Traffic and Transport in Bradford on Avon

The Evidence

To rebalance the use of roads to promote the health and well-being of residents and visitors, and economic viability of the town

Executive Summary

Bradford on Avon has occupied a pivotal position within the local and regional transport network for at least 2,000 years. Today, it lies at the centre of a regional trunk road system that stretches as far as the A303 in the south and the M4 to the north.

In December 2017, the Town Council, with support from local Wiltshire councillors and non-councillor committee members, devised the following outcome;

To rebalance the use of roads to promote the health and well-being of residents and visitors and economic viability of the town.

The Bedeman/Jennison Review found that the majority of the traffic is through-traffic, *not* local, with some three out of five vehicles that cross the bridge originating from outside the town. This is highly significant, and requires a total re-think of the approach to tackling these traffic problems

The health, social and economic cost this traffic brings in its wake is unsustainable. This includes include congestion, air and noise pollution, intimidation of pedestrians and cyclists, and over-parking. This is not conducive to the wellbeing of our residents, young and old, nor to leisure, business and tourism.

Any attempt to reduce congestion and improve the flow of traffic through and around the town should include deterrents to through traffic. Otherwise, the benefits of any measures will be very quickly lost as the improved flow of traffic draws in more vehicles from the wider road system.

Improvements to the wider road network, such as the A350 between Warminster and Chippenham and a relief road around Bath connecting the A36 directly to the A46, may be more effective than local measures in reducing the regional through-traffic using Bradford on Avon.

A proposal by Bath to introduce a Clean Air Zone could have a major adverse impact on traffic through Bradford on Avon.

As a key stakeholder, we should engage with Wiltshire Council and BANES on traffic and transport issues.

In addition to local and through-traffic, we need to recognize a third type, destination traffic. This has major implications for the management and provision of parking. Too little and it will restrict employment and economic growth, too much and it will overload the traffic infrastructure, elements of which are occurring now.

The availability of parking is considerably less than other comparable towns.

The imminent increase in rail passenger capacity to and from Bradford on Avon offers considerable potential for more rail journeys to replace road journeys.

A high quality modern and clean bus fleet could greatly contribute to re-balancing road use.

Active travel for a number of reasons is to be encouraged. Active travel needs the obstacles to be mitigated in order to increase the uptake from individuals, which could be transformed

The growth of rail transport from the town is to be welcomed, but it is putting increased pressure on vehicle access and parking.

Monitoring needs improvement to adequately understand air quality across the whole town, and measure improvement. Measurement needs to include more sensitivity (PM 2.5) and portability. We expect that health in some areas of the town is being damaged by vehicle and other pollution.

These problems are complex and inter-dependent. They will not be solved by a single, simple solution, but they can be greatly improved by a careful blend of measures, determined by a detailed examination of the available evidence. This report aims to provide the latter.

Battery Electric Vehicles are at present a partial solution for the Internal Combustion Engine, but locally, they do have a capacity for significant improvement in pollution in the local community. Bradford on Avon has a particular issue with a lower proportion of private drives than most similar towns.

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1. Introduction

Bradford on Avon stands at one of the few crossing points over the River Avon. The centre of the Town grew up around the ford across the river: indeed the Town's very name derives from 'Broad Ford' – a wide, shallow river crossing. The construction of the Town Bridge only added to the strategic importance of Bradford on Avon, as demonstrated by the 1643 battle here during the English Civil War.

Bradford on Avon is a busy crossing-point within the wider traffic network. Today, the volume of vehicular traffic squeezing between its narrow streets gives rise to serious concerns about air quality, pedestrian and cyclist intimidation, and parking. Pedestrian and cyclist movement across town is also hampered by the steep gradients of streets and pathways to the north of the centre.

Bradford on Avon does enjoy an extensive network of footpaths, especially alongside the river and the canal. It benefits from the public transport system: a frequent direct train service runs to London, Salisbury, Weymouth and the South Coast, and Bath, Bristol and Cardiff to the west. There are also regular bus services between Bath and Salisbury, and to surrounding towns and villages, as well as around the town itself.

1.1. A historical problem

Long-term residents in the town will state that traffic has been an issue for 30 years or more. Studies and consultations since the 1990s have shown that volume of traffic in Bradford on Avon, together with the related problems of pedestrian safety and air pollution, is of paramount concern to residents, visitors and local businesses alike. Yet, in spite of years of discussion and debate, little real progress has been made: single method approaches have run into opposition and credible solutions that enjoy wide support within the town and in Wiltshire Council remain as elusive as ever.

The primary reason for this failure is that traffic systems, even in relatively small towns such as Bradford on Avon, are highly interdependent, and the problems arising from such systems are complex. Obvious solutions to traffic-related problems frequently prove ineffective, expensive and even counter-productive. Successful measures, on the other hand, may at first appear counter-intuitive: for example, enabling motorway traffic to flow faster at busy times by imposing temporary speed restrictions to slow it down. Interventions may have adverse, frequently unforeseen, consequences: for example, speed bumps are now known to increase exhaust emissions and so cause further air pollution.

A single 'silver bullet' solution to the Town's traffic-related problems is therefore unlikely to succeed on its own.

Another obstacle to agreement on ways to tackle traffic-related problems arises from the differing priorities segments of the community accord them: drivers are frustrated by congestion and the lack of parking, whereas pedestrians and cyclists are intimidated by traffic. Pollution affects everyone.

1.2. Who are KERB

The Key Evidence Review Board (KERB) is an informal panel[1] which was set up at the end of 2017 to review all available evidence, and to provide the Town Council, local residents, Wiltshire Council and other interested parties with the necessary information, evidence and objective analysis to examine the aim of rebalancing road usage in Bradford on Avon.

KERB comprises:

Simon McNeill-Ritchie – Chair

[1] See details page x

Simon is a former British diplomat, company chairman, social entrepreneur and academic. He was elected as an independent Town councillor in May 2017 and he currently chairs the Council's Town Development, Business & Tourism Committee.

Trevor Bedeman,

Trevor is a management consultant in data sharing, risk and statistical analysis. He is a founding partner of White-Stripe, which lobbies for pedestrian safety and against traffic intimidation.

Rob Brown

A keen rambler, Rob is Treasurer and Membership Secretary of West Wilts Rail Users Group and a Team Leader for Heart of Wessex community rail volunteers.

Nigel Gerdes

A retired electrical and electronic engineer, who worked in MoD project management, Nigel is a former Chair of Climate Friendly, Bradford of Avon, and a member of Wiltshire Walking for Health

1.3. Aims

The of this report is aligned to the following aims which have been approved by the democratic bodies and decisions of the town over the last two years:

- The Neighbourhood Plan that was approved in September 2017 by 95% of residents who voters. Specifically, the Neighbourhood Plan seeks *'to improve the pedestrian environment in the Town, encouraging people to walk or cycle rather than use their cars thereby assisting in the improvement of the overall environment and air quality. Also to ensure that future developments are located where they can easily be accessed by pedestrians, cyclists and public transport, including where possible extending the footpath and cycle route systems.'*
- In December 2017 the Town Council resolved: 'To rebalance the use of roads to promote the health and well-being of residents and visitors and economic viability of the town.' This cannot be achieved except by engaging the relevant stakeholders, particularly Wiltshire Council and BANES.

An additional aim of the report is to break the unsuccessful cycle of single solutions to our traffic related problems. This report does not seek to provide solutions – this has been a recurring barrier to resolution, and one that has been actively discouraged by key stakeholders, including Wiltshire Council, as Highways Authority.

Instead, it aims to collate and present evidence to the reader to inform their understanding of 'the traffic issue' in Bradford on Avon, and to draw, as far as possible, conclusions on causation.

In presenting conclusions, it may then follow that readers will form an opinion on outcomes – and it is this process of defining the problem and what 'good' looks like that forms the underlying basis for the report.

