Towards Vision Zero

Guidelines to help Local Authorities in the development of Road Danger Reduction Strategies and Action Plans

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MAYOR OF LONDON

CROSS RIVER PARTNERSHIP
Delivering London's Future Together

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This study was commissioned by the Cross River Partnership on behalf of the Central London Sub Regional Transport Partnership.

About Cross River Partnership

Cross River Partnership manages the Central London Sub Regional Transport Partnership (CLSRTP) and facilitates the delivery of projects on behalf of Transport for London. CLSRTP is a collective of senior transport officers and directors from ten London boroughs who provide strategic advice for, and on behalf of, Transport for London (TfL). The partnership, which has been active since 2009, acts as a trusted impartial forum for the boroughs to share experiences and enable collaboration on key sub-regional transport priorities, delivering projects, innovative pilots and trials, forward thinking research and strategies.

The ten London borough partners are:

1. City of London Corporation
2. City of Westminster
3. London Borough of Camden
4. London Borough of Hackney
5. London Borough of Islington
6. London Borough of Lambeth
7. London Borough of Lewisham
8. London Borough of Southwark
9. London Borough of Wandsworth
10. Royal Borough of Kensington and Chelsea

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1. Executive Summary

In London, the 2018 Mayor's Transport Strategy[1], sets out the goal that, by 2041, all deaths and serious injuries will be eliminated from London's transport network. To achieve this, efforts to reduce the danger posed by motor vehicle journeys will be focused on five areas, known as 'The Vision Zero Action Plan'.

This report is aimed at providing a set of Guidelines that can guide Local Authorities in the development of Road Danger Reduction Strategies and Action Plans towards achieving Vision Zero.

The first step of the research that has informed these Guidelines has entailed an analysis of collision trends and patterns on the road network of the ten Boroughs belonging to the Central London Sub-Regional Transport Partnership (CLSRTP)[2], followed by an investigation on the effectiveness of road safety measures in ten case studies among infrastructure intervention delivered in recent years.

Case Studies were identified using a statistical analysis of STATS19 data across locations in the road network where a significant year-on-year drop in the number of collisions was observed in the study period.

Analysis of collision trends and patterns

Most London Boroughs experienced an increase in Killed and Serious Injured casualties from 2016 to 2017, followed by a plateau in the period 2017-2019, and a decrease in 2020 (influenced by the changes in travel patterns during lockdowns and COVID-19 related restrictions).

Among the ten London Boroughs, the average proportion of KSI (Killed or Seriously Injured) casualties over the total number of casualties is 15%. The Borough with the highest proportion of KSI casualties is the City of London with 22%, while Lewisham has the lowest proportion of KSI casualties (12%).

Overall, across all Boroughs, in the five-year study period 2016-2020, KSI casualties affecting vulnerable users accounted for 84.1% of all KSI casualties: 31.9% were pedestrians, 26.6% pedal cyclists and 25.6% powered two-wheelers drivers.

Looking at casualties by mode of travel, pedestrians are the largest road user KSI casualty group: there were 2,531 pedestrian KSIs in the five-year period, accounting for 32% of all KSIs.

In the five-year study period, 58% of F&S (Fatal and Serious) collisions took place on Borough roads while 42% took place on TLRN (Transport for London Road Network) roads.

61% of the F&S collisions took place on roads with a 30mph speed limit while 38% on roads with a 20mph speed limit. The proportion of collisions occurring on 20mph roads has been gradually increasing from 2016 to 2020, but this is likely due to the fact that the London Boroughs have been progressively implementing 20mph speed limits on all or almost all of their roads; moreover, the 20mph speed limit has been gradually introduced on all TLRN roads within the Inner Ring Road.

Analysis of Case Studies

Case Studies were identified using a statistical analysis of STATS19 data across locations in the road network where a significant year-on-year drop in the number of collisions was observed in the study period, cross-referenced with infrastructure schemes introduced in recent years.

The ten interventions selected for additional analysis are:

- Bank Junction: 'Bank on Safety' scheme bus and cycle only traffic restrictions
- Upper Holloway Road: 20 mph speed limit
- Farringdon Road/ Clerkenwell Road Junction: Junction redesign as part of the north-south Cycle Superhighway (CS6)
- The Cut/ Blackfriars Road Junction: Junction redesign as part of the north-south Cycle Superhighway (CS6)
- Stockwell Road/ Clapham Road / South Lambeth Road Junction ('Stockwell Cross'): Junction redesign as part of Cycle Superhighway 7 (CS7)
- Moor Lane to Queen Street: Cycle improvements as part of Quietway 11
- Grove Park Town Centre: Streetscape improvements
- Waterloo Road/Westminster Bridge Road Junction & St George's Circus: Bus priority measures on Westminster Bridge Road and junction improvements as part of the north-south Cycle Superhighway (CS6) at St George´s Circus
- Millbank / Lambeth Bridge Roundabout: Safety improvements
- Manor Road/ Stamford Hill Junction: Safety improvements

All case studies witnessed reductions in the number of collisions and/or in the proportion of Fatal and Serious, supporting the efforts towards the achievement of Vision Zero.

The most common reasons for the success of these case studies are: speed reduction strategies; traffic management strategies; improvements to crossings and footways; provision of high-quality cycle facilities; removal/ reduction in conflict between user groups (e.g., cycles and general traffic; buses and general traffic; pedestrians and cycles...)

