trendsetter-cities-for-30-kmh-20mph/se-sweden-trendsetter-cities-for-30-kmh/> accessed 12<sup>th</sup> July 2018.

<sup>7</sup> Hönig, M., Sammer, G. 1996. *General 30 KPH speed limit in the city of Graz*. University Bodenkultur, Vienna.

<sup>8</sup> Wernsperger, F., Sammer, G. 1995 *Results of the scientific investigation accompanying the pilot trial of 30kph in side streets and 50 kph in priority streets*. Proceedings of Seminar G PTRC European Transport Forum, University of Warwick.

<sup>9</sup> Fischer, T. 2010. *Traffic Safety in Graz*, Reggio Emilia.

<sup>10</sup> Elvik, R. 2002. Optimal speed limits: the limits of optimality models, *Transportation Research Record*, 1818, pp. 32-38.

<sup>11</sup> Poulter, D., McKenna, F. 2007. Is speeding a "real" antisocial behaviour? A comparison with other antisocial behaviours, *Accident Analysis and Prevention*, 39: pp. 384-389.

<sup>12</sup> Department for Transport, 2010 *British Social Attitudes survey: attitudes to transport*. London: Dept. Transport.

<sup>13</sup> Tapp, A., Nancarrow, C., Davis, A., Jones, S. 2016. Vicious or virtuous circles? Exploring the vulnerability of drivers to break low urban speed limits, *Transportation Research Part A*, pp. 195-212.

There is, it has been established, overwhelming evidence that lower speeds result in fewer collisions and in reduced severity of collisions including injuries.<sup>14, 15</sup> The OECD reported this year that research consistently shows that lower speeds reduce deaths and injuries, not least because there is more time to react. For example, the risk of being killed is almost 5 times higher in collisions between a car and a pedestrian at 50km/h (31mph) compared to the same type of collisions at 30 km/h (18.6mph).<sup>16</sup> Research by the Transport Research Laboratory has shown that for urban roads with low average speeds there is an average 6% reduction in collisions with each 1mph reduction in average speed.<sup>17, 18</sup> This latter point is often overlooked in local debates about the effectiveness of 20mph speed limits especially in the absence of three years or more of post-implementation casualty data. Road traffic injury is also strongly associated with poverty. Child pedestrian deaths in deprived neighbourhoods are over four times those in affluent neighbourhoods.<sup>19, 20</sup>

### **The research question and task**

The research question set by the Welsh Government was set as:

To review research into the effects of 20mph/30kph speed limits on

- road safety,
- active travel and
- air pollution

and to provide an overview report on the findings.

<sup>14</sup> MASTER Project, 1999 *Managing speeds of traffic on European roads*. Transport Research, Fourth Framework Programme Road Transport. Luxembourg: Office for Official Publications of the European Communities.

<sup>15</sup> Taylor, M., Lynam, D., Baruya, A. 2000. *The effects of drivers' speed on the frequency of road accidents*, Crowthorne: TRL.

<sup>16</sup> International Transport Forum/OECD, 2018. *Speed and Crash Risk*. Paris: OECD <https://www.itf-oecd.org/sites/default/files/docs/speed-crash-risk.pdf> accessed 18th July 2018.

<sup>17</sup> Finch, D., Kompfner, P., Lockwood, C., Maycock, G. 1994. *Speed, speed limits, and accidents*. TRL Project Report 58, Crowthorne: TRL.

<sup>18</sup> Taylor, M., Lynam, D., Baruya, A. 2000. *The effects of drivers' speed on the frequency of road accidents*, Crowthorne: TRL.

<sup>19</sup> Abdalla, I., Barker, D., Raeside, R. 1997 Road accident characteristics and socio-economic deprivation. *Traffic Engineering and Control*, December, 672-676.

<sup>20</sup> Adams, J., White, M., Heywood, P. 2005 Time trends in socioeconomic inequalities in road traffic injuries to children, Northumberland and Tyne and Wear 1988–2003, *Inj Prev* 2005;**11**:125-126 doi:10.1136/ip.2004.007823 accessed 30<sup>th</sup> August 2015.

## 2. Methodology

### 2.1 General approach

Firstly, the Review provides a summary of the available evidence. In order to assist with understanding the value of each study assessed to be in scope for the Review studies have been graded by an assessment of methodological design and robustness, highlighting what is known about the impact of an intervention and sometimes also noting where the gaps in knowledge lie (i.e. what is not known).

Secondly, the researcher, who is a specialist in this inter-disciplinary field, has a library of both published peer reviewed and grey literature on 20mph internationally. Consequently, the Review search was primarily intended to identify relatively gaps in the researchers' library. It is worthy to note that previous reviews, including for NICE (NICE Guidance 8 addressing the built environment and physical activity including active travel) published in 2008, on aspects of the built environment, devoted significant funds to systematic searches and yet the final 'in scope' find has been comprised largely of grey literature found by the researchers. This has been also been reported for other Reviews.

### 2.2 Search

#### 2.2.1 Databases searched

The following databases were searched for this Review:

Cochrane Library; ICE Virtual Library; Medline; Scholar Google; Scopus; Science Direct; Taylor Francis; TRB (Transportation Research Board); TRID (Transportation Research Integrated Database).

#### 2.2.2 Search terms

All search strategies were agreed with the client. Tailored search terms were used appropriate to each particular database.

**Table 1: Inclusion criteria**

Research Question/Types of intervention		
Years	2010-18	
Search terms	Road safety, danger, casual <sup>t</sup> *, injur <sup>*</sup> , speed <sup>*</sup> air pollut <sup>*</sup> , emission <sup>*</sup> , active travel, traffic, walk <sup>*</sup> , cycl <sup>*</sup> 20mph, 30km/h	Focus on road safety impacts, those addressing air quality, and those addressing active travel.
Peer reviewed	Yes	Search engines
Grey Literature	Yes	Personal library and snowballing of contacts
20mph	Yes (urban and rural)	Also 30km/h
Research design	All	
Types of participants	All ages	
English language only	Yes	
Inclusion dates	January 2010 to June 2018	

The date of January 2010 was selected for the start of the inclusion period for the searches (ending July 2018) on the basis of published studies in this field addressing 20mph/30km/h speed limits i.e. that there was limited evidence on 20mph and 30km/h speed limits prior to 2010. This inclusion date was agreed with the client.

### **2.3 Scoping and the selection of studies for inclusion**

The agreed search strategy resulted in 29 studies being identified through the library searches as potentially meeting inclusion criteria. In addition, the researcher drew on his personal library, references contained in studies found, and through snowballing retrieved a further 14 references. This resulted in a total of 43 studies. Abstracts were then read and if not excluded at this stage full-text eligibility assessments were then made. Fourteen studies were found to be out of scope leaving 29 studies which met the inclusion criteria.

### **2.4 Study Type and Quality Appraisal method**

To assist with understanding as to how robust each study included was in terms of methodological robustness, each study was categorised by study type (categorised as Type 1-3) based on a NICE Appraisal tool.<sup>21</sup> The studies were categorised into the following study types:

*Type 1* Systematic reviews, meta-analyses of randomised controlled trials.

*Type 2* Systematic reviews of, or individual, non-randomised controlled trials, case-control studies, cohort studies, controlled before-and-after studies, interrupted time series studies, correlation studies.

*Type 3* Non-analytic studies (for example, case reports, case series studies, after only studies).

Studies were then classified into one of three categories (++ , + or -) within a given type based on the extent to which the potential sources of bias had been minimised.

**++ All or most** of the data are adequately described and the conclusions of the study are thought very unlikely to be reversed by further studies (low risk of bias).

**+ Some** of the data are adequately described and the conclusions of the study are thought unlikely to be reversed by further studies (risk of bias)

**- Few or no** data are adequately described, and the conclusions of the study are thought liable to be reversed by further studies (high risk of bias)

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<sup>21</sup> National Institute for Health and Clinical Excellence, 2006. *Public health guidance: development process and methods*. London: NICE.

### 3. Search results

#### 3.1 Study design

No systematic reviews, meta-analyses of randomised controlled trials were found. All studies were non-randomised controlled trials, case-control studies, and weaker study designs.

#### 3.2 Study categorisation

As noted above, all of the included studies were subjected to full paper assessment using an appropriate appraisal tool. The results are presented in **Table 2** by study type and quality.

**Table 2: Study type, quality, and lead author**

Study type & quality	Lead Author(s) and Year
1+	
1-	
2++	Dons. E., et al 2013; Williams, D., North, R. 2013; Mertens, L., et al, 2016; Jones, S, Brunt, H. 2017; NICE, 2017; Pilkington et al, 2018; Aldred, R. 2018; (7)
2+	Atkins, 2010; Warrington BC, 2010; Wann, J. et al, 2011; Bristol CC, 2012; Edinburgh City Council, 2013; Cairns et al, 2014; Kröyer, 2015; Tapp, A. et al, 2015; Tapp, A. et al, 2016; Mertens, L., et al, 2017; (10)
2-	Dinh, D., Kubota, H. 2013a, Dinh, D., Kubota, H. 2013b; Dinh, D., Kubota, H. 2013c; van Schagen et al, 2016; Calderdale Council, 2018 (5)
3+	Toy, 2012; Dorling, 2014; Greig et al 2014; McKibben, D. 2014; Robinson, J., Newman, N. 2016; Transform Research and Communication, 2017; WHO, 2017 (7)
3-	

#### 3.2 Studies by country of origin

In terms of studies and their country of origin, 20 of the 29 studies were conducted in the UK. Table 3 presents the studies by country and lead author. In terms of external validity the likelihood is that they would be relatively easy to transfer from one urban local authority setting to another.