2. Defining the problem

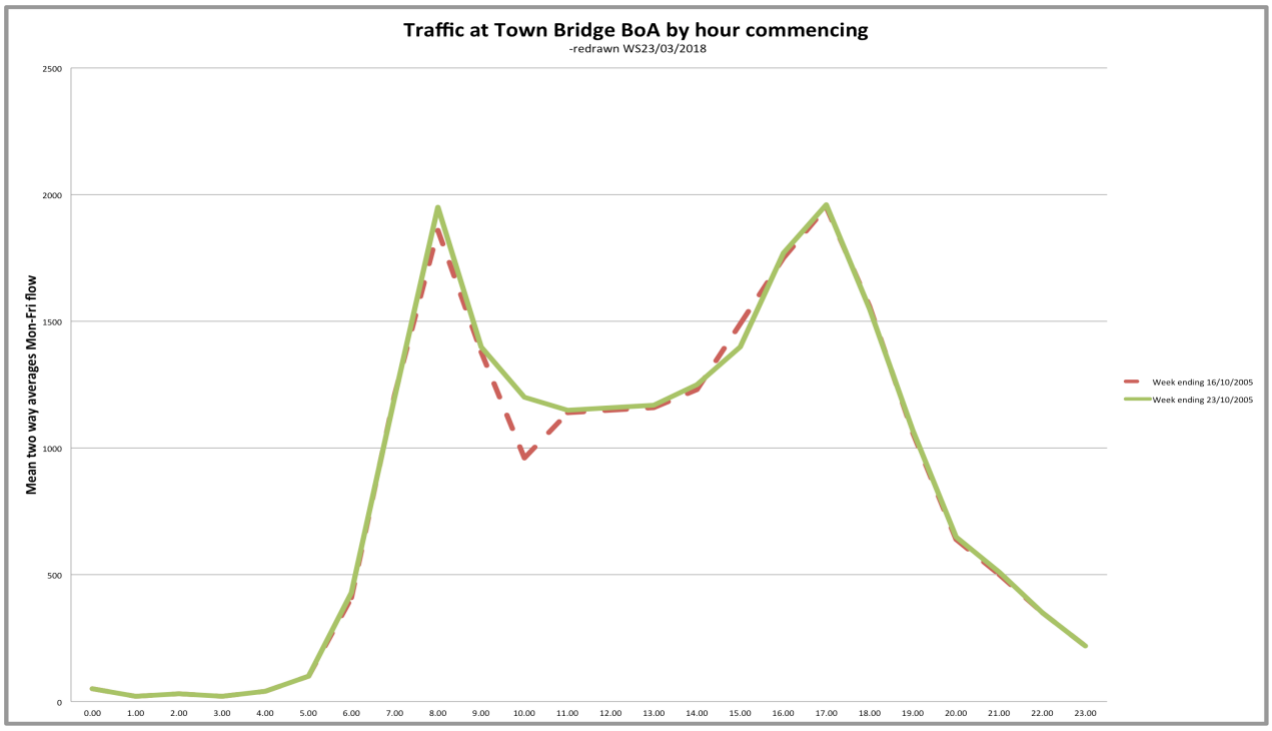
2.1. Motorised Traffic

Most of the problems with Bradford on Avon's town centre and main roads are attributed to its traffic – congestion, speed, volume, parking, (lack of) safety, air and noise pollution are all negative aspects caused by motorised traffic crossing the town.

2.1.1. Traffic Congestion

Of the various problems associated with road traffic, congestion within Bradford on Avon at key times of the day was identified by many residents at the time of the 2017 Local Elections as the town's most serious problem. Graph 1 below illustrates the times of the day when traffic congestion is at its highest.

Figure 1: Volume of Weekday Traffic across the Town Bridge per hour



The two peaks in the volume of road traffic over the town bridge occur around 8am and 5.30pm, coinciding with the typical commuter pattern. While school-related traffic undoubtedly contributes to congestion in localised pockets, it can account for only a relatively small proportion of traffic congestion in the town centre.

The perception that traffic congestion is due to school journeys alone overlooks the fact that many other road users are also away over summer. Were this not the case, Congestion Equilibrium Theory (see below) predicts that traffic elsewhere in the wider traffic network would quickly take up any spare road capacity.

2.1.2. Congestion Equilibrium Theory

Congestion Equilibrium Theory predicts that as congestion within a road system worsens, drivers will seek alternative routes in an attempt to reduce their journey times. Equilibrium occurs at the point when the journey times along all available alternative routes are the same. If improvements are made to the traffic flow along one particular route it follows that traffic previously using other routes will quickly divert along it until it too becomes no better and no worse than the alternatives.

The implications for Bradford on Avon are that any measures to reduce congestion within the town centre may merely attract more vehicles from the surrounding road networks, unless they include significant deterrents at all the entrances to the town (e.g. traffic lights, tolls, road narrowing, etc).

2.1.3. The 'Atkins Report'

To determine effective measures to tackle congestion in town, one needs to identify where the traffic comes from. In 2013 Atkins, a global engineering design consultancy, was commissioned by Wiltshire Council to undertake a Traffic Flow Study examining patterns of vehicular movements within and around the town. The key objectives of the Study were:

- To establish overall traffic volumes and vehicle types;
- To understand through traffic movements, and
- To understand the origin of observed vehicles

Using Automatic Number Plate Recognition (ANPR) technology, a survey was carried out over six days (Monday to Saturday) in June 2013, considered to be a neutral month for a survey when traffic was expected to be typical. Atkins reported the results of the survey in June 2014, and the key finding was that only 31% of vehicles crossing the bridge originated from outside the town.

2.1.4. The Bedeman/Jennison Review

The figure of 31% appeared low to many knowledgeable observers in the town, and in December 2016 Trevor Bedeman of White Stripe, together with Chris Jennison, Professor of Statistics at the University of Bath, began to re-examine the original data. They identified a number of significant failings and errors by Atkins in the conduct of the study and their evaluation of the results. Finally the through-traffic estimate did not agree with the postcode origin data.

This interpretation was supported by postcode registration data collected by Atkins at the same time, and also reviewed by Bedeman and Jennison. This data was far less prone to the errors present in other aspects of the survey. The most remarkable finding from this data was the small proportion of vehicles driving within the town on weekdays that were registered to addresses in the BA15 postcode area – less than one in six (16%). Indeed, notably more vehicles (21%) were registered to Trowbridge. Overall, almost three-fifths of cars (59%) and more than half of Light Goods Vehicles (53%) were registered between 2 and 25 miles away. Heavy Goods Vehicles were registered even further afield: more than two-fifths (43%) were registered 5-50 miles from the town, with a similar number (41%) registered 50-200 miles away.

Conclusion

The Bedeman/Jennison Review found that the majority of the traffic is through-traffic, not local, with some three out of five vehicles that cross the bridge originating from outside the town, and leaving it to continue their journey. This is highly significant, and requires a total re-think of the approach to tackling these traffic problems.

2.2. The Wider Traffic Context

The traffic in Bradford on Avon should not be treated in isolation, but seen as a key part of a wider sub-regional road (and rail) network. The town lies at the centre of a local lozenge-shaped road system (Illustration 1), which in turn forms links the two main arterial routes from London to the South West and Wales (Illustration 2).

Bradford on Avon lies within a diamond-shaped road system, the four sides of which comprise the A4 along the north, the A350 to the east, the A361 along the south, and the A36 on the west (Illustration 1). This in turn forms a key component of the road system linking the two main arterial routes from London to the South West and Wales, the M3/A303 and the M4 (Illustration 2).