Vision Zero Guidelines

The following guidelines have been developed using the findings of the analysis of collision statistics across the 10 CLSTRP Borough and of the 10 case studies as a starting point. The Guidelines have been organised into seven themes.

The themes can help in navigating through the range of potential road safety measures available to designers and highway authority.

However, a key finding has been that there is no 'one size fits all' solution to achieving Vision Zero. Rather, the most appropriate mix of measures in any location will need to be tailored to its specific context and challenges.

Another overarching finding is that ambitious action will be needed to achieve Vision Zero. The context of central London means that its road network is intensively used a range of road users, inevitably leading to conflicts. As such, measures that remove conflicts are likely to be essential, including those that seek to reduce motorised traffic.

Theme 1 – Pedestrian priority: pedestrian casualties account for 18% of all casualties across CLSTRP Boroughs (the third most involved VRU group) and 31% of KSIs, the most involved user group across all modes of travel. Transport for London and Local Authorities across Central London have already been putting in place various measures to improve pedestrian safety along road links and at junctions, improve pedestrian comfort along footways and increase permeability through provision of new/better crossing facilities. The analysis of the ten case studies undertaken as part of this report confirms that these features can result in significant improvements and relevant reductions in the number of collisions resulting in pedestrian casualties.

Theme 2 – Cycle Facilities: cycle casualties account for 25% of all casualties across CLSTRP Boroughs (the most involved VRU group) and 30% of KSIs, the second most involved user group across all modes of travel. Reflecting this growing demand and call for action, a large proportion of highway improvements delivered in recent years, and of the ten case studies selected for this report, has its focus on the provision of high-quality cycle facilities or includes some form of improvements to cycle quality. Guidance for the planning and design of cycle infrastructures, inclusive of safety considerations and recommendations, is mainly provided by the recent Cycle Infrastructure Design Guidance LTN 1/20, and by TfL's London Cycle Design Standards (2014).

Theme 3 – Powered Two-wheelers are the second group of vulnerable users most involved in road casualties across CLSTRP Boroughs after cyclists (22%). Measures that can be considered are: target and prioritise intervention on nodes and links with a high number of collisions; develop a 'motorcycle readiness' audit to be used on safety hotspots and all new major highway improvement schemes (following TfL's Urban Motorcycle Design Handbook); working with BIDs and business owners to ensure that vehicles and equipment meet legal requirements.

Theme 4 – Speed: vehicle speed is one of the most important factors not just in determining the severity of a collision but in determining whether one happens in the first instance. All ten CLSRTP Boroughs have already introduced 20mph limits on all local roads and some of them are now working in collaboration with TfL to extend the limit to streets located within the TLRN network.The 20mph speed limit already applies to all TLRN roads within the Inner Ring Road

Theme 5 – Public Transport: improving safety on public transport can play a role in encouraging more users to prefer this mode of travel over private motorised vehicles, supporting traffic reduction strategies. Moreover, several traffic management strategies comprising the restriction to motorised vehicles of portion of the road network, combined with bus safety improvements, could generate a virtuous circle of collision reduction.

Theme 6 – Freight Vehicles: Local Authorities can promote safety behaviours among freight operators and drivers by incentivising schemes such as FORS with businesses and BIDs.

Theme 7 - Traffic Management: Traffic Management Strategies are increasingly playing a crucial role on road safety. The solutions comprehended under this heading include: Permanent or Timed road closures (to all traffic or to certain user classes); Modal Filters (including point closures except cycles, bus gates etc.); One-way restrictions (with or without contraflow cycling); School Streets; Low Traffic Neighbourhoods.

Theme 8 – Behavioural Change and Enforcement: as well as introducing physical interventions across the road network, a comprehensive Vision Zero Strategy should target as many components of the Safe System approach as possible. It should thus include supporting measures involving behavioural changes and smart travel programmes, increasing people's awareness about road dangers and interaction with other road users. This include School Travel Planning, Cycle Training, Pedestrian Skills Training, Motorcyclists Skills Training.

Theme 9 – Experimental and Temporary Schemes: While temporary and interim interventions cannot address all existing road safety issues, they can still make a noticeable positive impact and provide a quick and effective demonstration of the potential impact of more permanent solutions.

2. Introduction

Vision Zero is a road safety policy first adopted in Sweden in 1997. The long-term goal of Vision Zero, as the name suggests, is that no-one is killed or seriously injured as a consequence of traffic collisions within the road transport system and that the design and function of the road transport system3 should be adapted to the requirements of Vision Zero4. Vision Zero policies for road traffic safety have been introduced in other countries, such as Norway, Denmark, Australia and the USA.

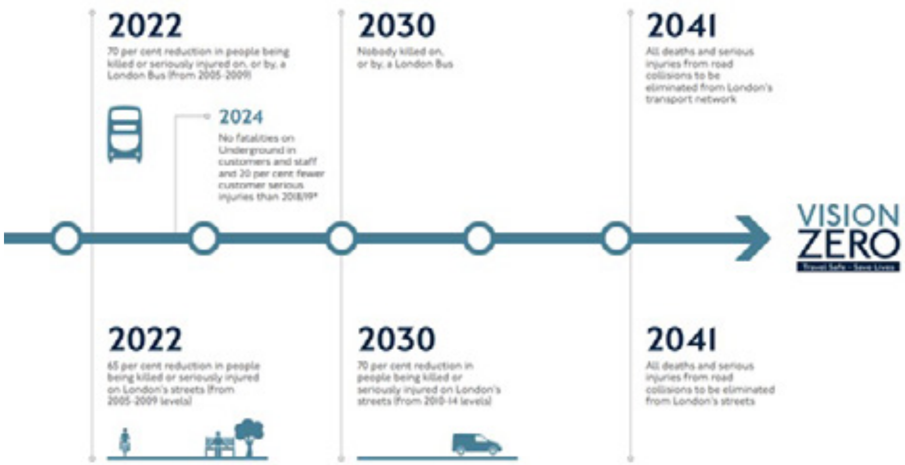
In the UK, several cities have moved towards a Vision Zero approach, such as Blackpool, Edinburgh, Liverpool and London. A 'Safe Systems Approach' is supported by the Royal Society for the Prevention of Accidents (RoSPA) to meet Vision Zero objectives, and it has been adopted by Highways England and is endorsed by the Department for Transport.