**Table 3 Summary of studies by country of origin**

Country of origin	Lead Author(s)
UK	Atkins, 2010; Warrington BC, 2010; Wann, J. et al, 2011; Bristol CC, 2012; Toy, 2012; Edinburgh City Council, 2013; Williams, D., North, R. 2013; Cairns et al, 2014; Dorling, 2014; Greig et al 2014; McKibben, D. 2014; Tapp, A. et al, 2015; Jones, S., Brunt, H. 2016; Robinson,

	J., Newman, N. 2016; Tapp, A. et al, 2016; NICE, 2017; Transform Research and Communication, 2017; Aldred, R. 2018; Calderdale C, 2018; Pilkington et al, 2018 (20)
Belgium	Dons. E., et al 2013; Mertens, L., et al, 2016. (2)
Netherlands	van Schagen et al, 2016. (1)
Japan	Dinh, D., Kubota, H. 2013a, Dinh, D., Kubota, H. 2013b; Dinh, D., Kubota, H. 2013c. (3)
Sweden	Kröyer, 2015. (1)
International/Global	Mertens, L., et al, 2017; WHO, 2017. (2)



## 4. Individual study findings

### 4.1 Themes

The included studies were grouped into the following themes for analysis although it is recognised that some studies covered a range of impacts of 20mph. The themes and the number of studies represents the number of studies in each theme:

- Health inequalities (3)
- Air quality/pollution (4)
- Marketing and publicity campaigns (2)
- International, national and local reviews of intervention evidence (10)
- Driver speed choice (3)
- Driver attitudes (3)
- Cycle use, pedestrians, barriers and risks (4)

### 4.2 The studies

The studies are reported in their themed areas for their key finding and results. Section 5 will then consider these in the context of the research questions, addressing road safety, active travel, and air pollution.

#### Health inequalities

**Dorling, D. 2014 20mph speed limits for cars in residential areas, by shops and schools, in British Academy, “If you could do one thing” ... Nine local actions to reduce health inequalities, London: British Academy.**

This thought piece by a specialist on inequalities, cites existing research findings to argue that 20mphs should be the default for residential areas and that there would be a particular benefit to children and young adults from poorer localities, and so reduce health inequalities. Children especially in poorer income groups are over 4 times more likely to be killed or seriously injured while using local streets than among the children of the wealthiest income group. It would also be of benefit to drivers through less standing traffic and easier filtering onto roads from side roads. Other benefits are less pollution, strong communities, more and safer walking and cycling; and reduced obesity.

**Greig, G., Garthwaite, K., Bamba, C. 2014 Addressing health inequalities: five practical approaches for local authorities, *Perspectives in Public Health*, 134(3): 132-134.**

This review of five practical approaches for local authorities includes 20 mph limits and cites the Portsmouth evidence of a 22% reduction in road traffic casualties per year. Specifically, it cites evidence that 20mph speed limits reduce overall extreme speeds and work better over areas of larger coverage combined with engagement with road users and light enforcement. It also stated that 20mph limits can encourage walking and cycling and cited the World Health Organisation for evidence of these benefits.

**Cairns, J., Warren, J., Garthwaite, Grieg, G., Bamba, 2014 Go slow: an umbrella review of the effects of 20mph zones and limits on health and health inequalities. *Journal of Public Health*, pp. 1-6. doi:10.1093/pubmed/fdu067**

This study used systematic review methodology to locate and evaluate published systematic reviews of the effects on health and health inequalities of 20 mph zones and limits ('umbrella' review). Umbrella reviews are an established method of locating, appraising and synthesizing systematic review level evidence. Five reviews were found reporting on 10 unique studies. Overall, they provided convincing evidence that these measures are effective in reducing collisions and injuries, traffic speed and volume, as well as improving perceptions of safety in a couple of the studies. There was also evidence that such interventions are cost-effective.

Where reported, there was also evidence of positive attitudes to such schemes by local residents, who generally favoured the schemes. However, effects on physical activity—most notably walking and cycling and children playing outside—were less clear. This may have been because the interventions evaluated in these studies might not have provided the cultural change necessary in terms of residents' and road users' attitudes to speed and safety. The weakness was that only 2 of the 10 studies addressed 20mph limits and no direct studies addressed health inequalities. Whilst there were no direct studies of the effects on health inequalities, it is possible to suggest that targeting such interventions in more deprived areas may be beneficial.

### **Air Pollution/Quality**

**Dons, E., Temmerman, P., van Poppel, M., Bellemans, T., Wets, G., Panis, L. 2013. Street characteristics and traffic factors determining road users' exposure to black carbon, *Science of the Total Environment*, 447: pp. 72-79.**

This study of personal exposure to pollutants made reference to motorised travel and in-vehicle exposure to black carbon which at low speeds including 30km/h in urban areas increases due to following distance reduction and so increased exposure via nearby vehicles, mostly on main highways rather than local roads due to traffic intensity. Exposure in urban areas is higher for both in-vehicle occupants and active travellers than in rural areas although higher for in-vehicle occupants. Travelling in peak hours increases exposure of all road users.

**Williams, D., North, R. 2013. *An evaluation of the estimated impacts on vehicle emissions of a 20mph speed restriction in central London*, Prepared for the City of London on behalf of the central London local authorities, London: Imperial College.**

This report detailed research work undertaken in the first quarter of 2013 to address the question of the environmental impacts of 20mph restrictions in central London. It sought to address: the impacts of differences in driving styles between 20mph and 30mph roads; the impact of this change on estimated tailpipe emissions of NO<sub>x</sub>, PM<sub>10</sub> and CO<sub>2</sub>; the impact on emissions of different methods of speed control on urban roads; and the impact on emissions from brake and tyre wear of a 20mph speed limit.

Although there was a moderate increase in CO<sub>2</sub> and NO<sub>x</sub> in petrol cars, the study reported that particulate matter emissions reduced for both petrol and diesel cars and NO<sub>x</sub> and CO<sub>2</sub> emissions reduced for diesel cars. As road traffic is responsible for up to 80% of particulate pollution, this was a significant finding which supports the case for measures which secure observance of 20 mph speed limits. Furthermore, diesel vehicles were found to emit around 10 times more particulate matter and

nitrous oxides than petrol vehicles. An 8.2% and 8.3% reduction in PM10 and NOx when driving at 20 mph consequently has a significant impact on air quality - equivalent to removing up to half of all petrol cars off the road.

Conclusions were that:

- it would be incorrect to assume a 20mph speed restriction would be detrimental to ambient local air quality, as the effects on vehicle emissions are mixed;
- driving styles (as characterised by the vehicle operating mode and distribution of cruise speeds) were found to be different on 20mph roads as compared to 30mph roads yet on residential streets with 30mph speed limits were often shown to have vehicle speed not exceeding 20mph. This was also true of heavily trafficked non-residential streets;
- streets where traffic flow was more likely to be interrupted were shown to have higher emission rates. However, this was often the result of other traffic management infrastructure (pedestrian facilities and junctions);
- it is accepted that lower speed limits impacts on brake and tyre wear emissions resulted in lower demand for power at lower speed limits which is likely to be beneficial to emissions of this type.

**Jones, S., Brunt, H. 2017. Twenty miles per hour speed limits: a sustainable solution to public health problems in Wales, *Journal of Epidemiology and Community Health*, 71: pp.699–706. doi:10.1136/jech-2016-208859**

This paper identified 20mph speed limits as a possible intervention that would impact positively on road traffic injuries, air quality and encourage active travel is a significant public health challenge. Estimates of attributable deaths and Years of Life Lost were made once 20 mph limits were introduced in place of all existing 30mph speed limits in Wales.

The authors place a particular focus on children, not least because of the The Wellbeing of Future Generations Act goals in Wales. Risks to children are key, not least because of the harms that they suffer because of speeding traffic; road traffic injury risk deters parents from allowing them to play outside and walk or cycle to or from places, risking obesity, reducing activity levels and reducing the opportunities for socialisation. If these children are allowed to play, walk or cycle near roads, because they are at a similar height to motor vehicle emissions and have a faster breathing rate than adults, they suffer double jeopardy; more exposed and more vulnerable. In addition, height and smaller stature means that if these children are hit by vehicles, the head is a primary point of contact and the risk of serious injury is much higher than for adults. So, parents decide that it is 'safer' to transport their children by car but air pollution levels inside vehicles are much higher than those outside because fans and air conditioning units drawing fumes from exhausts directly into the vehicle. Air pollution can also affect the growth of the unborn baby and may be linked to premature birth.

The authors estimated that as a result of introducing 20mph speed limits:

- in terms of road traffic injuries, 6–10 lives would be saved and 1200–2000 casualties avoided each year, at a value of prevention of £58M–£94M.

- in terms of air pollution, deaths attributed to nitrogen dioxide (NO<sub>2</sub>) may increase by 63, and years of life lost by 753. However, deaths attributed to particulates (PM<sub>2.5</sub>) may decrease by 117 and years of life lost by 1400, and thus overall gains of 54 lives saved and a decrease of 647 years of life lost.

When reviewing the existing literature, 'no effect' on air pollution was the worst outcome that the authors found. In terms of air pollution, the authors noted that a localised approach is likely to be detrimental because emissions are affected by driving style, in particular acceleration and deceleration. The authors assumed a linear relationship between the proportion of road that is 30 mph and the contribution of those roads to the overall burden of air pollution. In reality, they note, 30 mph roads are likely to contribute more air pollution than is suggested by their length because of the range of vehicles, the numbers of vehicles and the stop start nature of the motorised traffic on them. Therefore, this approach underestimates the effect of a switch to 20 mph on air pollution. To bring about changes in driving style will need much wider 20 mph limit use. In addition, a universal 20 mph limit avoids displacing motorised traffic onto other local roads, increasing risks elsewhere and creating inequalities.