Figure 2: BoA - Vicinity

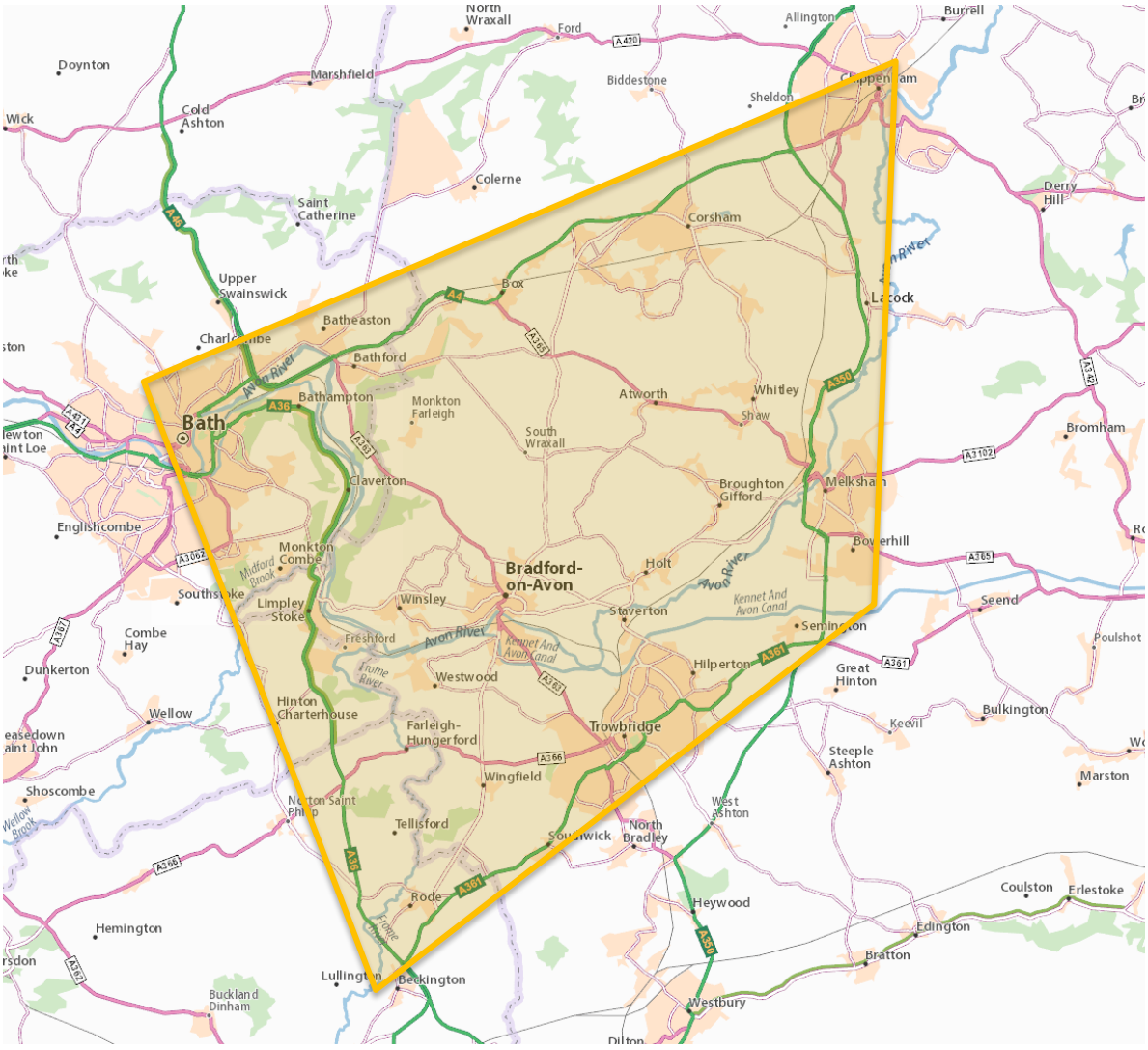
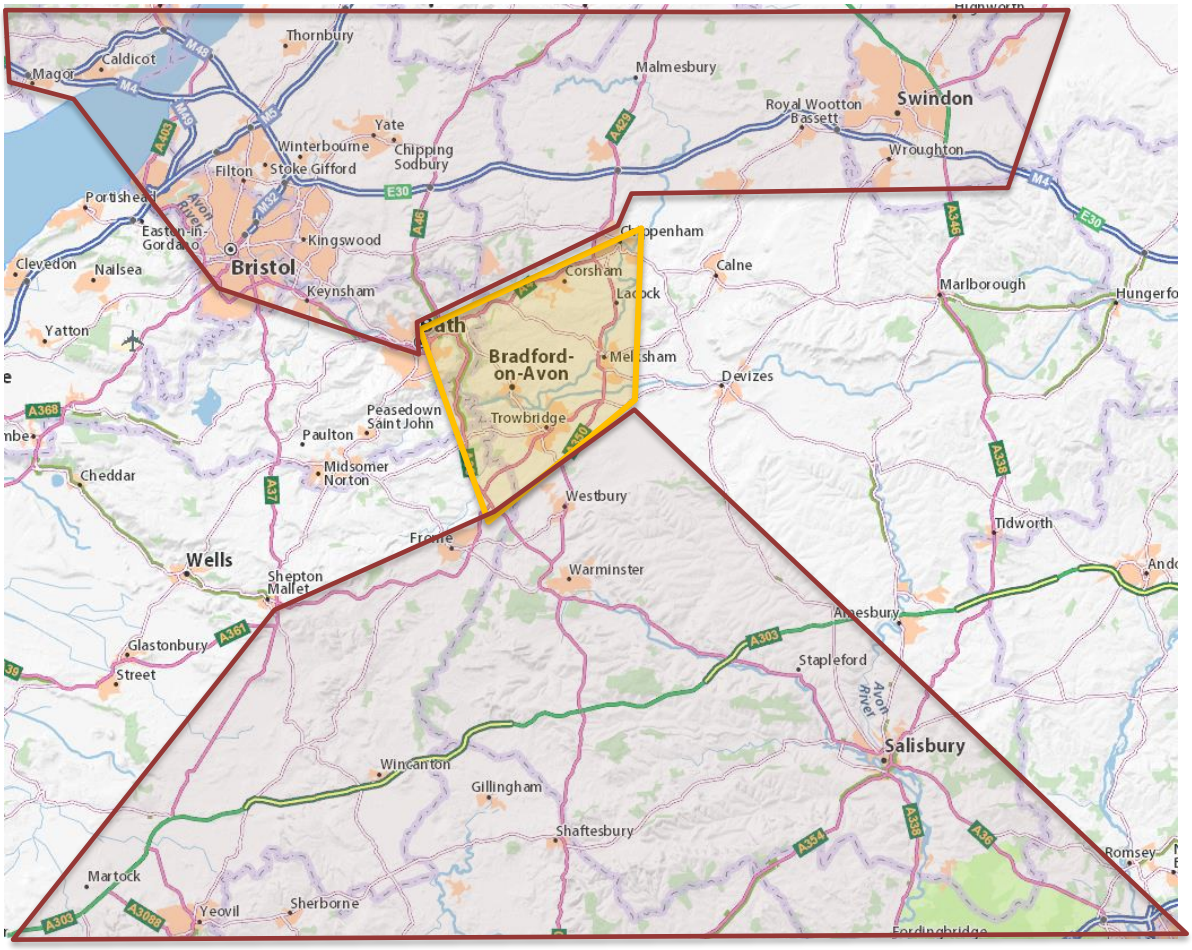


Figure 3: BoA - Wider Network



2.2.1. Implications for Bradford on Avon

If this road system is already in a state of Congestion Equilibrium, we would expect journey times within it to be very similar. A simple experiment on Google Maps produces the following options and results for a typical car journey between Westbury and the southern end of the A46 at Bathampton, on a typical weekday.

Figure 4: Route Options Westbury to Bathampton

Options	Time	Distance	Ave. Speed
Via Staverton	**30 mins**	**15.7 miles**	**31 mph**
Via Bradford on Avon	**31 mins**	**14.6 miles**	**28 mph**
Via Bath	**32 mins**	**16.5 miles**	**31 mph**

The slightly faster speeds on the two external routes is effectively offset by the shorter mileage afforded by the route through Bradford on Avon. The almost identical results in terms of the time of each journey, irrespective of route, demonstrate that the road system around Bradford on Avon is indeed congested, and since varying the route would make little difference to journey time, it is also in equilibrium.

Conclusion

Any attempt to reduce congestion and improve the flow of traffic through and around the town will not be effective without deterrents to through traffic; the benefits of any measures may be lost as the improved flow of traffic draws in more vehicles from the wider road system.

2.2.2. Trans-regional Traffic

Bradford's place at the centre of such a local system also has implications for re-routing external traffic around Bradford on Avon with a relief road (by-pass).

In order to reduce traffic within the town, a relief road would need to make a significant difference to the journey times involved for that route to be preferred. In the case of a journey from Westbury to the A46, routes through Staverton and Bradford on Avon diverge at Yarnbrook and join up again at the junction of the A363 with the B3105 on the northern edge of the town.

At present, both options take 22 minutes, but improving the Staverton route to allow the 31 mph speeds achieved elsewhere on that route reduces the time taken by more than 4 minutes (-19%). This would arguably make it worthwhile to opt for that route instead of through Bradford on Avon. The difficulty is that while there are obvious pinch points along that route that delay traffic, such as the Staverton Bridge, the entire 4.3 mile stretch from the north of Bradford on Avon to the Hilperton Roundabout on the A361 would need to be improved to achieve this.

The second difficulty with relying on a relief road at Staverton stems from the town's position at the *centre* of a congested road system. A relief road on the eastern side of the town will not offer an attractive alternative route to traffic travelling across the road system between the north and the south-west. The times, distances and speeds from the Beckington Roundabout on the A36 to the A46 are as follows.