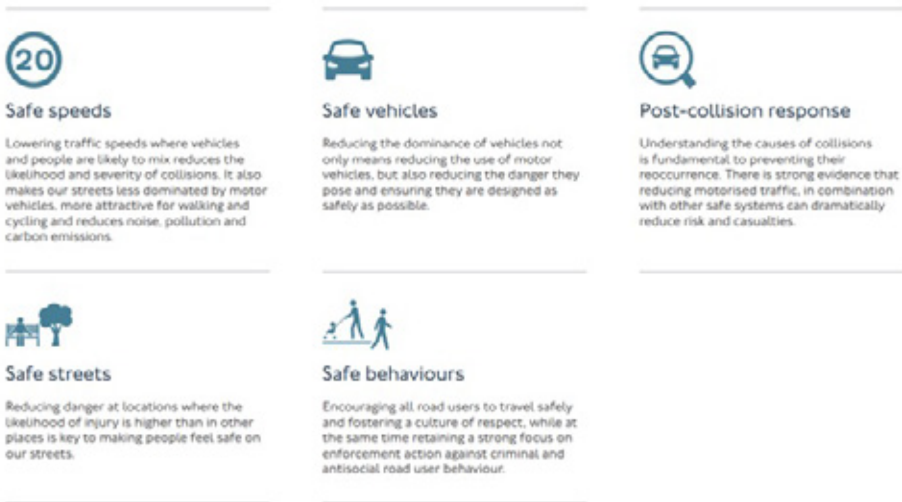
Vision Zero for London

In London, the Mayor's Transport Strategy (2018[5]), sets out the goal that, by 2041, all deaths and serious injuries will be eliminated from London's transport network. Specific short-, medium-, and long-term targets have been set as shown in Figure 2.1 below.

To achieve this, efforts to reduce the danger posed by motor vehicle journeys will be focused on five areas, known as 'The Safe Systems Approach'':

Figure 2.1: Mayoral targets in achieving Vision Zero. Source: Vision Zero action plan progress report (2021[6])





Safe Systems Approach

Overview

A Safe System Approach is the generic term for approaches such as 'Vision Zero', 'Sustainable Safety' and 'Towards Zero'. It is based primarily on Vision Zero, recognising that human beings' lives and health should never be compromised by their need to travel. Unlike the traditional approach to road safety, the Safe System approach recognises that human error is no longer the primary cause of accidents (RoSPA, 2018[7]).

Safe System is based on the underlying principles that[8]:

- Human beings make frequent mistakes that lead to road collisions
- The human body by nature has a limited ability to sustain collision forces with known tolerance to injury thresholds
- It is a shared responsibility between stakeholders (road users, road managers, vehicle manufacturers, etc.) to take appropriate actions to ensure that road collisions do not lead to serious or fatal injuries

Components of the Safe System

According to the Safe System approach, crashes resulting from failures in the road system can be addressed through improvements to the road system. These improvements can include management of infrastructure, improved vehicle design and reduced speeds. There are five essential elements of the Safe System approach, which reflect a holistic view of road safety, as the diagram below shows:

Figure 2.2: The five pillars of action of the Safe System. Source: Loughborough University Design School Safe System Course, 2017

Notes to the reader

Note on Terminology

Within this report, statistics and trends related to both collisions and casualties are reported. It is important to note the difference between these terms:

- **Collision** refers to a single incident on the road network and is represented by a single row in the STATS19 'Attendant' table.
- **Casualty** refers to a person killed or injured in a collision. A single collision may result in multiple casualties.

Collisions that are recorded to result in one or more deaths or serious injuries are referred to in this study as fatal and serious collisions (F&S Collisions). A single F&S collision may result in multiple people killed or seriously injured (KSIs). KSI is used to refer to the number of casualties resulting in death or serious injury and is not used as a term that refers to the number of collisions. Fatal casualties are defined as those human casualties who sustained injuries which caused death less than 30 days after the accident.

STATS19 data only includes recorded on-road collisions which resulted in personal injury, therefore collisions which go unreported, and/or only resulted in property damage, are not included in the analysis presented in this report. It should also be noted that vulnerable road users may restrict or change their behaviour in response to both actual and perceived level of safety and again this will not be reflected in the analysis presented. Despite the known limitations, STATS19 data is the most appropriate, accessible and understood source of information on collisions and therefore it was appropriate to use for this study.