The analysis did not account for potential increases in cycling/pedestrian casualties that may occur because there are more of them. However, the critical mass effect suggests that more cyclists and pedestrians will reduce the risk to all. In addition, collisions that do occur will be of lower speed and recent estimates suggest that at 20 mph there is a 1.5% risk of death, compared with 5% at 30 mph.

**NICE, 2017 *Air pollution: Outdoor air quality and health*, NICE Guideline 70 [nice.org.uk/guidance/ng70](https://www.nice.org.uk/guidance/ng70). London: NICE.**

In the section on smoother driving and speed reduction NICE Guidance says that ensuring motorists drive steadily at the optimum speed can help reduce stop-go driving and so improve fuel consumption as well as reducing congestion and air pollution. Reducing the speed limit in residential areas, while making sure that it does not result in an increase in vehicle emissions, will reduce road danger, injuries and air pollution. It therefore recommended:

Consider promoting a smooth driving style by using:

- speed limits and average speed technology on the roadside real-time information to tell drivers what the current optimum driving speed is
- 20mph limits without physical measures to reduce speeds in urban areas where average speeds are already low (below around 24mph) to avoid unnecessary accelerations and decelerations
- signs that display a driver's current speed to reduce unnecessary accelerations.

NICE noted that the benefits include:

- Reducing stop-go driving will lower emissions of air pollutants from accelerations and decelerations, lowering exposure of the population to poor air quality.
- Reduced speeds in urban areas supports a modal shift to walking and cycling. This will reduce emissions of air pollutants.

- Reduced speeds reduces the number and severity of road injuries.

### **Marketing, and publicity**

**van Schagen, I., Commandeur, J. Goldenbeld, C., Stipdonk, H., 2016.**

**Monitoring speed before and during a speed publicity campaign, *Accident Analysis and Prevention*, 97: pp. 326-334.**

Driving speeds were monitored during a period of 16 weeks encompassing different stages of a national anti-speeding campaign in the Netherlands. The campaign targeted speed limit violations in built-up areas. Speeds of over 10 million vehicles were measured. Ten locations with 30 km/h were measured along with ten 50km/h locations. In the Netherlands 30 km/h is the speed limit for residential and shopping streets. Local posters were placed at half of the locations in each group to remind drivers of the speed limit.

The decrease in average speed and the share of speed violations immediately after the placement of local speed limit reminder posters at 30km/h roads had a positive effect on speed and speed behaviour. However, due to the lack of a control group it was not possible to assign changes in speed to the campaign. The authors, drawing on previous work, concluded that the effects of a stand-alone campaign without large-scale police enforcement are limited. This may be particularly true for speed campaigns since speed behaviour has been found to be difficult to change.

**Toy, S. 2012 *Delivering soft measures to support signs-only 20mph limits*. Bristol: University of the West of England.**

The study commenced in July 2011 with a review of published literature and “grey” unpublished material and provided a rich data source which is summarised below. The primary research question was “What evidence is there to demonstrate the effectiveness of social marketing approaches in influencing drivers’ choice of speed in urban areas?” The literature search focused on driver attitudes and behaviour in urban areas as well as best practice in influencing urban speed choice.

It addressed a number of largely unexplored areas to support 20mph including vehicle fleet management, and community engagement approaches. One of the significant opportunities to influence driver behaviour is the use of organisational policy and vehicle tracking systems or “black box” telemetry to implement a zero tolerance approach to drivers found speeding in a work vehicle. The literature shows that organisational culture has a strong influence on driver behaviour and many local authorities and private companies are introducing such schemes to their vehicle fleets as they bring fiscal as well as social and environmental benefits.

Delivering soft measures to support signs-only 20mph limits culture, such as responsive Vehicle Activated signs which tell drivers how fast they are driving and whether they are keeping to the speed limit, mass media and advertising, can have a short term influence on driver behaviour. For influence to be maintained, the evidence is that 20mph speed limits need to be supported by enforcement, physical measures and other reinforcing reminders.

Whilst communities are often very concerned about speeding vehicles and have been encouraged to take action, for example through the Community Speed Watch initiative, there is little published research on the speed-reducing impact of such measures. However, the case study research found much evidence to support the idea that community engagement and empowerment – for example through Third Sector initiatives such as DIY Streets and Playing Out – can lead to radical and lasting improvements in the physical and social street or neighbourhood environment.

The study also carried out a detailed analysis of data from six locations which have implemented signs-only 20mph schemes: Graz in Austria and Portsmouth City, Oxford City, Bristol City, Lancashire County and Warrington Borough. These case studies provide a good source of practical information and lesson learning on all aspects of implementation from policy drivers and consultation to monitoring and evaluation. Some common themes emerge from comparison of these case studies: firstly, that inadequate or in some cases negligible resources are allocated to the soft measures or “winning hearts and mind” element of scheme delivery and secondly that the police have often been reluctant to endorse, let alone enforce, a 20mph limit in residential areas. These two factors present major risks to the cost-effectiveness of 20mph signs only initiatives.

Qualitative research reveals JIMBYism (Just In My Back Yard). Qualitative data collection with Bristol residents and drivers was an important part of this study and the analysis brings some fresh and revealing insights into attitudes and behaviours relating to 20mph limits. A total of 52 people living in or around Bristol were interviewed through nine focus groups and eight in-depth interviews. A wide range of people including high mileage commuters, professional truck drivers, new or learner drivers, parents of toddlers and retired residents was interviewed. One point which comes up time and again in the analysis is the hypocritical attitude of “JIMBYism” in which interviewees freely admitted they want 20mph adhered to in their street but are not committed to driving at 20mph in other people’s streets and neighbourhoods. Other common reasons for failure to comply with signs-only 20mph limits in the Bristol pilot areas identified are: feeling pressure from “other” drivers; force of habit; no fear of getting caught; lack of awareness of new limit despite presence of signs and roundels; and difficulty in staying at 20mph due to poor concentration or car gearing. However, a significant number of individuals are prepared to champion the cause for 20mph saying that they always adhere to the limit as they want to make streets safer and more pleasant for all.

The detailed analysis of the qualitative data segmented interviewees and focus group participants into three broad categories relating to 20mph limits: supporters, pragmatists and sceptics. The report presents some illuminating and personal stories or soundbites from each of these groups on a range of 20mph themes. The soft measures or social marketing implications are then identified so that a programme of interventions can start to be defined. For example, one interviewee said “...I used to [drive at 20] and then I just noticed that no one else does, so I started going a little bit faster.” This downward spiral of silence could be reversed through a carefully designed social norming campaign to help people feel that 20mph is normal, not weird.

This research report provides an evidence base for soft measures – where such evidence exists – coupled with unique insights from drivers and residents already experiencing 20mph signs-only limits in Bristol. It forms a useful starting point for policy makers and practitioners as well as academics to develop a programme of social marketing-led soft interventions to support the implementation of signs-only 20mph schemes. The final section of the report provided a checklist of “20 things to make 20mph normal”.

**International, national and local evaluations of intervention evidence**  
**Atkins, 2010. *Interim Evaluation of the Implementation of 20mph speed limits in Portsmouth*. For Department for Transport. London: DfT.**

Portsmouth City Council (PCC) was the first local authority in England to implement an extensive area-wide 20 mph Speed Limit scheme – that is introducing signed 20 mph limits largely without traffic calming, covering most of its residential roads which previously had a 30 mph speed limit. The implementation of the 20 mph Speed Limit scheme was carried out on 94% of the PCC road length (410 km of the 438 km of road length).

One of the aims of the scheme was to be self-enforcing (avoid the need of extra police enforcement) and partly to support the low driving speeds and encourage less aggressive driving behaviour. Overall there was an increase in the number of sites that demonstrated speeds of 20 mph or less after the implementation of the scheme. Many sites already had low average speeds of 20 mph or less before the scheme was implemented. At the sites monitored with higher average speeds before the scheme was introduced, there were significant reductions in average speeds. For example, for the group of sites monitored with average speeds of 24 mph or more before the scheme was introduced, the average speed reduction was 6.3 mph. The average reduction in mean speeds on all roads was 1.3 mph.

Comparing the 3 years before the scheme was implemented and the 2 years afterwards, the number of recorded road casualties has fallen by 22% from 183 per year to 142 per year, faster than the fall in casualties in comparable areas elsewhere in the country. During that period casualty numbers fell nationally – by about 14% in comparable areas. It was concluded from the figures then available that the implementation of the 20 mph Speed Limit scheme has been associated with reductions in road casualty numbers. The scheme has reduced average speeds and been well-supported during its first two years of operation. Through qualitative survey work school pupils, 17% of pedestrians, cyclists and public transport users reported that they had increased the amount that they travelled on foot, bicycle and public transport.

**Warrington Borough Council, 2010. *Executive Board. 20mph speed limit trial assessment*. Warrington Borough Council.**

The report describes outcomes of investigations into the feasibility and potential benefits of extending 20mph speed limits to all residential streets within the Borough in order to encourage an attitudinal change in drivers. Pilots were launched on 14th February 2009 and were to run for an 18 month period, the maximum length of time permitted for the ‘experimental’ Traffic Regulation Orders (TRO) required to make the 20mph speed limits enforceable.

In summary, the results show that traffic flow reduced by an average of 2678 vehicles per week per road throughout the 3 trial areas; average speeds reduced by 1.45 mph and; a reduction of injury collision occurrence of 25.5%. Each of the trial areas saw increases in average speeds during the final monitoring stage. However, as the authors noted, it is not possible to say whether speeds will increase to their original levels without undertaking further assessment in 2011.<sup>22</sup>

The report concluded that the trial of 20mph speed limits in Warrington demonstrated some undoubted benefits in terms of collision and average speed reduction. Public opinion was also generally supportive, although there was concern that enforcement would not be as rigorous following the trial, with a very high proportion stating that physical measures would be needed to continue to benefit from speed reductions. Monitoring results also indicated that average speeds might be increasing again, and that this could have a detrimental impact on collision reduction benefits. However, there was sufficient evidence to suggest that the trials should be made permanent, with the exception of the local distributor routes Park Road and Long Lane.