Figure 5: Route Options Westbury to Bath

Route	Time	Distance	Ave. Speed
Via Bath	23 mins	12.3 miles	32 mph
Via Bradford on Avon	22 mins	12.3 miles	34 mph
Via Staverton	31 mins	16.0 miles	31 mph

The situation is worse for drivers seeking to travel between the A303 and Junction 18 (A46) on the M4, as shown in Illustration 3, and it is Bradford on Avon's position along this route that is responsible for much of the Town's traffic.

The relative times and distances for the two options are:

Figure 7: Route Options Westbury to Southern end A46

Route	Time	Distance
Via Bradford on Avon	60 mins	39.4 miles
Via Bath	65 mins	39.4 miles

While there is very little difference between the two options in terms of distance, the journey time through Bath is on average five minutes (8.5%) longer. And the difference may be even greater at different times of day, days of the week, and even times of the year. Therefore, in spite of the much faster nature of the A36 road itself, the route through Bradford on Avon is quicker.

The route from where the A36 enters Bath to the junction with the A46 at London Road West is 2.9 miles and takes an estimated 14 minutes. The average speed for this section is less than one-third that for the entire journey.

Figure 6: Trans-Regional Traffic between the A303 and the M4

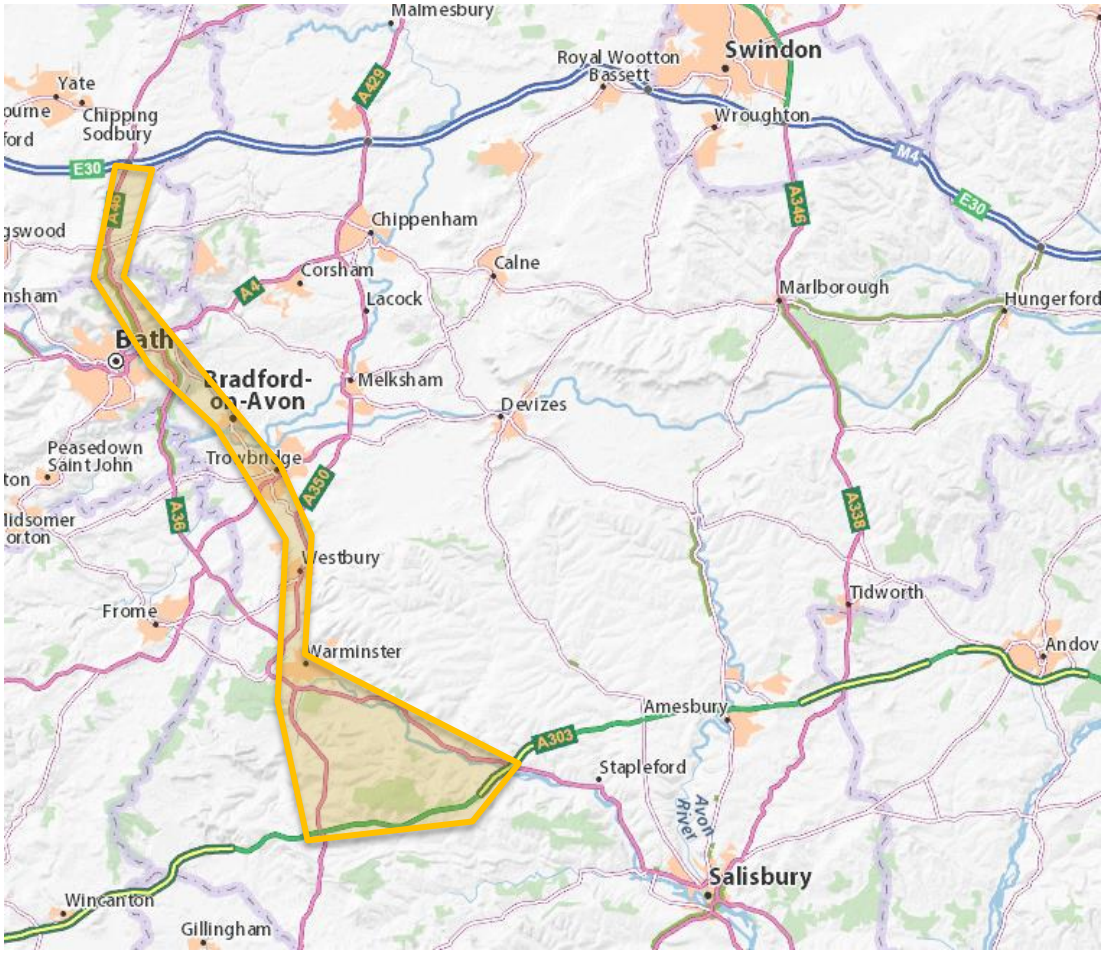


Figure 8: Wylye to J18 M4 via Bath

Section	Time	Distance	Ave. Speed
Wylye	39 mins	28.7 miles	44 mph
Bath	14 mins	2.9 miles	12 mph
A46	12 mins	7.8 miles	39 mph

A link from the A36 at the southern edge of Bath to the A4/A46 intersection at Bathampton would reduce the distance of the original journey by about two miles and, more importantly, by approximately 13 minutes (20%). Now the relative attractiveness of travelling via the two routes looks like this:

Figure 9: Route Options Wylye to J18 M4

Route	Time	Distance
Via Bradford on Avon	60 mins	39.4 miles
Via Bath	52 mins	37.4 miles

Conclusion

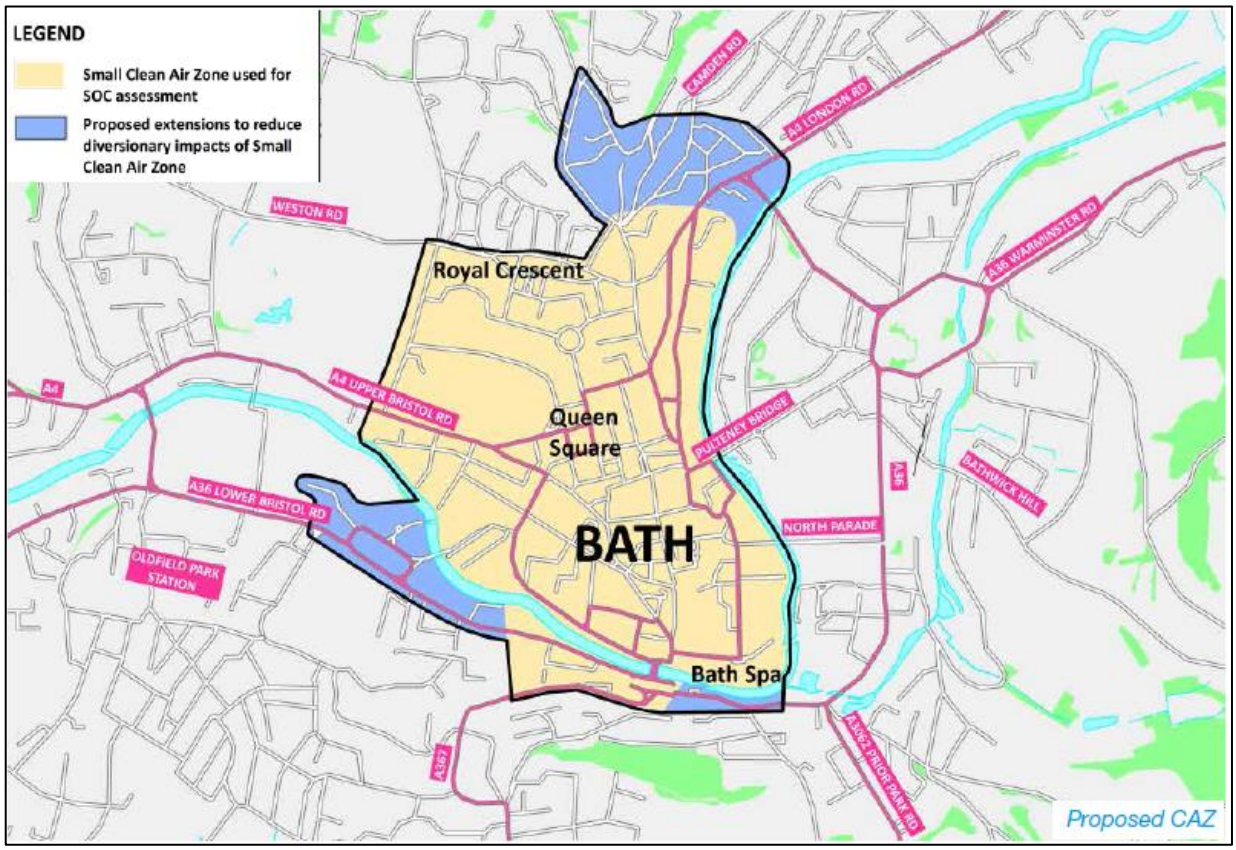
Improvements to the wider road network, such as the A350 between Warminster and Chippenham and a relief road around Bath connecting the A36 directly to the A46, may be more effective than local measures in reducing the regional through-traffic using Bradford on Avon.