Impact of the COVID-19 Pandemics on Road Safety

It needs to be also noted that the COVID-19 pandemic changed people's travel patterns and habits, both temporarily (as effect of the lockdowns) and potentially in the long term, and therefore had an impact on road safety too. In order to avoid the risk of skewing the findings of the analysis with data affected by temporary disruptions in travel patterns, collision data from year 2020 were excluded from the overview analysis of collision trends and patterns. They were also excluded from the selection process of the case studies. Nevertheless, for some case studies which were implemented more recently, in order to have sufficient post-implementation collision data (36 months), collision data from 2020 were included in the analysis too and any road safety issues that could have arisen due to COVID-19 were identified and recognised.

Figure 2.3 Temporary Road Layout for Social Distancing, LB Southwark

Changes in collision reporting

From September 2016 onwards, the Metropolitan Police Service introduced the Case Overview and Preparation Application (COPA) to report road traffic collisions. This system uses a new method of assessing the severity of injury sustained in collisions, as recommended by the Department for Transport, whereby Police officers record the type of injury suffered rather than their assumptions about the severity of the injury. The recording system then assigns an injury severity according to the type of injury recorded. This contrasts with the previous system where officers recorded whether, in their judgement, an injury was 'slight' or 'serious'. The use of these systems has resulted in improved accuracy in the recording of injury type, with more injuries being classified as serious rather than slight.

As a result, 2017 data across London showed an increased number of serious collisions over 2016. TfL has undertaken analysis to back cast the number of casualties that would have been reported by the police using an injury-defined rather than a severity-defined system. This allows the number of injuries reported by the police during 2017 to be compared with data collected using previous systems. This back cast, however, applies only to aggregate statistics and not to individual collision records. As such, some of the year-on-year comparisons in the following pages might be influenced by the change in reporting.

3. Road safety trends and patterns 2016-2020

Overview

Five years of collision data were analysed for the ten London Boroughs within the Central London Sub-Regional Transport Partnership (CLSRTP) area in order to identify collision trends.

Across this five-year period (2016 to 2020 inclusive), a total of 6,484 F&S collisions were recorded in the ten London Boroughs resulting in 7,386 KSI (Killed and Seriously Injured) casualties of which 211 were fatalities. F&S collisions accounted for 14.5% of all collisions.

Given the focus of this study on Vision Zero, this overview analysis of collision trends mainly examines F&S collisions and KSI casualties. Furthermore, this is not intended to be a comprehensive analysis of collision data, rather the purpose of it is to provide insights that can inform the Vision Zero Guidelines across the ten London Boroughs within the area.

Figure 3.1: Collisions by severity, 2016-2020 (inclusive)

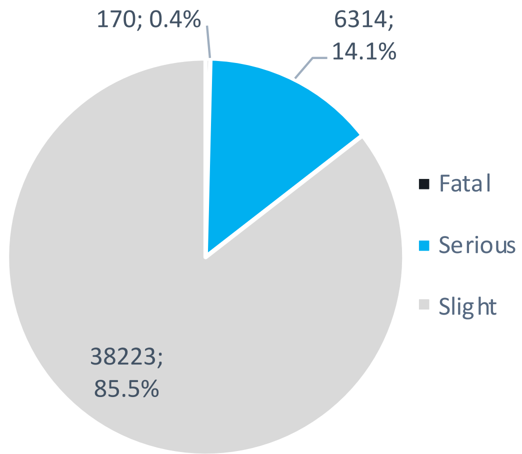
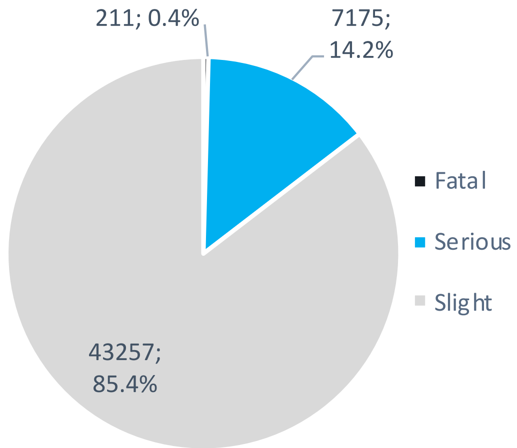


Figure 3.2: Casualties by severity, 2016-2020 (inclusive)



Casualty Trends

Figure 3.3 shows the number of KSI casualties for each of the ten London Boroughs by year. There are some commonalities in trends across most of the London Boroughs, with an increase in KSI casualties from 2016 to 2017, followed by a plateau in the period 2017-2019, and a decrease in 2020.

City of Westminster is the Borough with the highest number of KSI casualties across all years, followed by Lambeth. The City of London has a significantly lower number of KSI casualties compared to the rest of the Boroughs – this is due to its smaller size and therefore smaller length of road network.

The City of Westminster saw the biggest absolute decrease in KSI casualties in 2020, which reduced by 100, from 283 in 2019 to 183 in 2020. The City of London saw the sharpest proportional decrease in KSI casualties which reduced by 45% from 83 to 46. The London Borough of Lewisham saw the smallest proportional as well as absolute decrease in KSI casualties in 2020 compared to 2019, with just a 12% reduction.

It needs to be noted that year-on-year trends are clearly influenced by the changes in reporting system between 2016 and 2017 and by the pandemic in 2020.