The report also concluded that the benefits that had been gained from the trial were notable, and there could be significant benefits gained through a wider roll-out. However, financial implications needed to be taken into account, particularly given the financial pressures that would be experienced over coming years.

In terms of equality and diversity/equality impact assessment it was stated that a reduction in average speed in residential areas will prevent the frequency of road traffic collisions. The use of 20mph speed limits will specifically assist vulnerable road user groups, including young and elderly pedestrians and pedal cyclists. Reducing average speed through the use of 20 mph speed limits will therefore have a positive impact on the age target group.

**Bristol City Council (BCC), 2012. 20MPH Speed Limit Pilot Areas. Monitoring Report. Bristol: Bristol City Council.**

The Bristol pilots were designed as 'signs only 20mph' without what was noted to be expensive physical measures for traffic calming. The pre and post monitoring included speed counts, injury data, walking and cycling counts, noise and air quality assessments, doorstep questionnaires, and monitoring of reliability and journey time for buses. The Inner South pilot began on 21st May 2010 and the Inner East on 22nd October 2010.

The pilots were underpinned by a joint communications campaign delivered by Bristol City Council and NHS Bristol working in partnership with local community groups, local schools, and with support from Avon and Somerset Constabulary. The main publicity was through leaflets, posters, articles in local newsletters and some mass media coverage. The experience of delivering the pilots suggested that clear communications, which explained the case for 20mph, dispelled the many myths about 20mph, and that feature local people, are critical to building the culture change that the vast majority of local people say they wanted to see.

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<sup>22</sup> A request was made by email to Warrington Borough Council for more recent data. No reply was received.



Some of the key headline findings are as follows:

- 65% of roads saw a reduction in mean speeds
- 18 roads no longer saw average speeds above 24mph
- The average reduction in mean average speed across roads in the Inner South area was 1.4mph, and in the Inner East area was 0.9mph
- The mean average speed across all roads has dropped to 23mph and under between 7am through to 7pm
- Increase in counts for walking range from 10% increase to 36% increase according to whether one looks at South pilot or East, weekends or weekdays, and correcting (or not) for rainy days.
- Increase in counts for cycling range from 4% increase to 37% increase, according to the same variables.
- Support for 20mph limits amongst pilot area residents is around 82%
- Around 70% support a citywide expansion of 20mph limits in residential areas
- Pedal cycle casualties in the Inner South area have fallen by 3 in the same period but remained constant in the Inner East
- Pedestrian casualties have remained constant in both areas.
- Around half of residents felt the limits were clearly signed.
- 35% of respondents from the main roads felt roads were safer following the 20mph limits being installed.
- 89% of residents supported 20 mph on all residential streets
- 56% of residents supported 20mph on 'main' roads

In terms of casualties the data did not show significant indications to any trend either way. It was noted, therefore, that it was not possible to draw any firm conclusions until longer term data have been collected. In terms of both air and noise pollution, it was reported that the introduction of 20 mph limit areas has had a negligible effect on traffic noise. It showed a small reduction in road traffic noise in the order of -0.5 dB maximum (unlikely to be noticeable) and the effect on air quality is too small to be measurable. Both impacts were assessed using modelling techniques.

### **Edinburgh City Council, 2013. *South Central Edinburgh 20mph Limit Pilot Evaluation South.***

The Council noted that with current levels of available funding available to the Council, it would take many more years to introduce physically traffic calmed 20mph zones to all residential areas. Depending on the scale of implementation, however, 20mph limits may be introduced at 1/6th of the cost of traditional 20mph zones.

For the 28 locations that had their speed limit changed to 20mph for the piloting of 20mph speed limits in the city, average 'before' speeds were 22.8mph, while 'after' speeds fell to 20.9mph; an average fall of 1.9mph. Speeds after implementation also reduced on the 20 locations that remained with a 30mph limit, though the average fall was only 0.8mph (to 25.4mph), less than the fall witnessed across 20mph limit streets. The speed surveys have demonstrated that the 20mph speed limit has resulted in an overall positive drop in speeds in the majority of cases. Although 75% of the surveyed 20mph streets continue to have average vehicle speeds in excess of 20mph, in all streets (except the four locations for further attention) speeds remain

lower than 24mph, the DfT threshold recommended for the effective operation of 20mph Limits.

In terms of road safety, assessing casualty reduction as a direct result of the Pilot was restricted, however, as there only existed verified incident data covering a nine month period following the Pilot's launch on 23 March 2012. The City Council noted that this is of limited value as analysis usually spans a three or five year period.

The overall level of support for the 20mph speed limit has increased from 68% 'before' to 79% 'after', while the proportion of respondents strongly supporting the 20mph speed limit increased significantly from 14% 'before' to 37% 'after'. Only 4% were opposed, from 6% 'before'. Households with children are more likely to support the 20mph limit with 94% (83% 'before') of households with children in support compared to 77% (67% 'before') of households without.

Change in residents' travel behaviour within the Pilot area was assessed for the year period following the launch of the Pilot. The net change (the difference between the overall increase and decrease in mode use) was +7% for journeys by foot, +5% for journeys by bicycle, -3% for journeys by car. This reflects a net increase in levels of walking and cycling within the Pilot, while levels of car use in the Pilot reduced overall.

**McKibben, D. 2014 *Impact of 20mph speed limits*. Research and Information Service Research Paper, NIAR 168-14, Belfast: Northern Ireland Assembly.**

This summary notes that it is clear that 20mph speed limits are becoming increasingly common; particularly in the current economic climate as this route has enabled local road authorities to take affirmative action against the road safety problems caused by excessive speed, without the capital outlay required to install physical traffic calming measures. What is less clear is whether or not area wide speed limits have any meaningful impact.

This study lists a number of 20mph speed limit implementations within the UK. This includes limited descriptions for Portsmouth, Bristol, and Edinburgh. Additional information is provided for Graz, the Netherlands, the EU and also Dublin. No conclusions are made.

**Robinson, J., Newman, N. 2016. *20mph Research – Purpose, Methodology and Early Findings*. Study for Dept. for Transport. Presentation at City of London, February.**

A presentation by Atkins staff during the early stages of a 3 year project to assess 20mph speed limits, funded by the Department for Transport. The presentation reported some provisional findings. These included that 51% of residents support 20mph limits before implementation but this rises to 75% after implementation. 9% were unsupportive which rose to 12% after implementation. Drivers were very supportive with 66% saying that the new limits were a good idea. 77% of drivers also thought that 20mph is beneficial for cyclists and pedestrians.

The majority of residents are perceived to be aware of the 20mph limit in their street but some residents remain unaware and are unlikely to perceive any benefit. 20mph limits are perceived to be beneficial; for pedestrians, cyclists and residents. 75% of

residents and drivers felt the limit was beneficial for the local community. Questionnaire results suggest a small number of residents are walking and cycling more in some case study locations. 22% of residents felt that the 20mph limit had made their street a more desirable place to live while less than 1 in 10 thought more people were out and about on their street. Very few residents (3%) believed the limit meant people were avoiding the area or were less likely to use local shops and amenities.

**Transform Research and Communication (TRC), 2017. *20mph default speed limits for residential areas*, Edinburgh: Transform Scotland.**

This paper was a resume of past studies, such as those conducted by the then Scottish Executive, as noted in the Introduction, the Bristol research of 2012, and previous research addressing traffic calmed 20mph zones. It did also include a summary of evidence from a Steer Davies Gleave study which reported that:

‘Reducing speed limits is one way to lower vehicle speeds. The available evidence indicates that on average, the change in average vehicle speed is approximately 25% of the change in the speed limit. This would equate to a decrease of about 2.5mph for a 10mph reduction in the speed limit. However, this is heavily dependent on local circumstances.’<sup>23</sup>

It cited some research on emissions not mentioned in other studies reported here. A study on 30km/h zones showed a 12% reduction in fuel consumption, which suggests that 20mph limits without humps can cut residential CO2 emissions by 12%. Less acceleration and braking smooths traffic, reduces gaps between cars and reduces idling. Less acceleration and braking smooths traffic, reduces gaps between vehicles and reduces idling.

The study outcomes relating to 20mph were: that ‘enforcement’ and ‘engineering’ are now generally more problematic in cost and other terms than during the first wave of 20 mph restrictions introduced by Local Authorities in the 1990s, the emphasis in seeking to achieve significant and sustainable reductions in vehicle speeds is now expected to be largely through 20 mph limits reinforced by ‘education’ – but this points to a need for profound cultural change in terms of public attitudes to speed, and that is likely to take time. The forthcoming Atkins Review for the Department for Transport was also noted as hopefully proving important evidence.

**Pilkington, P., Bornioli, A., Bray, I., Bird, E. 2018 *The Bristol Twenty Miles Per Hour Limit Evaluation (BRITE) Study*, Bristol: University of the West of England.**

In July 2012, Bristol City Council voted to introduce 20mph speed limits throughout the city. This followed the completion of successful pilot schemes in South and East Bristol (based on the 2012 report above). The 20mph speed limit was introduced in six phases. The first area implemented on 20th January 2014 covers Central Bristol and borders the two pilot areas. The process of introducing 20mph limits across the city was completed in September 2015. The roll-out of the 20mph speed limits in Bristol was about more than reducing road traffic casualties, although this was one of

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<sup>23</sup> [Steer Davies Gleave, 2014. Research into the impacts of 20mph speed limits and zones, London: SDG.](#)

the aims. The roll-out sought to improve health and well-being across the city, taking a holistic perspective as to how slower traffic speeds might impact on people's lives.