2.3. **Proposed Bath Clean Air Zone (CAZ)**

BANES (Bath & North East Somerset) is currently pursuing plans to *reduce* further the free-flow of traffic through the City between the A36 and the A46. BANES is one of 28 local authorities in the UK required by central government to come up with a full plan to tackle their air pollution hot spots by the end of 2018.

To tackle air pollution in Bath BANES proposes under the *Bath Clean Air Plan* to introduce a CAZ. This would involve charging high-emission buses, coaches, private hire, taxis and HGVs, as well possibly as Light Goods Vehicles (LGVs) and certain cars (pre-2015 diesel and pre-2006 petrol). The area of the CAZ includes the London Road, thereby discouraging through traffic travelling between the A36 and A46 from entering Bath.

Figure 10: Proposed CAZ, Bath



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As Wiltshire Council has pointed out after consultation, the objectives of the CAZ are too tightly focused on Bath.

'Whilst this may resolve local diversionary trips it introduces long distance diversionary trips. This revised extension will have an impact on long distance/through traffic north south. A primary concern for Wiltshire is that this could increase the number and proportion of the most polluting vehicles through towns which already have poor air quality, ***such as Bradford on Avon****.'*

This view was endorsed by traffic professionals at the Traffic and Pollution Conference convened by the MP for Bath on 9 June 2018.

Of particular note are the assumptions by BANES in modelling the proposed CAZ, which predict that 7% of cars and 8% of LGVs will seek alternative routes. These look optimistic, and Wiltshire Council is surely understating matters when it describes as 'unreasonable' the assumption that no HGVs whatsoever will seek to avoid the Zone: based on our own analysis above, we believe it is highly likely that some HGV drivers will detour along other routes, most notably through Bradford on Avon.

Conclusion

A proposal by Bath to introduce a CAZ could have a major adverse impact on traffic through Bradford on Avon.

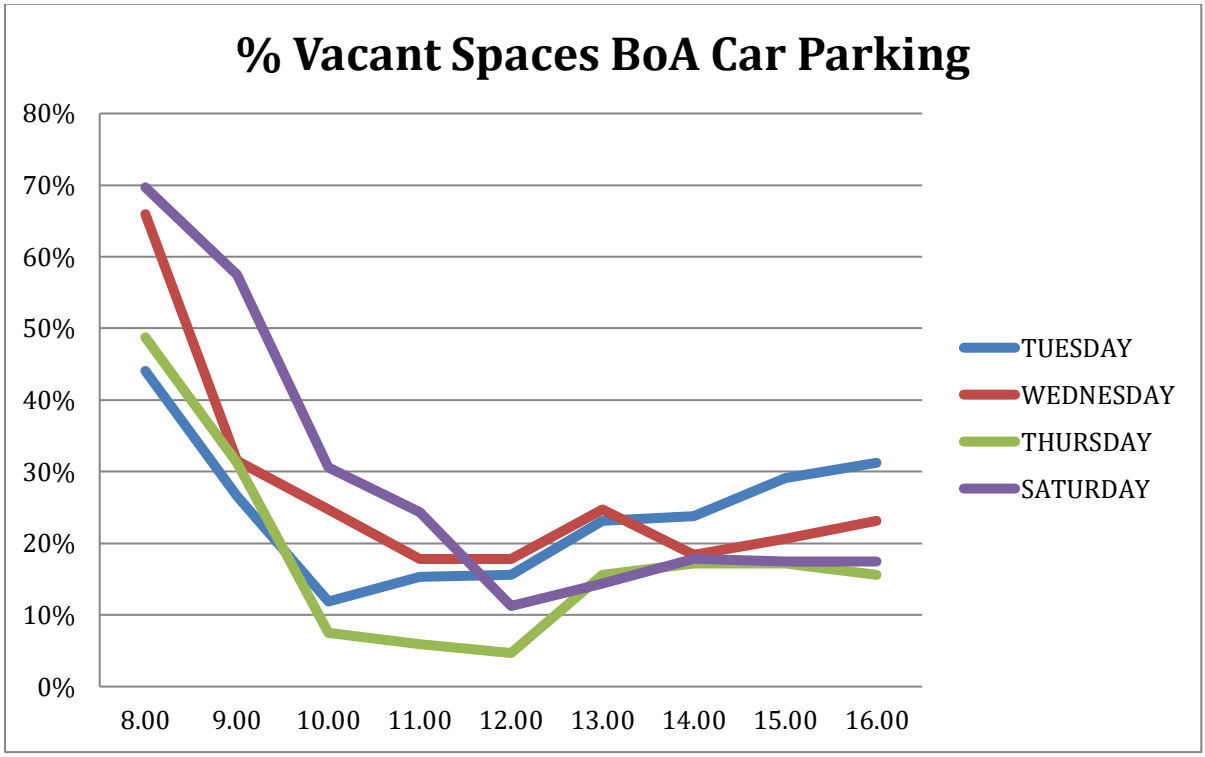
2.4. Lorry Watch

Bradford on Avon Lorry Watch group was established in 2010 to prevent lorries that exceed the weight restriction (18 tonnes) from crossing the Town Bridge. Local volunteers man a rota throughout the day and report offending vehicles to Wiltshire Police, who then identify the owner through the DVLA and issue a warning letter. Should they re-offend, they are taken to Court. To date, Lorry Watch has achieved approximately 160 successful prosecutions, resulting in fines of more than £250,000. Lorry Watch also serves as an invaluable deterrent: when it started there were 70+ infringements per month. Today, the number is about one-third of that. However, should Bath City Council succeed in introducing the CAZ described above, we fear that the volume of HGV traffic through the Town will increase significantly.

2.5. Parking

In 2018, Bradford on Avon Town Council commissioned a study of the use of car parking spaces (both in the car parks and on the street) within the town centre. This found that the availability of parking spaces during ordinary weekdays ranged from 15% to 25%. The availability of parking spaces on market day (Thursday) was considerably lower, dropping as low as 5% at midday. These figures are noticeably lower than the national average of 38% and 34% respectively. Availability in the only long stay off-road car park in the town centre, station zone B, on Saturday recorded no free spaces between 12.00-13.00, and just 2% between 13.00-14.00 on the Saturday audit alongside.

Figure 11: Parking Availability in the Town Centre



Parking is a double-edged sword. Many people need to drive to get to work or to shop within the town. We need to recognize this as a new form of traffic 'destination traffic'. This traffic is complex as it may contain many different effects on the town.

On the other hand the provision of more parking may simply encourage more people to drive into town. Encouraging the take-up of electric and other 'green' forms of vehicle will not reduce the need

for somewhere to park the vehicles. And the provision of sufficient parking in the right places helps to avoid unnecessary driving around looking for somewhere to park. Anecdotal evidence suggests that shortage of parking on Sundays and public holidays is limiting the number of tourist visits.

Conclusion

In addition to local and through-traffic, we need to recognize a third type, destination traffic. This has major implications for the management and provision of parking. Too little and it will restrict employment and economic growth, too much and it will overload the traffic infrastructure.

2.6. Public Transport

In Wiltshire, public transport includes buses, trains, community transport and taxis. Public transport provides important benefits to individuals and the community by reducing car journeys, thereby reducing traffic congestion and pollution. Young and old people, as well as those from lower income households or with mobility difficulties, are particularly dependent on public transport.

2.6.1. Trains

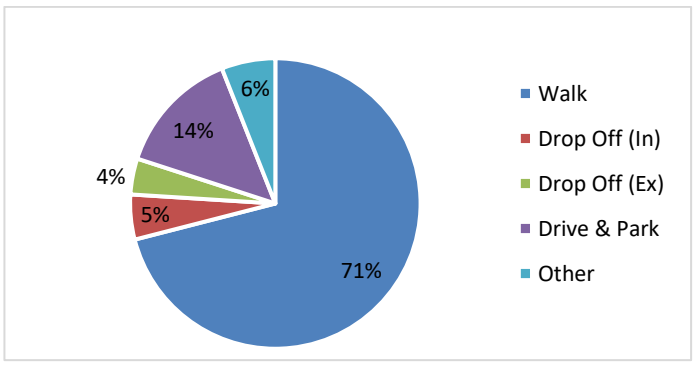
Bradford on Avon enjoys a rail service of 80 trains per weekday that link directly with London, Salisbury and the South Coast, and Bath, Bristol and Cardiff to the west. These provide an effective alternative to the car for commuting to work, school and leisure purposes. However, the benefits in terms of ease, speed and less pollution are offset in part by overcrowding and frequent delays – Bradford on Avon has the 6th worst record in the UK for late trains.