Figure 3.3: Number of KSI casualties by Borough, by year

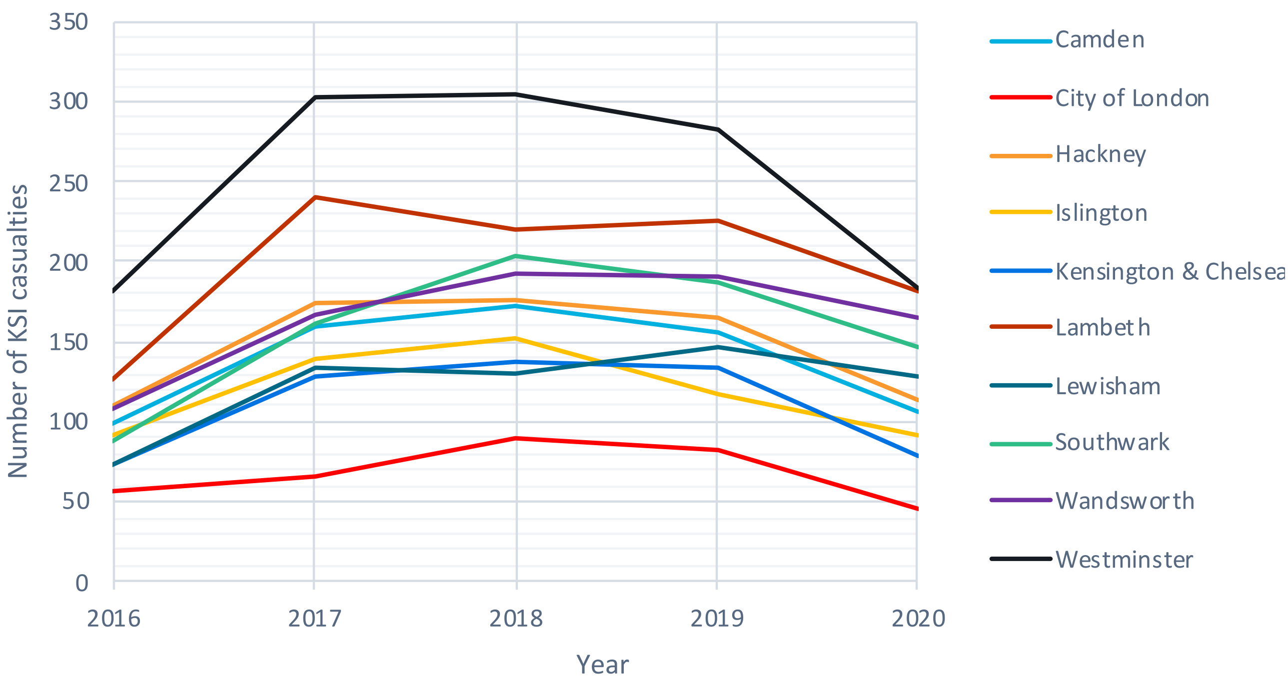
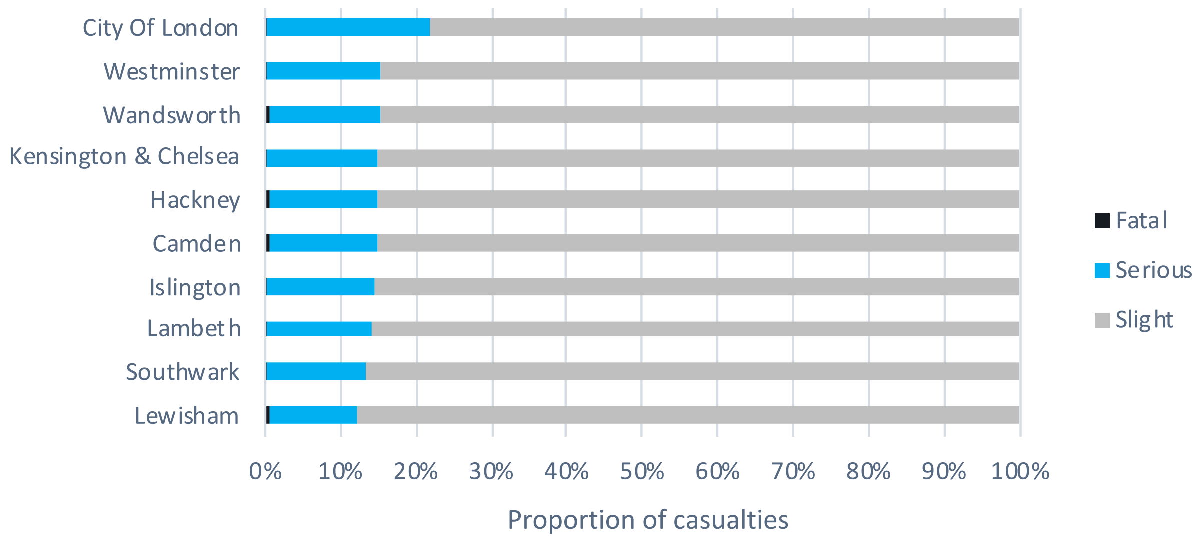


Figure 3.4: Proportion of casualties by severity for each Borough



Among the ten London Boroughs, the average proportion of KSI casualties over the total number of casualties is 15%. As seen in Figure 3.4 the Borough with the highest proportion of KSI casualties is the City of London with 22%, while the London Borough of Lewisham has the lowest proportion of KSI casualties (12%).

This is also related to exposure, as KSI casualty rates are usually higher for vulnerable road users and City of London has on average highest proportion of vulnerable road users on its network while the London Borough of Lewisham has the lowest (based on average annual daily flow data on specific count points – Source: roadtraffic.dft.gov.uk).