The aim of the study was to evaluate the impact of the roll-out of 20mph speed limits across the city of Bristol. The methods used for the research took a holistic, public health approach to evaluation, using a variety of data sources to examine: changes in vehicle speeds; road traffic casualties; levels of walking and cycling; public perceptions and attitudes; and reported levels of health and wellbeing across the communities in Bristol before and after the introduction of 20mph speed limits across Bristol. The authors noted, it is important to note that success is not defined by all average speeds being under the set speed limit of 20mph – it is about bringing vehicle speeds down closer to 20mph, and assessing any positive impacts of that speed reduction compared to the situation before the introduction of the lower limits.

In terms of speed, on average, according to Automatic Traffic Count (ATC) speed data (with over 36 million vehicle observations analysed) there was a statistically significant 2.7mph decrease in vehicle speeds on roads where the 20mph speed limit was introduced, when controlling for other factors that might affect speed (areas, calendar year, time of day, season, type of road, and day of week). In the areas that stayed 30mph, there was a statistically significant negligible reduction in speed (0.04 mph).

The largest reduction in speed was on 20mph A and B roads. Average speeds on 20mph roads were found to be below 24 mph in every area except for the Outer North and South areas of Bristol. On 30mph roads, average speeds are below 30mph in every area. Average speeds declined by a greater amount in the summer months and on weekends, where traffic volume (and congestion) is lowest. 94% of roads surveyed saw a reduction in average speeds. Average speed decreased on 100 roads out of 106.

In terms of wider public health benefits clear majority support remains in Bristol for 20mph speed limits, with 62% supporting such limits on residential roads and 72% on busy streets. However, there is cynicism in Bristol about lack of enforcement of 20mph limits, a lack of compliance from “other drivers” and an increased readiness to report that it is sometimes okay to drive above the posted speed limit on residential roads. The number of people who walk or cycle to work in Bristol has increased between 2010 and 2015. More children in Bristol now walk or cycle to school following the introduction of the 20mph speed limits. It is not claimed, however, that 20mph was a direct cause of these changes.

Annual rates of fatal, serious, and slight injuries following the introduction of the 20mph speed limits are lower than the respective pre-20mph limit rate, thus showing a reduction in the number of injuries. Although the study methodology does not allow a direct causal relationship between the introduction of the 20mph speed limits and reductions in injuries to be proven, there is a very promising trend that is plausibly associated with the 20mph intervention:

- The estimated total number of injuries avoided across the city each year is 4.53 fatal, 11.3 serious, and 159.3 slight injuries.

- The estimated annual saving following the decrease in casualties is £15,256,309, based on Department for Transport formula for calculating the cost of road traffic casualties.
- The decrease in casualties has also benefitted some vulnerable groups. It is estimated that; two child lives will be saved every three years; 3 older adult lives will be saved every two years; and 3 pedestrian deaths will be avoided every year.
- More than 4 child serious injuries will be avoided in just over three years; 4 older adult lives will be saved in three years; and 2 pedestrian severe injuries will be avoided every year.
- The number of avoided slight child injuries per year is 7.68; 25.77 older adult slight injuries will be avoided each year; and 24.54 pedestrian slight injuries will be avoided each year.

In terms of overall conclusions, the study has found statistically significant reductions in average traffic speeds of 2.7mph across the city of Bristol, following the introduction of 20mph speed limits. This is a larger reduction than seen in previous evaluations in other cities. The study employed a more sophisticated analysis than previous studies of 20mph limits, including using individual speed data from over 36 million vehicle observations and controlling for other factors that might affect changes in traffic speeds.

The study made a strong final conclusion. This was that:

“in order to assess effectiveness of 20mph speed limits, it is vital that other towns and cities follow Bristol’s example, and prioritise the ongoing collection and analysis of appropriate data on vehicle speeds, road traffic casualties and wider public health impacts.”

**Calderdale Council, 2018. *Report to Scrutiny Panel. 20mph speed limits.*  
Halifax: Calderdale Council.**

This Scrutiny Report was to provide the Panel with information on the impact of the 20mph schemes. At the May 2014 Cabinet meeting, the Council agreed to a phased approach for the delivery of 20mph speed limit areas on main residential streets and this was completed with the final 20mph phase implemented in December 2017. 55% of Calderdale roads are now 20mph and 71,000 (74%) households have 20mph speed limits in their area. In terms of casualty changes, casualty figures were assessed for 7 areas 3 years prior to the introduction of the 20mph area being implemented and the 3 years post introduction. For these seven areas the total number of casualties 3 years prior to installation was 171, compared to a 3 year after figure of 120 casualties. This gives a total reduction in casualties of 51 (30%) over this 3 year period.

However, although the initial figures were very promising, for the recently installed 20mph areas, the Council didn’t yet have 3 years of post-implementation data. For these 9 areas, the total number of casualties in the 3 years prior to installation was 258, this compares to a pro-rata 3 year after figure of 155 casualties. This is based on casualty data for 2.5 years and the last 6 months to reach 3 years estimated. This represents a predicted reduction of 103 casualties (40%).

In terms of speeds driven, over 3.5 million vehicle readings were taken. There was an average reduction in speed of 1.9mph across the 20mph locations resulting in an average speed of 23.2mph. All areas showed a reduction in the average speed with 85% of roads surveyed having a reduction in average speed. There are a small number of roads where speeds have not reduced and, the authors noted, there are some challenging areas.

It is of note that there has been significant police engagement. Police engagement and enforcement continues in 2018 via Operation Hawmill. £20k has been allocated by the police and match funded by Calderdale Council – the operation will run twice a week and targets nuisance motorists and dangerous drivers and focuses on the four factors 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). Areas that will be targeted have been selected in relation to the area where they receive most complaints eg Warley, Park, Town Centre / Boothtown, Skircoat. 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.

Independent surveys were conducted with residents regarding their views and opinions on 20mph speed limits. 2000 people across Calderdale were interviewed in February 2015. 89% were in favour of the introduction of 20mph speed limits across our area. Doorstep surveys were also carried out with 240 households in Todmorden (in 2015 and 2016) and 500 in Sowerby Bridge before and after installation of 20mph speed limits (in 2015 and 2017). Other findings were that:

- Survey data shows continuing support for the scheme of over 80%.
- The vast majority of residents feel that 20mph is an appropriate speed for their street. Perceived advantages are around safety (particularly for pedestrians and residents).
- Increased cycling in Todmorden for those who already owned/had use of a bike.
- Increase in 'aggressive driving' as a perceived disadvantage post implementation.
- No change in walking patterns in Todmorden; increase in walking in Sowerby Bridge.

Indications suggest that the 20mph roll out has been effective in reducing casualties by 30%. Further monitoring will be required over the next three years for a full picture of all areas that have been implemented. Although there is still majority support for 20mph speed limits in Calderdale, there remains concern about compliance and behaviour of other drivers. Whilst there has been a reduction in speed of an average of 2mph, education and engagement needs to be maintained to encourage drivers to think of 20mph as the norm in residential areas to create 'healthy streets' where everybody can enjoy spending time and being physically active.

The findings support a principle known as the "prevention paradox" this term coined by Professor Geoffrey Rose argues that interventions can achieve large overall health gains for whole populations but might offer only small advantages to each

individual. 20mph on the majority of residential streets is an intervention that addresses a large number of people who are at a small risk and is potentially more effective in reducing injury than an intervention addressing small numbers 'at high risk.

**World Health Organisation, 2017. *Managing Speed*. Geneva: WHO.**

This is a summary of the evidence-based interventions that are shown to be effective in tackling speed in the light of a global health and development problem. At the global level, about half of all road user deaths are among vulnerable road users i.e. pedestrians, cyclists and motorcyclists. In 2011 the United Nations declared a Decade of Action for Road safety which has a target of stabilising and then reducing the number of global road traffic deaths. In September 2015, this goal was augmented by a much more ambitious target within the Sustainable Development Goals which, within its health goal, calls for a reduction in the absolute number of road traffic deaths and injuries by 50% by 2020.

WHO says that a safe speed on roads with possible conflicts between cars and pedestrians, cyclists or other vulnerable road users is 30km/h. To achieve these safe speeds, local authorities should have the legislative power to reduce limits as needed to better protect all who use the roads. In addition, drivers should be informed of limits through sign-posting the legal limit on roads and rigorously enforcing the law. WHO places such a speed limit within a Safe Systems Road Safety framework.

Enforcement is essential to make speed limits effective. Indeed, where countries have changed their speed limits, but have taken little action to enforce them, there have been very limited benefits. WHO notes that enforcement through the use of automated speed control is most effective at reducing speed.

It is noted that Grenoble is the first French city to reduce the entire city speed limit to 30km/h, through posted speed limits and some traffic calming measures, with the aim of improving safety and reducing air pollution.

**Speed choice**

**Dinh, D., Kubota, H. 2013a. Profile-speed data-based models to estimate operating speeds for urban residential streets with a 30 km/h speed limit, *IATSS Research*, 36: pp. 115-122.**

A speed limit of 30 km/h has been widely introduced for urban residential streets to ensure traffic safety and allow these streets to fulfil other intended functions. However, excessive speeds on these roads are very common, causing traffic safety problems and threatening neighbourhood liveability. The research objective was to develop models for predicting operating speeds on tangent sections of urban residential streets with a 30km/h speed limit. The influences of various roadway and roadside elements on drivers' speed choice in terms of maximum speed and speed at the entrance to the next un-signalised intersection were evaluated. Rather than using spot-speed data as often used in previous studies, drivers' speeds were measured continuously using an elaborate field survey.