The number of rail journeys to/from Bradford on Avon has more than doubled in last 15 years and is currently running at more than 500,000 per year (=1,400 per day). This number is expected to increase over the next few years by 50% to approximately 750,000. To cope with this increase, Network Rail has recently extended the platforms at Bradford on Avon and elsewhere to take a replacement fleet of 166 Turbo Express diesel trains, providing substantially improved capacity.

However, while improvements to the town's rail service are generally to be welcomed they will also lead to an increase in rail journeys from Bradford on Avon by passengers from out of town. A survey of the journeys taken by morning commuters to the station carried out in May 2018 by Councillor Simon McNeill-Ritchie and a team of volunteers found that while the vast majority (71%) are residents arriving on foot, half of the remainder (14%) – almost one in seven – travel in by car from as far away as West Ashton and Southwick to the south, and Box and Corsham in the north.

They park all day either in the Station Car Park or elsewhere in town. A further 4% were out-of-town commuters, who were dropped off at the station: while these did not take up parking spaces, they involved twice as many journeys, contributing to congestion and pollution within the town centre. With the planned increase in the capacity and frequency of services from our station, we must expect these figures to rise too, with all the consequences for our traffic congestion and parking problems.

Figure 12: Commuter Journeys to BoA Railway Station



Conclusion

The imminent increase in rail passenger capacity to and from Bradford on Avon offers considerable potential for more rail journeys to replace road journeys.

2.6.2. Buses

Greater use of buses would undoubtedly relieve our roads of much of the current congestion: nationally, if drivers switched just one in twenty five of their car journeys to bus or coach, it would mean one billion fewer car journeys per year. It would also improve our air quality, as buses produce just 5% of all CO2 emissions from road transport in the UK, compared with nearly 60% from passenger cars.

A diesel bus on average produces emissions equivalent to 30 modern diesel cars. In addition, bus services are also vital to specific age groups: 40% of people over 60 years of age use the bus at least once a week, while among the biggest users of bus services are young people seeking to access employment. This was recognised in the Conservative 2017 General Election manifesto, which pledged to 'introduce significantly discounted bus and train travel for apprentices' in an attempt to make the qualifications more attractive to people from disadvantaged backgrounds.

According to the Campaign for Better Transport every £1 of public investment in buses provides between £3 and £5 of wider benefits. In Wiltshire, 92.2% of respondents in a recent 'What matters to you survey' stated that the same (62.3%) or more (29.9%) should be spent on transport coordination and bus services. Yet, between 2013 and 2017 Wiltshire Council reduced the number of miles it subsidises by 1.35 million (-33.9%). Since roughly half the bus mileage in Wiltshire is, this is the equivalent to losing one-sixth of the total public bus service in the county.

The justification given for these cuts is falling passenger numbers; local bus usage mirrors the national picture of a slow, year on year decline. Cause and effect are difficult to prove; we seem to be caught in a vicious circle between less frequent services and declining passenger numbers.

The answer to greater public take-up of bus services, however, may be more frequency and routing of services, both within the Town and to other key destinations. The same survey of train passengers above found that few commuters currently use buses or bikes to travel to/from the station. Bus services that visit the station forecourt, timed to coincide with train arrival and departure times, and capable of carrying bicycles, would also encourage more people to use public transport more often.

Another factors affecting bus usage is perception of reliability and public awareness. Surveys of bus stops completed over previous years have shown that route information is partially or even wholly out-of-date, and a long way from providing real-time information to users as is now seen in larger towns or at railway stations. This may combine with frequency and routing to lead individuals to discard buses as an option.

Finally, national evidence suggests that there is an 'image' problem with buses, outside of major urban areas – making buses attractive to users, through comfort and added services such as device charging and wi-fi, and improving the environmental impact of the vehicles themselves may also make them more attractive to a younger demographic.

Conclusion

A high-quality, modern, well designed routes and well-advertised bus fleet could greatly contribute to re-balancing road use.

2.7. Active Travel

2.7.1. Cycling

Cycling has enjoyed a resurgence in recent years in Bradford on Avon. Cycling clubs organise regular rides, and bike hire by the canal is popular with visitors. The re-launch of the BoA Cycling Festival in July 2018 attracted over 1000 people into the town, including 440 participants. Cycling is more than a local pastime; the presence of The Moulton Bicycle Company reminds us that cycling is a unique part of the town's heritage. Encouraging cyclists to visit as part of the Great West Way initiative is a vital spoke in the town's tourism strategy.

Encouraging more cycling in and around Bradford on Avon it would have a positive impact on local traffic. Over half of all car journeys are typically less than five miles in distance, and short car trips in particular can have a disproportionate impact on pollution.

In contrast with cycling for recreation, cycling for commuting purposes barely features within the town. The survey of rail commuters found that under 2% cycled to the station (cyclists from out of town made up another 1%). Few children cycle to school. The main obstacles seem to be the topography of the town and safety concerns. More people are investing in electric bikes and the town could do to encourage further take up. Buses with bicycle racks might be another.

Concerns about safety stem largely from the volume of traffic and the associated pollution – paradoxically problems that more cycling would help reduce. Devising dedicated cycling routes might help with these.

2.7.2. Walking

Bradford on Avon's centre is compact, and we know that a large number of rail commuters walk to station each morning from as far away as the edges of the town. There is considerable potential for more walking within town.

The town has a dearth of formal crossings, particularly considering when the great volume of motorised traffic along the many through routes. New crossings have only been introduced at a very slow rate, and individually rather than as a matter of strategy.

Pavement parking damages our pavements, and significantly affects pedestrian safety. Improvements on a minor scale, such as hedge trimming, can significantly improve pavement access.

As with cycling, opting to walk for shorter trips in particular can have a disproportionate impact on pollution if it replaces a vehicle journey.

2.7.3. Obstacles to active travel

- The hills of the town
- Narrow, congested streets
- Safety, traffic intimidation
- Traffic pollution
- Lack of dedicated and effective access routes
- Lack of train and bus cycle provision
- Small number of station cycle racks
- Cycle security
- Cost of electric bikes

Conclusion

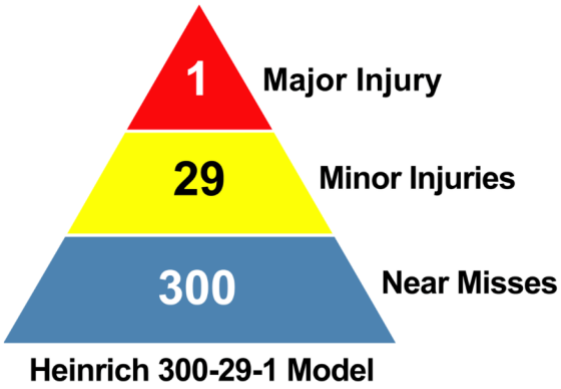
Active travel for a number of reasons is to be encouraged. Active travel needs the obstacles to be mitigated in order to increase the uptake from individuals, which could be transformed.

2.7.4. Pedestrian Safety Measurement and Risk

Risk is defined as the product of likelihood and impact. It is a predictive measure, and can be used to predict serious incidents from near misses or a historic series. There is much work to be done looking at the hotspots of the town as a whole, and working to permanently and radically improve safety. Many industries, such as air transport and construction, have transformed their safety in recent years by this approach. Modern workplace safety reporting is far more comprehensive and accurate, typically including both incident and near miss reporting, as forward indicators of risk.

The Heinrich model example shows how a triangle of near misses leads to a serious incident. The actual proportions vary with circumstances.

Figure 13: Heinrich Model



Wiltshire Transport, and thus transport planning for Bradford on Avon, uses the Police accident reporting (STATS19) for measures of safety. This road accident reporting grossly under-reports in its own terms. At UK level, it is accepted that only 35% of such accidents are reported. Serious injury may be only as little as 12%. DoT believe that deaths are accurately reported. This has implications for risk assessment capability, as it allows for the possibility that not only are near-misses disregarded, but that some serious incidents that would be included are not.