Casualties by mode of travel, age and gender

Looking at casualties by mode of travel, pedestrians are the largest road user KSI casualty group: there were 2,531 pedestrian KSIs in the five-year period, accounting for 32% of all KSIs. In 2020, there was a shift in travel behaviours due to the COVID-19 pandemic, which varied by transport mode therefore the fluctuations in the number of KSI casualties in 2020 varied by road user type:

- There was a significant reduction in pedestrian KSI casualties of 39% in 2020 compared to the previous years (2016 to 2019 average)
- A similar reduction was observed for car occupant casualties, with a 41% reduction compared to the previous years
- KSI powered 2-wheeler casualties also decreased in 2020 by 28% compared to the previous years
- Pedal cycle KSI casualties, however, increased by 6% in 2020 compared to 2019 and by 22% compared to the average of the previous years
- There were also reductions observed in 2020 in terms of casualties for the remainder of the motorised modes (car or taxi occupants, goods vehicle and bus occupants)

Overall, across all ten London Boroughs in the five-year study period, VRU KSI casualties accounted for 84.1% of all KSI casualties: 31.9% of all KSIs were pedestrians, 26.6% pedal cyclists and 25.6% powered two-wheelers drivers or passengers while just 9.2% were car drivers or passengers and 3.4% bus or coach occupants.

In terms of the distribution of the KSI casualties by Borough:

- The City of London and the London Borough of Camden are the Boroughs with the highest proportion of pedestrian KSI casualties (39%), followed by Westminster (38%)
- The London Borough of Islington and the City of London are the Boroughs with the highest proportion of pedal cycle KSI casualties (34%), followed by the London Borough of Southwark (31%)
- Powered two-wheeler collisions had a higher incidence in the London Borough of Wandsworth (32%) and the London Borough of Lambeth (30%)
- The Borough with the highest proportion of non VRU casualties was the London Borough of Lewisham, with 19% of all KSI casualties involving car drivers or passengers.