From the road design perspective, the results from the models suggested that attention should be paid to the selection of street length, the allocation of cross-section elements, and the characteristics of intersections to obtain desired driving speeds. The models can be used to assess the issue of existing, to re-design streets to make them more calming, and to plan and design new urban streets to meeting the intended traffic goals.

**Kröyer, H. 2015. Is the 30km/h a 'safe' speed? Injury severity of pedestrians struck by a vehicle and the relation to travel speed and age, *IATSS Research*, 39: pp. 42-50.**

Swedish collision data from 2004-08 was used to analyse the relationship between injury severity for pedestrians struck by a vehicle and the speed environment at casualty locations. The results showed that there was a relationship between the mean travel speed and the age of the pedestrian struck and the injury severity and risk of fatality. The main result from the analysis is that the overwhelming majority of collisions in all age groups occur at locations with a speed limit of 50km/h (71.5% to 83.4%) Only 8.2% to 15% of the collisions occurred where the speed limit is 30km/h or below. The author noted that the low proportion at 30km/h is probably the combined effect of low traffic volumes in these streets, and the fact that there is a much lower risk of collisions compared to 50km/h.

The data also shows that even though fatal collisions are rare in the speed environments where the mean travel speed is below 40km/h and severe injuries are rare below 25km/h, over 30% of severe injury collisions occur in speed environments below 35 km/h. This indicates that 30km/h speed limits might not be as safe as previously believed. Seniors and older seniors (75+) and children are struck by vehicles just as much in low speed environments of 30km/h at on 50 km/h roads. The author concludes from this that current speed policy needs to address this issue.

**Dinh, D., Kubota, H. 2013b Speeding behaviour on urban residential streets with a 30km/h speed limit under the framework of the theory of planned behaviour, *Transport Policy*, 29: pp. 199-208.**

This study addressed the issue of combatting speeding on urban residential streets with a speed limit of 30km/h. It is necessary to identify the determinants as to why violation has often been committed willingly. Using the Theory of Planned Behaviour (TPB) framework, it found that speeding intention was significantly associated with speeding behaviour which was assessed by on-street observed speed. About 22% of the variance in observed speed was explained by intention. This result is consistent with previous research findings using a meta-analysis (Armitage and Conner, 2001) in which 20% of the variation in observed behaviour was accounted for by the TPB. Also, consistent with previous research, this study supported the issue of past behaviour, self-judged driving skill, and belief in the social acceptance of speeding behaviour. The findings suggested that changing drivers' beliefs about their driving skill and the way they view their driving action as a social manner which they should respect, may be a potential area for reducing excessive speeds.

The study also addressed the perceived appropriateness of the 30km/h speed limit, perceived function of residential streets with a 30km/h speed limit, and perceived



right of vulnerable street users on these streets. The outcome of testing these variables was that they contributed to a statistically significant increment of explained variance in speeding intention and all of them were significant predictors in the model after controlling for other TPB components as well as demographic and driving-related variables. Thus, agreement with appropriateness of the speed limit, function of the street, and vulnerable road user rights were predictors of intention to speed or not.

### **Driver attitudes**

**Dinh, D., Kubota, H. 2013c. Drivers' perceptions regarding speeding and driving on urban residential streets with a 30km/h speed limit, IATSS Research, 37: pp.30-38.**

This study drew substantially on a literature review and survey of driver perceptions regarding driving at 30 km/h. General knowledge and opinions about residential streets with a 30km/h speed limit showed that not all drivers perceive the intended functions of 30km/h residential streets. When asked about the function of these streets, only 24% of respondents said that their use for residential activities was more important while still 19% said that their use for traffic was more important. Presuming that the perceived functions of streets influences driver behaviour, drivers should be better educated about residential uses to reduce bad driving manners. On the positive side, this research revealed that drivers tended to respect the rights of vulnerable street users as a majority of respondents agreed that motorists should give priority to pedestrians/cyclists anywhere they are encountered on 30km/h residential streets.

The survey results showed that drivers were less likely to recognise speeding on neighbouring streets as a serious matter. Consistent with previous research (Stradling et al, 2003), a majority of respondents suggested either redesigning streets to make them inherently calmer or installing traffic-claiming tools as the most effective anti-speeding interventions. This finding suggests that drivers tend to push responsibility onto urban planners and street designers to make the 30 km/h speed limit more credible. The result supports the introduction of educational measures and social campaigns to cope with driving violations.

The conclusions stated that the research confirmed that almost all drivers had exceeded the speed limit and that they intended to do so in the future if nothing changed. Drivers tended to have positive beliefs about complying with the speed limit and to understand the negative consequences of speeding, but a majority of them believed that breaking the speed limit would reduce their travel time. A number of drivers still supported the use of 30km/h limits and also favoured protecting the rights of vulnerable street users. With regards to anti-speeding counter-measures, from a driver's point of view, streets should be designed to make the 30km/h speed limit more credible. Lastly, six underlying factors affecting drivers speed choice were identified. These were: favourable driving conditions, unfavourable driving conditions, driver's current mood, responsibility to others, responsibility for safety of vulnerable street users, and the traffic situation.

**Tapp, A., Nancarrow, C., Davis, A. 2015 Support and compliance with 20mph speed limits in Great Britain, *Transportation Research Part F*, 31: pp. 36-53.**

Using a population wide survey of drivers in GB, this study explored how support and compliance with 20mph speed limits were interlinked. Supporters as a whole are most inclined to support 20mph limits because the limits may mean fewer serious collisions and that children can play more safely. Supporters-compliers are more inclined to this than other groups. They differ from supporter-non-compliers in that they are much more likely to appreciate benefits such as to make our streets more pleasant to live in, and improve the quality of life. This suggests that the priorities of supporter-compliers seem to lie with residency based benefits as well as driver centric safety/traffic concerns.

20mph speed limit opponents can also be split into two. Those who oppose but may comply (opponent-compliers) with the limit, and those who oppose and may not comply (opponent-non-compliers). Opponent-compliers, on the face of it, have claimed behaviours that appear to be at odds with their attitude to 20mph limits. Both opponent-compliers and opponent-non-compliers tend to register mild rather than strong opposition to 20mph limits. Opponent non-compliers are also more likely to register only mild agreement that they may not comply: this contrasts with the strong feelings about pro-compliance expressed by those who support and may comply.

The findings support a model of driver speeding that offers considerably more complexity than simple mechanisms of attitude predicting behaviour. A number of discriminators of the dimensions of support-opposition and compliance-non-compliance with respect to 20mph speed limits in GB were identified. Key discriminators include self-enhancement bias, social contagion, and inattentive/automatic driving. There seems to be a de-coupling of attitudes and behaviour such that high numbers of drivers apparently contradict their support or opposition for 20mph limits with their actual driving. These findings suggest that the designers of 20mph limits and possibly 30km/h schemes internationally need to include programmes that directly address compliance.

**Tapp, A., Nancarrow, C., Davis, A., Jones, S. 2016. Vicious or virtuous circles? Exploring the vulnerability of drivers to break low urban speed limits, *Transportation Research Part A*, 91: pp. 195-212.**

This study addressed two models of how drivers may or may not comply with 20mph speed limits. This could be a 'vicious circle effect' that copycat driving could create that leads to increased levels of non-compliance. However, it is also possible that an alternative 'virtuous circle' effect may emerge from the high levels of societal support for 20mph limits pressurising drivers to comply with speed limits. Drivers have a tendency to drive at speeds that they regard as socially acceptable, and social acceptability tends to be governed by cultural norms.

The creation of new urban speed limits creates a 'blank canvas' with the new 'norm' yet to be established, in particular, as our results above indicate, by the 'mainstream middle' of drivers. But who creates the new conditions of normality? It is possible to conceptualise the time just after the imposition of new speed limits as a period in

which a ‘battle’ ensues between the two extremes - those who support the new limit and are keen to comply, those who oppose the limit and lack commitment to comply with it, and those in between these polarised positions. Whilst at the extreme we suspect Staunch Supporters are very likely to obey the limit and Staunch Opponents seem likely to break them, the *middle ground* is much less certain, but very important, perhaps ultimately in deciding the direction of travel of the new norm: towards general compliance, or general non-compliance.

The behavioural outcomes modelled above rest upon two key underlying processes that policymakers may want to address: first, the role of public opinion in shaping word of mouth towards support or opposition (an attitudinal model), and second, the role of social norms in setting ‘acceptable’ boundaries for driving (a behavioural model).

In Great Britain public opinion is shaped by a variety of vested interests both for and against 20mph limits. Groups that support low speed limits typically stem from public or third sector: road safety professionals, the health sector, senior police officers, local authorities, campaigning groups such as cycling campaigning charities, and low speed lobbying groups such as 20s Plenty. Their messages include encouraging positive attitudes towards stronger enforcement; challenging the default assumptions that urban roads are primarily for travel/cars and promoting the alternative narrative that roads are urban living spaces for sharing; challenging the dominant discourse that ‘we must keep the economy moving’ and therefore the needs of business transport should prevail, and promoting a more balanced view that promotes health and wellbeing agendas; and, perhaps most difficult, challenging the culture of speed that is promoted through auto-advertising, media, and TV (programmes such as Top Gear have worldwide reach with much of its content implicitly celebrating speeding). Policy makers and campaigners may also make use of persuasion techniques, mentioned earlier, such as *Building on Premises* (messages that begin with content that already has high agreement – such as ‘lower speed limits lead to less accidents’) and *Inoculation* (‘arming’ people against attacks on their beliefs), perhaps guided by the data reported on here.