The Department for Transport 2012 estimates for the cost of a single fatal incident are £1,900,000, a serious incident £220,000, and a slight incident £23,000.

2.7.5. Safety hotspots and perception

The town has many hotspots along the major roads that are concentrations for minor and occasionally more major vehicle collisions, and similarly many minor pedestrian safety incidents, and rarely, serious pedestrian collisions. These hotspots are related either to the trunk roads that cross the town, or rat-runs related to those roads, and finally to immediate traffic at the entrance to the school buildings. They show the lack of formal pedestrian crossings in many of these locations.

On the Town Bridge, pedestrians report many slow-speed minor collisions especially with wing mirrors. The Bath Road/Winsley Road roundabout has a few vehicle altercations a day, and a minor collision every few days. We know for example of a serious unreported collision in 2017 there where a pedestrian was knocked over by a vehicle. The Bath Road school crossings are perceived by parents as unsafe, and the number using them looks to be in decline; as a result as more children are driven short distances to school. Woolley Green has regular serious vehicle collisions, often involving HGVs or vans, we estimate one every quarter, and in 2017 one of two children waiting at the crossing point had a serious injury from a van leaving the road, and her brother a narrow escape. Woolley Green has a long and tragic history of pedestrian injury to the very small community.

2.7.6. Traffic Intimidation

Lack of actual and perceived safety leads to considerable traffic intimidation, in particular vehicles over pedestrians, but also potentially of vehicles over cyclists. This is likely to be associated with volume, space available, including pavement widths, speed composition and behaviour of vehicles in many places throughout the town.

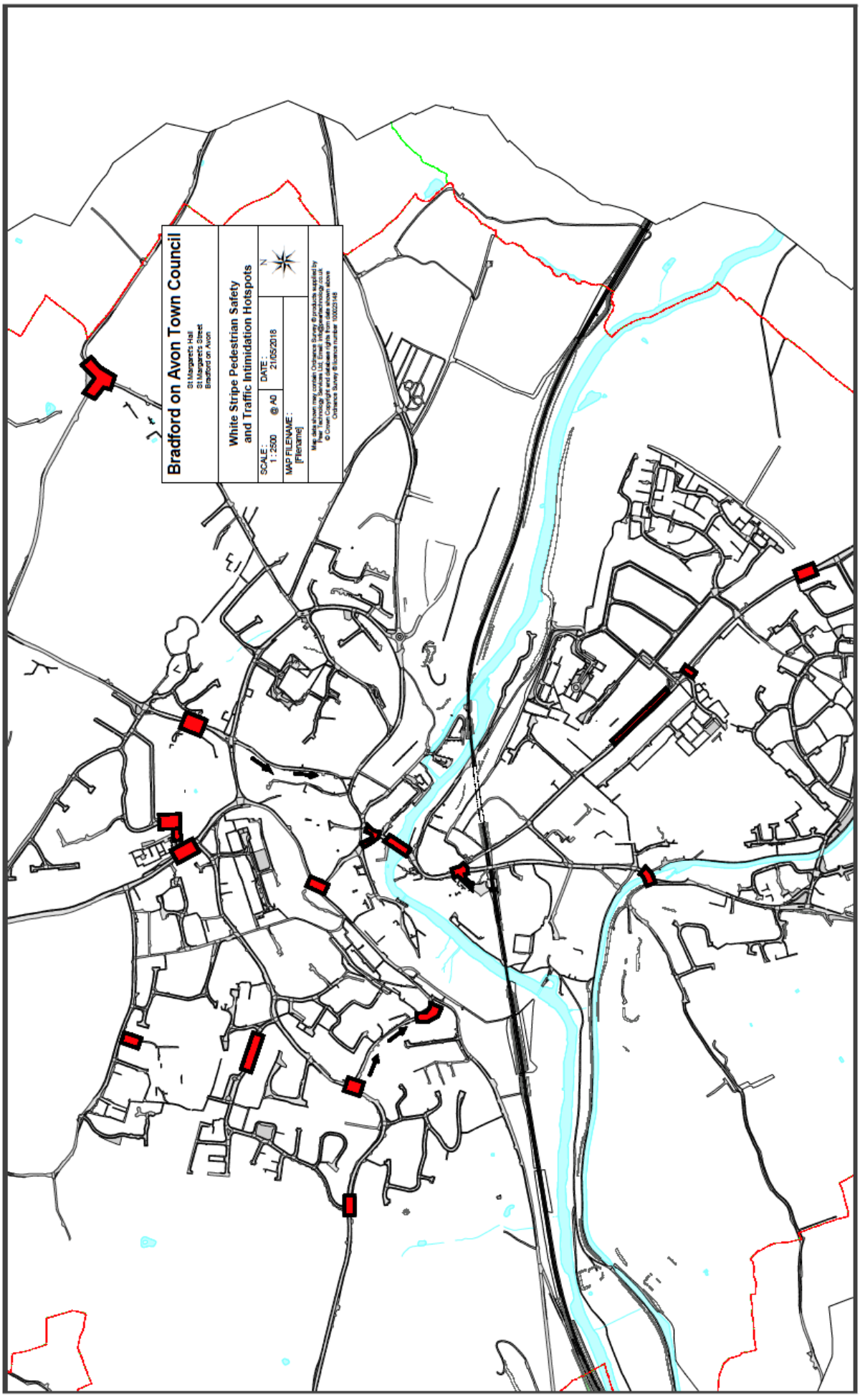
This has the effect that the number of potential journeys by pedestrians or cyclists is depressed, displaced and re-routed. This is likely to occur all along the busy through routes across the town, and also rat-runs. Social and economic activity is likely to be depressed as a consequence in these areas. Such intimidation can be seen as a basic form of risk assessment by these users.

There are no measures of such intimidation, though there are anecdotal accounts from residents and visitors.

Conclusion

Safety measurement should include intimidation in order accurately understand pedestrian issues. Traffic related safety in Bradford on Avon is likely to be grossly under-reported. Many modern industries apply a risk-related approach which the town should also consider.

Figure 14: Safety Hotspots in Bradford on Avon



2.8. Pollution

2.8.1. Air Quality in Bradford on Avon

Air Quality is one of the major challenges to the health of the town. We expect that residents' health in some areas is being damaged by vehicle and other pollution in the town. Bradford on Avon includes one of the 8 Air Quality Management Areas (AQMAs) in Wiltshire that regularly exceeds air quality targets and places residents' health at risk. Bradford on Avon has NOx nitrous oxides pollutants and PM particulate matter particulates in combination.

Wiltshire Council has a statutory duty to protect the health and wellbeing of our residents. Neighbouring council BANES is required by central government to develop an Air Quality Plan to tackle this issue by the end of 2018 and will need to consult on it with surrounding councils. Wiltshire Council Transport Planners have already raised their concerns about the implications of a BANES Clean Air Zone (CAZ) and the potential impact on our county, and the Council's Public Protection & Development Control have also commented on the BANES CAZ so that its potential local effects are better understood where traffic is discouraged from existing routes into and around Bath.

2.8.2. Pollutants

Both petrol- and diesel-engine cars produce gases that are toxic to people or harmful to the environment. The former include nitrogen monoxide (NO), nitrogen dioxide (NO2) (collectively called NOx) and carbon monoxide (CO).

'Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO2. Reduced lung function growth is also linked to NO2 at concentrations currently measured (or observed) in cities of Europe and North America.' World Health Organization 2May 2018

Vehicles are the source of much of this harm which can enter the lungs of anyone in the street nearby – pedestrians, cyclists and even occupants in the vehicles behind. Diesel vehicles produce anything from 7 to 25 times the NOx of petrol cars.

CO is produced in much higher quantities in petrol cars than by diesel cars. It is formed by the incomplete combustion of fuel in car engines, and can have serious, life shortening effects, especially when concentrated in a confined space, such as a car engine running in a garage. The mandatory addition of catalytic converters on petrol cars has reduced, but not eliminated, the danger.

The primary source of environmentally-harmful car pollution is carbon dioxide (CO2), which is also produced in greater amounts by petrol cars than their diesel equivalents. CO2 is not harmful to breathe and is converted by trees and plants into oxygen, but it is a greenhouse gas linked to Global Warming.

Pollutants are caused by the incomplete combustion of fuel in ICE (Internal Combustion Engine) car engines. Complete combustion under all circumstances is impossible in such engines.

2.8.3. Particulates

Particulates are composed of burnt and un-burnt particles of diesel or petrol exhaust. The most potentially damaging form is ultra fine PM(0.1 microns) (Particulate Matter) since it carries toxic molecules in the blood stream to the heart and brain.