Figure 3.5: Number of KSI casualties by mode of travel, by year

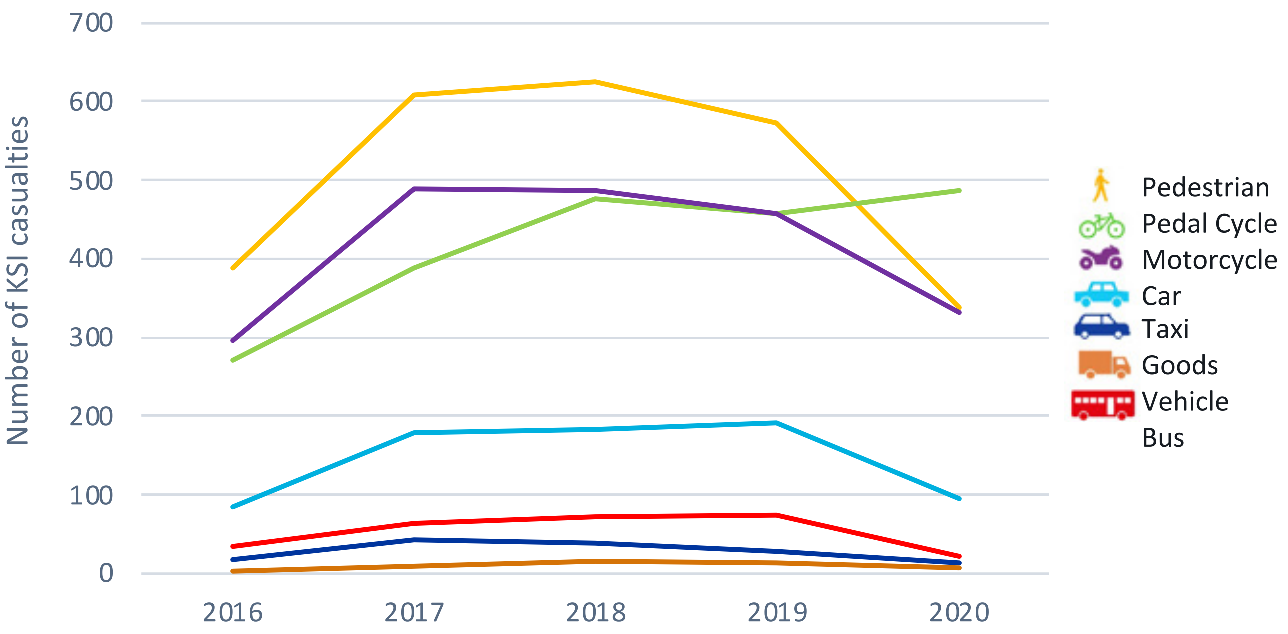


Figure 3.6: Proportion of KSI casualties by mode of travel, by Borough

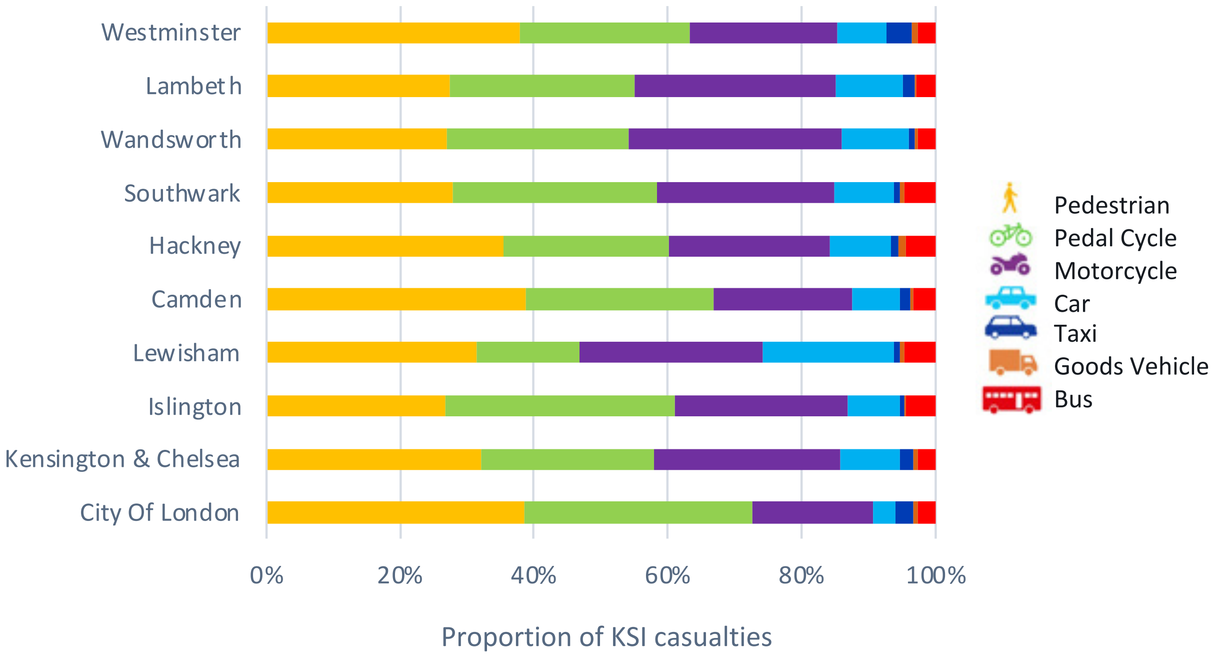
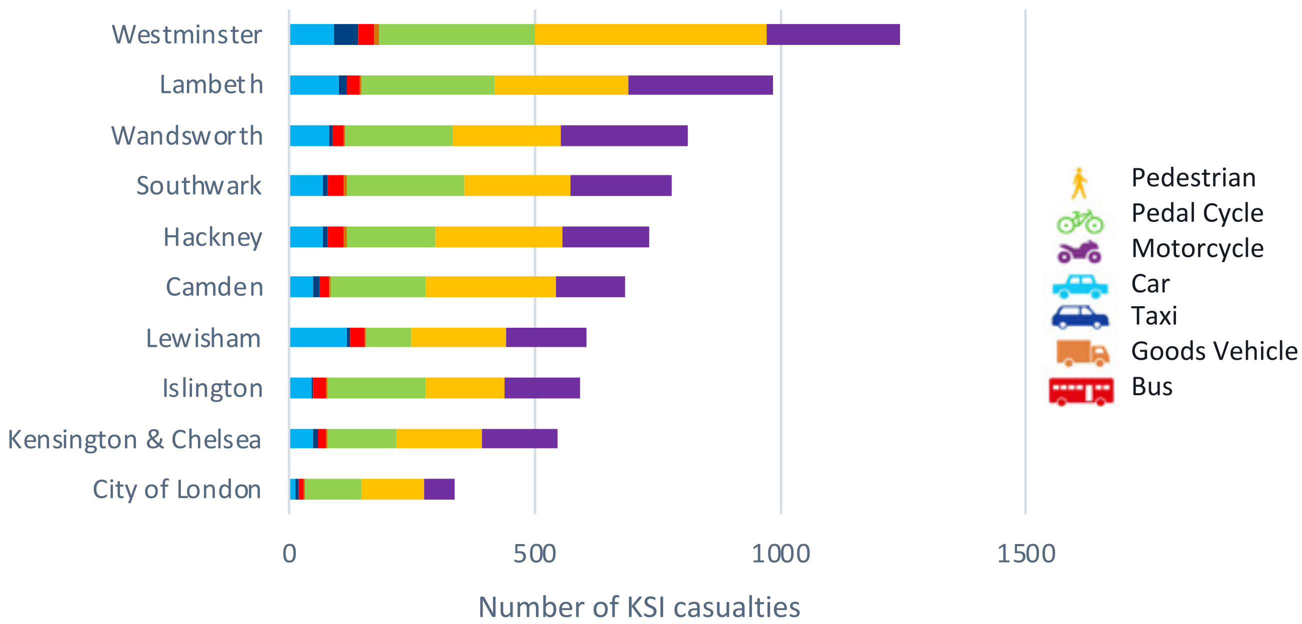


Figure 3.7: Number of KSI casualties by mode of travel, by Borough



Looking at absolute casualty numbers, however, the City of Westminster is the Borough with the highest number of both pedestrian KSI and pedal cycle KSI casualties, with 471 and 317 reported respectively, and the London Borough of Lambeth is the Borough with the highest number of powered two-wheelers KSI casualties (297) (see Figure 3.7).

Age and gender are known to impact KSI risk. As shown in Figure 3.9 within each age band, males within the 25-59 age group are more likely to be involved in collisions (both KSIs and slight). While Figure 3.8 and Figure 3.9 show that the greatest number of casualties occurs in the 25-59 age band, this band also contains the largest population. When considering the proportion of KSI casualties out of the total number of casualties for each group, elderly people are shown to experience a higher percentage of KSIs, as shown in Figure 3.10. Overall, 71% of all KSI casualties within the 5-year period were male and 29% female.