Those against low speed limits tend to be (often quite small) campaigning groups such as the Alliance of British Drivers, Safespeed, and Motorists Against Detection. Less obvious but arguably more powerful forces include national media (e.g. Sunday Times, 2015; Telegraph, 2014), and large organisations or corporations that have the power to lobby and influence Government decision making: auto manufacturers and suppliers, the Federation of Small Businesses, the RAC Foundation, and so on. The view of these opposition groups is that increased policing of limits would be too costly and in any event not welcome for ‘law abiding citizens’. Local promotion of limits on safety grounds may be dismissed as misguided because, these groups claim, the link between speed and crashes is contested. Indeed, the presumption may be that ‘most people’ should be left alone to ‘use common sense’ whilst driving, with the implication that safety or health issues are exaggerated or not important. It is unlikely that the complexities of drivers influencing each other’s behaviour would be accepted: more likely, driving safety would be simply attributed to each individual’s

ability and experience, with education seen as the way forward: 'speed doesn't hurt anyone – it is bad driving that causes problems'.

The authors conclude that perhaps the most realistic outcome for supporters of speed limits would be to create 'normative support' and 'normative compliance', that is, states of cultural normality in which the *expected* behaviour is to comply, with non-compliance generating significant social disapproval. There seems considerable merit in this basic idea: as mentioned earlier there is little doubt that social norms are important influences on driver behaviour. In the context of new 20mph limits, the mechanism for change would be to support compliance with 20mph as the descriptive norm (a belief that others *are* complying) as well as the injunctive norm (a belief that others *should* comply). It is possible to embed a norm by making use of another norm, in this case, the principle of reciprocity – the expectation that one should return a favour of a good deed. For instance, in an attempt to 'give something back' to drivers, in 2010 the British Government contemplated the parallel increase in motorway speed limits from 70 to 80mph in concert new urban 20mph limits. Although this idea was eventually rejected, the principle remains.

### **Cycle use, barriers and risks**

**Wann, J. Poulter, D., Purcell, C. 2011. Reduced Sensitivity to Visual Looming Inflates the Risk Posed by Speeding Vehicles When Children Try to Cross the Road, *Psychological Science*, 22(4) pp. 429–434.**

The ability to detect and avoid looming objects is critical to survival. Almost all locomotor animals are sensitive to visual looming or changes in optical size. Sensitivity to optical expansion is critical for selection of an appropriate response in order to avoid a collision (e.g., when crossing the road). Failure to detect and process looming information accurately can have serious consequences. Globally, pedestrian accidents are the third leading cause of death for 5- to 9-year-olds, and children's visual limitations in gauging speed and distance are cited as a key deficit contributing to such accidents. In the United Kingdom alone, there are more than 6,500 pedestrian casualties per annum, and 30% of the individuals killed are children ages 0 to 15 years.

The study is the first to demonstrate that the neural mechanisms for detection of looming are not fully developed until adulthood. The perceptual threshold for looming detection has not typically been considered in research to estimate the time available before the vehicle passes (TTP) the pedestrian. In principle, detection of looming is an essential component in making robust TTP judgments, which dictate effectiveness in skills such as catching, hitting, and road crossing. The developmental trends observed may explain some of the developmental trends in these activities. The study provided evidence of clear improvements in looming thresholds with increasing age, showing that younger children's poorer perceptual acuity potentially exposes them to greater risk at the roadside.

The researchers determined that children could not reliably detect a vehicle approaching at speeds higher than approximately 25 mph and did not reach adult levels of perceptual performance under most viewing conditions. The findings have

important implications for road-safety policy in terms of the upper limits of vehicle speed that allow children to make accurate judgments, and these findings converge with evidence that the risk of pedestrian accidents involving children is nearly 3 times higher in places where mean speeds exceed 25 mph compared with places with lower mean speeds. The data support the case for reduced speed limits outside schools and in other areas densely populated by children.

Results suggest that children's perceptual limitations place them at greater risk of stepping out in front of cars that are traveling at higher speeds. The combined implication is that driving in excess of 20 mph in a residential or school area not only increases the potential severity of any impact with a pedestrian, but also increases the risk that a child will injudiciously cross in front of the vehicle.

**Mertens, L., van Dyck, D., Ghekiere, A., de Bourdeaudhuij, I., Deforche, B., Van de Weghe, N., van Cauwenberg, J. 2016. Which environmental factors most strongly influence a street's appeal for bicycle transport among adults? A conjoint study using manipulated photographs, *International Journal of Health Geographics*, 15:31.**

This study identified micro-environmental factors that, the authors argue, should get priority when adapting the micro-environment to increase the street's appeal for middle-aged adult's bicycle transport. Through using manipulated photographs as part of a survey to offer choices in the way the street may be seen as safer for bicycle use, the authors were able to identify a hierarchy of measures to improve the street's appeal for cycling.

The study showed that a cycle path segregated by a hedge was the most important factor. However, where no cycle path was present the effect of speed limits and traffic density created the largest impact on the street's appeal for bicycle transport. Thus, where there are no possibilities to provide a separation between cycle path and motorised traffic, adjusting the speed limit of the traffic from 50km/h to 30km/h may ensure an increase in the street's appeal for bicycle transport. In contrast, when a segregated cycle path is available, the authors found no additional effect on the street's appeal of a 30km/h limit. The authors note that these findings should be communicated and included into policies at national and subnational level encouraging bicycle transport.

**Mertens, L., et al, 2017 Built environmental correlates of cycling for transport across Europe, *Health & Place*, 44: 35-42.**

This cross-sectional study sought to determine which objective built environment factors, identified using a virtual neighbourhood audit, was associated with cycling for transport in adults living in five urban regions across Europe. Previous studies have indicated that cyclists find it important to have restrictive speeds for motorised traffic when they have to share the road. Moreover, zones where the maximum speed is limited to 30km/h are proven to reduce the number and severity of bicycle crashes. This is in addition to the benefit of bicycle lanes.

Previous research by the authors found (above) that perceived lower traffic speeds were associated with higher odds of cycling for transport. Those results are

comparable with the findings in this study, showing that objectively assessed traffic speed levels of 30km/h or less were associated with higher odds of cycling. Consequently, the researchers concluded that there is a need for further tests that study the provision of bicycle lanes and reducing speed limits to promote cycling in Europe.

**Aldred, R., Goodman, A., Gulliver, J., Woodcock, J. 2018. Cycling injury risk in London: A case-control study exploring the impact of cycle volumes, motor vehicle volumes, and road characteristics including speed limits, *Accident Analysis and Prevention*, 117: pp.75-84.**

Few studies explore cycling risk in relation to exposure. The descriptive characteristics of injury and control points (controlling for confounding factors), makes some differences immediately apparent. For example, while around a quarter of cycling take place on streets with under 2000 motor vehicles per day, such roads only account for one in eight injury points (half of what might be expected if such roads were as safe/risky as other roads with difference amounts of motorised traffic). Similarly, the control point distribution suggests that although nearly 30% of cycling takes place on roads with 20mph speed limits, such roads account for just under 20% of injury points.

In this study, Safety in Numbers (SiN) was identified as a factor in explaining lower cycle injuries – more cyclists on a link means less exposure per cyclists - as drivers adapt to the presence of significant numbers of cyclists and take more care. However, in this study the researchers were able to report an effect of 20mph speed limits separate from SiN in protecting cyclists or reducing injury events.

Almost all (98%) of control and injury points fell on roads with 20mph or 30mph speed limits. There was a clear reduction in injury odds in 20mph compared to 30mph. The logarithmic relationship between motor traffic volumes and cycling injury risk suggests that reducing motor traffic volumes by, for example, 5000 motor vehicles a day will have much greater impact on relative injury odds on a road with 10,000 motor vehicles, than on a road with 30,000 motor vehicles. Further, building cycle routes that can generate new cycle trips will bring 'safety in numbers' benefits.

## 5. Key findings from the studies addressing road safety, active travel, and air pollution

Having drawn together the peer reviewed and grey literature, and placing it into 7 themes, the result is a stock of knowledge on a group of aspects addressing 20mph speed limits implementation. All respond to the research question set by the client: namely the road safety impact; the active travel and air pollution impacts. Some are weaker and some are stronger in terms of their methodological robustness and how confident, therefore, one can be in any findings reported. Table 2, in the Methodology section, provides some assistance in making sense of this.

**Table 4: Issues which each study/paper addresses**

Number	First author, year	Casualty impacts	Other road safety impacts	Air Quality impacts	Active Travel impacts
1	Aldred, R. 2018	√	√	X	X
2	Atkins, 2010	√	√	X	X
3	Bristol City Council, 2012	√	√	√	√
4	Cairns, J. 2014	√	√	X	X
5	Calderdale Council, 2018	√	√	X	X
6	Dinh, D. 2013a	X	√	X	X
7	Dinh, D. 2013b	X	√	X	X
8	Dinh, D. 2013c	X	√	X	X
9	Dons, E. 2013	X	X	√	X
10	Dorling, D. 2014	X	√	X	X
11	Edinburgh City Council	X	√	X	√
12	Greig, G. 2014	√	X	X	X
13	Jones, S. 2017	√	√	√	X
14	Kröyer, H. 2015	√	X	X	X
15	McKibben, D. 2014	√	X	X	X
16	Mertens, L. 2016	X	√	X	X
17	Mertens, L. 2017	X	X	X	√
18	NICE, 2017	X	X	√	X
19	Pilkington, P. 2018	√	√	X	X
20	Robinson, J. 2016	X	√	X	X
21	van Schagen, I. 2016	X	√	X	X
22	Tapp, A. 2015	X	√	X	X
23	Tapp, A. 2016	X	√	X	X
24	Toy, S. 2012	X	√	X	X
25	TRC, 2017	X	√	√	X
26	Wann, J. 2011	√	X	X	X
27	Warrington BC, 2010	√	√	X	X
28	WHO, 2017	√	√	X	X
29	Williams, D. 2013	X	X	√	X

From Table 4 we can see that just one study address all of these. Table 3 divides the road safety issue into casualty impacts, and other road safety impacts. The latter covers attitudes to 20mph speed limits, enforcement, the impact of speed on

casualty risk, marketing, and inequalities. Eleven of the 27 studies did, however, address at least two of the four impacts.