Static monitoring equipment is situated on the inner side of the bend of Mason's Lane at the junction with Newtown. It only measures PM at PM(10). The legal maximum for PM(10) is 40 ug per m3. The monitoring does not cover fine PM(2.5). It also does not cover ultra fine PM(0.1) as this is difficult to measure. For a more complete picture at least PM(2.5) which can be more harmful should be measured. The pollution levels on other parts of Mason's Lane and elsewhere especially

where pedestrians walk may well be different. This would require more portable monitoring in order to obtain more accurate results in respect of pedestrian routes and the number of days a year the maximum permitted levels are breeched on Mason's Lane.

2.8.4. Monitoring in Bradford on Avon

Wiltshire Council has one automatic monitoring station in BoA which monitors nitrogen dioxide (NOx) and particulate (PM10) towards the bottom of Masons Lane. Due to the requirement of power and space, finding a suitable location was extremely difficult and monitoring further up Masons Lane was just not possible due to the narrow pavement. The local authority has no requirement to monitor smaller particulates (PM2.5) and these levels are modelled by DEFRA.

The legal maximum for PM10 is 40 ug per m3. For a more complete picture at least PM2.5 which can be more harmful should be measured. The pollution levels on other parts of Mason's Lane especially where pedestrians walk may well be different. This would require portable monitoring in order to obtain more accurate results in respect of pedestrian routes and the number of days a year the maximum permitted levels are breeched on Mason's Lane.

All of Wiltshire Council's monitoring data (historic and real time), locations, annual reports, health advice and a warning service called Know & Respond can be obtained from a dedicated WC air quality website.

John Carter from Wiltshire Council has commented on this section 2.7 of the report, and his comments include tables from the monitoring stations. The full and un-abbreviated comments are expected to be available as Appendix X11 'The Health Effects of Air Pollution' J. Carter to this report.

2.8.5. Defra and WHO advice

'There is clear evidence that particulate matter has a significant contributory role in human all-cause mortality and in particular in cardiopulmonary mortality'. Defra report 2012 on the Health effects of (PM2.5)

'Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.' 'PM is a common proxy indicator for air pollution. It affects more people than any other pollutant. Small particulate pollution has health impacts even at very low concentrations – indeed no threshold has been identified below which no damage to health is observed. Therefore, the WHO 2005 guideline limits aimed to achieve the lowest concentrations of PM possible.' World Health Organization 2May 2018 Ambient Air Quality and Health.

Conclusion

Monitoring needs improvement to adequately understand air quality across the whole town, and measure improvement. Measurement needs to include more sensitivity (PM 2.5) and portability. We expect that health in some areas of the town is being damaged by vehicle and other pollution.

2.9. Traffic beyond the combustion engine

The UK Government expects electric vehicles to have replaced ICE vehicles for most private cars by 2040. Additionally, electric Public Service Vehicles are increasingly competitive against their diesel counterparts, and electric bicycles can provide a partial solution to the town's challenging topography. It is therefore sensible to briefly consider the 'state of the art' in this area, and implications for traffic management.

2.9.1. Electric Vehicles

Battery Electric Vehicles (BEVs) reduce air pollution hot spots. A BEV needs no gears or clutch, so automatic control of the vehicle is simpler than one with an Internal Combustion Engine (ICE). BEVs can brake using the electric motor to return energy to the battery. BEVs using such regenerative braking use conventional brakes less often so they produce less brake dust than ICEs. They generate no exhaust pipe pollution when moving or stationary.

BEVs have high torque (quick acceleration) and instant response to throttle. This changes driving dynamics, start-stop traffic and the ease of progression. Better driving could produce smoother and faster flow on congested roads when the majority of cars have electric drive.

BEVs drivers have a low operating cost per mile and tend to increase their annual mileage, but because of cost and limited range and poor public charging infrastructure, BEVs are mainly used for local trips (94% of all UK private journeys are less than 25 miles but the remaining 6% account for 50% of all road miles travelled). For this reason, the BEV is at present only an alternative to, rather than a complete replacement for, the ICE vehicle.

A bridge technology between BEV and ICE is a serial hybrid with or without plug-in charging and a battery range of greater than 50 miles on electric drive alone. This enables it to operate for a while in urban areas without causing pollution. However a small very efficient petrol engine (70+ mpg) recharges the battery while in motion (but does not mechanically drive the vehicle) and thus extends the range between or replacing plug-in charges. At all times the vehicle is electric drive so all the advantages of electric drive described above are available.

Any local authority that wishes to encourage the switch to BEVs as a means to tacking air pollution from ICEs needs to promote both public and private charging for residents and visitors owning pure BEVs and plug-in hybrids.

2.9.2. Electric Buses

Electric buses are powered solely by batteries, and should not be confused with hybrid buses, which are powered both by batteries and either a gasoline or diesel engine that activates after the bus has gone a certain distance. Due to the much larger mass of a bus than a car, electric buses have an effective range much lower than that of an electric car – as little as thirty miles. To overcome this, electric buses need to be charged periodically at a convenient place along the route, preferably at the layover location to avoid inconveniencing the passengers.

Proterra, a major manufacturer of electric buses, claims that although electric buses initially cost more than comparable diesel buses, over the lifespan of the vehicle the costs are comparable.

2.9.3. Electric Bicycles

The electrical bicycle, or e-bike, is a bicycle equipped with an electric motor. The motor is supplied with power from the battery, which is recharged through the ordinary electric supply. Some motors also charge while travelling downhill. When the sensor detects that the cyclist is pedaling, the motor starts, which helps in particular on steep hills. When the rider stops pedaling or brakes, the motor stops. E-bikes are currently quite expensive, but kits exist to convert traditional bicycles at less cost.

Pashley Cycles, which manufactures Moulton Bicycles under license, provides the bicycles for the London Cycle Hire Scheme. In May 2018 they announced that they would be providing the bicycles for a similar service in Edinburgh, including from April 2019 100 electric bicycles.

Conclusion

BEVs are at present a partial solution for the ICE, but locally, they do have a capacity for significant improvement in pollution in the local community. This must be balanced against other factors, including not increasing the overall number of local journeys made by car purely because they are perceived to be 'clean'. Solutions based on targeting emission – as opposed to congestion and pedestrian safety – could be undermined over time by this technical development.

In common with many other areas of the country, does not currently have effective public BEV charging infrastructure, and also has a particular issue with a lower proportion of private drives than most similar towns. This means that supply of public charging points would need to be improved to support significant growth in uptake.

3. Next Steps

The objective of this report is not to dictate the measures to be taken, but to provide a better and common understanding of the nature of our traffic. Further research and investigation is now needed to identify the various measures available, and to understand how they would function in reality, what adverse effects they might cause and how they might operate in conjunction with other measures. Any that are put into practice should be monitored carefully, their impact (or otherwise) measured, and their long-term suitability reassessed.

To help with this, we offer the following framework toolkit as a methodology for capturing the key attributes of each measure, and the relative ease with which they could be implemented.

3.1. The Programme Framework Toolkit

For these projects to succeed, we need to assess project feasibility and construction, and also provide monitoring as intrinsic to any programme. Each intervention is measured against eight axes, reflecting the overall objectives of the town in connection with the traffic situation. These are:

The results of each measure can then be combined to identify which blend of measures is expected to have the greatest positive impact. Each measure is assessed in terms of their Cost and Complexity versus the Benefit(s) it provides, with cheaper and simpler measures preferred to those that are more expensive and complex.

One advantage of this approach is that even if the cost and complexity of a particular measure means that it cannot be implemented immediately, it remains clear to successive Town Councils and electors why the measure continues to be pursued. We won't lose sight of the goal or the reasons for pursuing it in a particular way.

3.2. Community Engagement

3.2.1. Issues

Once we have reviewed the evidence, and shared those results, the next step is not to leap to our favorite solution, but to systematically consult the town on all the issues they have with traffic. That will include all aspects of traffic and whatever the town population wishes to include. We will gain evidence on the range and extent of these issues for the population as a whole. We plan to do this using the framework toolkit.

3.2.2. Outcomes

Once we have this detailed picture of the issues that concern us most, then we will also consult after reflection on the description and priority of objectives for this programme. At that stage we will be in a position to work with Wiltshire Transport as the transport engineering experts to develop the best combination of work to address these outcomes. This will take time, and there is no magic bullet.

3.3. Recommendation

This methodology (based on MSP) is adopted by the town council.