### **Road Safety: Casualty reduction**

The evidence for reduced casualties as an outcome of 20mph is strongest in this Review. While the need for more case-controlled studies and possibly randomisation remains, UK evidence from Portsmouth, Warrington, Bristol and Calderdale provides a consistent outcome of declining casualties including fatalities. This does not necessarily mean that speeds driven have lowered to 20mph in free flowing traffic situations but that the drop has been significant enough to likely translate into reduced injury severity and possibly more near misses. These estimations of declining casualties is in line and triangulates with the evidence from previous research which has found that for each 1mph average speed reduction there is a 6% reduction in urban traffic collisions. This means that there is greater confidence that the reported casualty reductions are true and the risk of bias is low. It is supported by previous research in Scotland prior to 2010. In addition, researchers have been able to identify that 20mph speed limits have a separate effect from any Safety in Numbers effect in protecting cyclists or reducing injury events (Aldred, R. et al, 2018). Furthermore, casualty reduction outcomes are also supported calls by international bodies such as the World Health Organisation (2017) for 20mph/30km/h speed limits albeit with the statement of the need for enforcement.

Estimations of the likely level of lives and casualties avoided have been estimated by Jones and Brunt (2017) for Wales. This study reported that if all 30mph roads in Wales were replaced by 20mph speed limits 6–10 lives would be saved and 1200–2000 casualties avoided each year, at a prevention value of £58M–£94M each year. Atkins (2010) reported an average speed reduction of 1.3mph, Warrington (2010) 1.45mph, Calderdale (2018) 2.0mph and Bristol (2018) 2.7 mph. These differences may be the result of the intensity of engagement with the public (Toy, 2012) but other factors may be at work including that city-wide verses selected areas. Interestingly perhaps, the Bristol 2018 study also found a slight drop in speeds driven on 30mph speed limit roads. This could be due to drivers being be more conscious of their speeds. To date, this study (BRITE) provides the most thorough analysis of the effectiveness of 20mph in any one locality. It had the minimum of 3 years of post-intervention casualty data for much of the city.

As a coda, another road safety aspect concerns children and visual looming. The evidence reported by Wann and colleagues (2011) is that children in their study could not reliably detect a vehicle approaching at speeds higher than approximately 25 mph and did not reach adult levels of perceptual performance under most viewing conditions. The findings have important implications for road-safety policy in terms of the upper limits of vehicle speed that allow children to make accurate judgments, and these findings converge with evidence that the risk of pedestrian accidents involving children is nearly 3 times higher in places where mean speeds exceed 25 mph compared with places with lower mean speeds.



## **Other road safety impacts**

1 In Bristol, NHS Bristol worked in partnership with local community groups, local schools, and with support from Avon and Somerset Constabulary (Bristol CC, 2012). Such a level of collaboration was not commonly found among other 20mph programmes in the UK. The level of activity in Bristol to research 20mph also resulted in Toy's work (2012) and the clear identification of JIMBYism (just in my back yard) whereby residents wanted 20mph on their street but were less concerned about speeds driven on other streets. This may be linked with findings that past behaviour, self-judged driving skill, and belief in the social acceptance of speeding behaviour. The researchers found that agreement with appropriateness of the speed limit, function of the street, and vulnerable road user rights were predictors of intention to speed or not. Like Toy's research, these researchers also reported that speeding on neighbouring streets was likely not to be seen as a serious matter (Dinh, D., Kubota, H. 2013b,c). Tapp, A., Nancarrow, C., Davis, A. (2015) segment drivers into supporter-compliers, support, non-compliers, Opponent-compliers and Opponent non-compliers and note key discriminators of non-compliance as include self-enhancement bias, social contagion, and inattentive/automatic driving.

2 Public support for 20mph is consistently high (62%-89%) for residential streets where reported (Atkins, 2010; Bristol, 2012; Edinburgh 2013; Robinson, J., Newman, N. 2016; Pilkington, P. et al, 2018; Calderdale BC, 2018), and 72% on busy streets eg high streets (Pilkington, P. et al, 2018).

3 20mph (30km/h) has also been reported to be important where cycle users share the street space with motorised traffic without segregation (Mertens, L. et al. 2016) and from analysis of injury data in London (Aldred, R. et al, 2018).

## **Air quality**

There is little evidence for the effect of 20mph speed limits on air quality. The study by Jones, S., Brunt, H. (2017) did provide calculations for an overall improvement in air quality. The most powerful statement that can be said for the link between 20mph speed limits and air quality is likely to be that where there has been any investigation into air quality impacts these are reported as either negligible or a slight improvement (eg Bristol CC, 2012; NICE, 2017; TRAC, 2017). As Williams and North (2013) conclude, it would be incorrect to assume a 20mph speed restriction would be detrimental to ambient local air quality, as the effects on vehicle emissions are mixed.

## **Active Travel**

Research has reported that objectively assessed traffic speed levels of 30km/h or less were associated with higher odds of cycling (Mertens, L. et al. 2017). Objective counts during the piloting of 20mph in Bristol did find small increases in walking and cycling (Bristol CC, 2012). Self-reported increases in walking and cycling were noted after implementation of the pilot 20mph speed limit in Edinburgh (Edinburgh CC, 2013).

## 6. Conclusions

The volume of the literature, both peer reviewed and grey, is still relatively small regarding 20mph speed limits compared with other health outcomes including for 20mph zones. With this caveat the research finding is strongest for casualty reduction. There is now evidence from 20mph implementation within the UK which finds a statistically significant reduction in casualties compared to background levels. Importantly, such findings triangulate with the evidence on speed reduction and collision reduction. The fact that for each average 1mph speed reduction in an urban area there is a 6% reduction in collisions fits well with the findings from the UK studies reported here.

In addition, as Pilkington and colleagues have noted in their 2018 study of the impacts of 20mph speed limits in Bristol, casualty reduction is being achieved even when speed driven don't drop to 20mph itself: **'success is not defined by all average speeds being under the set speed limit of 20mph – it is about bringing vehicle speeds down closer to 20mph, and assessing any positive impacts of that speed reduction compared to the situation before the introduction of the lower limits.'**

### Road Safety – casualty reduction

**For casualty reduction the evidence is consistent that casualties are reduced as a result of 20mph speed limits. The evidence is moderate to strong.**

### Other road safety outcomes

A number of aspects of road safety are reported. The evidence for each is weak although suggesting positive road safety impacts beyond casualty reduction.

### Air quality

For air quality the limited literature is consistent with small improvements in air quality. However, the volume and methodological strength of studies means that it is only possible to state that: **air quality is likely to be improved as a result of 20mph speed limits but the evidence is weak.**

### Active Travel

For active travel the volume and methodological strength of studies means that it is only possible to state that: **active travel may be improved as a result of 20mph speed limits but the evidence is weak.**



## Limitations:

As signalled above, beyond bio-medical and public health research the use of research method which could isolate causal relationships is often rare not least because it is harder to undertake and control for many confounding factors in the built environment. In a complex system<sup>24</sup> such as the built and natural environment, it is rarely possible or appropriate to undertake an experimental approach (such as a randomised controlled trial) that can in other circumstances offer the best way of assessing causality. This is also partly because the research lens has only recently been focused on the issue of 20mph speed limits. Some caution is therefore recommended as much of the evidence examined was reliant on findings from before and after studies albeit it is unlikely that further studies would reverse the conclusions.

There is a lack of data regarding 20mph speed limits in any rural or small towns settings. This is a significant gap in the evidence.

There also remains a gap in the evidence in relation to the steep social class gradient in terms of at least pedestrian road traffic injuries and this has been reported in many studies, notably addressing children. Cairns et al (2014) note that it is possible to suggest that targeting 20mph speed limit interventions in more deprived areas may be beneficial. Just three studies, including Cairns et al, were located and met the inclusion criteria. It is feasible that 20mph could make a disproportionately beneficial impact on pedestrian casualties in poorer communities relative to more affluent communities where casualties are already less frequent. However, Christie et al (2011), which was out of scope because it did not identify 20mph, warned that anti-social driving and riding behaviour in poorer communities may be a barrier to active travel such as among children in the communities which need safer streets most. This includes the reduced physical activity when children have restricted independent mobility. The need for Police enforcement is cited.

The findings of this review are also limited in their inability to draw firm conclusions about the impact of 20mph speed limits both on air quality and any changes in active travel participation. Frustratingly, many studies addressing how to increase levels of active travel and/or reduce injuries do not specifically address 20mph speed limits. The recent study by Aldred et al, (2018) is a helpful exception which did find an independent benefit of 20mph speed limits for cycle users in terms of reduced risk of road traffic injuries.

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<sup>24</sup> Rutter, H., et al, 2017. The need for a complex systems model of evidence in public health, *Lancet*. 7: 390:2602-4.

## **Appendix A: In-Scope studies**

**Aldred, R., Goodman, A., Gulliver, J., Woodcock, J. 2018. Cycling injury risk in London: A case-control study exploring the impact of cycle volumes, motor vehicle volumes, and road characteristics including speed limits, *Accident Analysis and Prevention*, 117: pp.75-84.**

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## **Appendix B: Out of Scope studies**

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**Bowden, V., Loft, S., Tatasciore, M., Visser, T. 2017. Lowering thresholds for speed limit enforcement impairs peripheral object detection and increases driver subjective workload, *Accident Analysis and Prevention*, 98: pp. 118-122.**

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