Figure 3.8: Distribution of KSI casualties by age

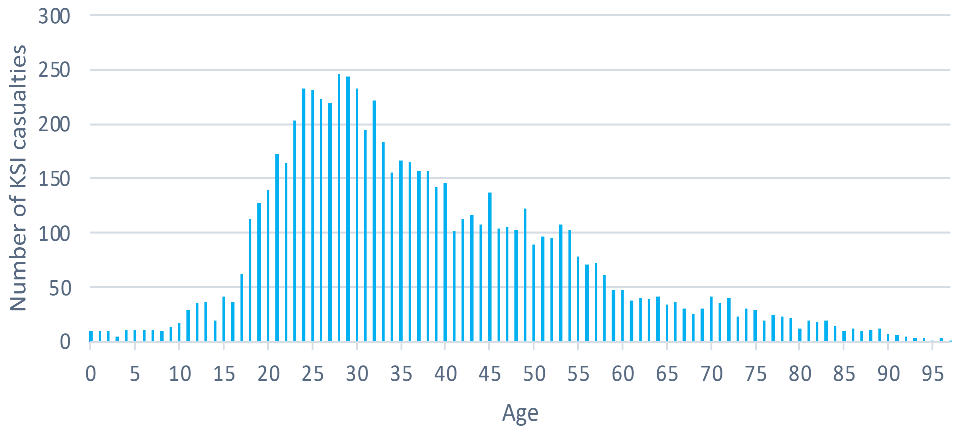


Figure 3.9: Number of Casualties by age band, gender and severity

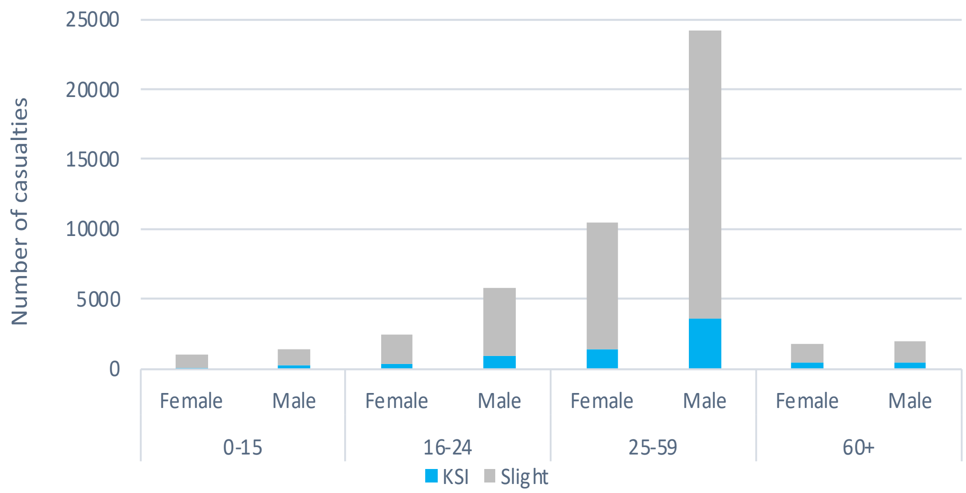
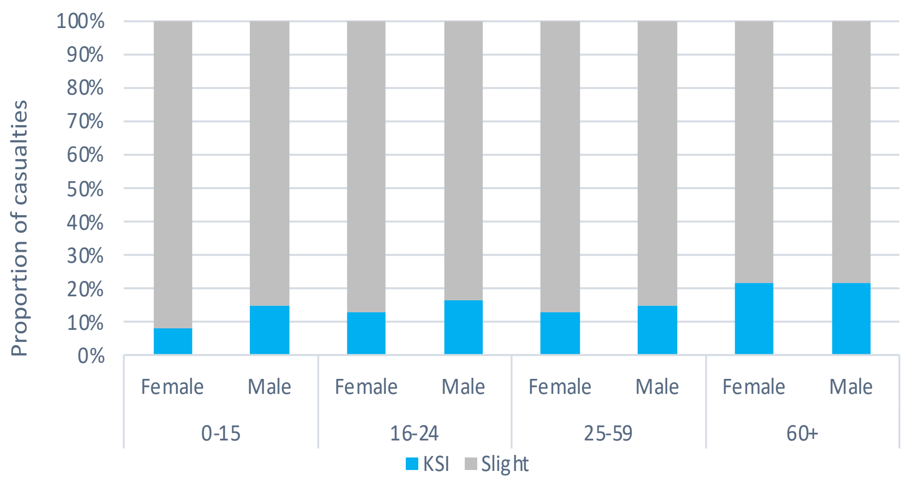


Figure 3.10: Proportion of KSIs by age band and gender



Regarding the distribution of KSI casualties by age and mode of travel, the following key figures were observed:

- Child KSI casualties were mainly pedestrians, accounting for almost 68% of all child KSI casualties;
- In the age group of 16-24, KSI casualties were mainly powered two-wheeler occupants (40%);
- In the age group of 25-59, KSI casualties were roughly equally split between the three VRU groups with 32% pedal cycle, 28% powered two-wheeler and 27% pedestrian KSI casualties;
- In the 60+, KSI casualties were mainly pedestrians (63%);
- Out of all the bus or coach occupant KSI casualties in the 5-year period, 50% were in the age group of 25-59 years old and 42% were elderly (aged 60 and over).

Figure 3.11: Proportion of KSI casualties by age and mode of travel

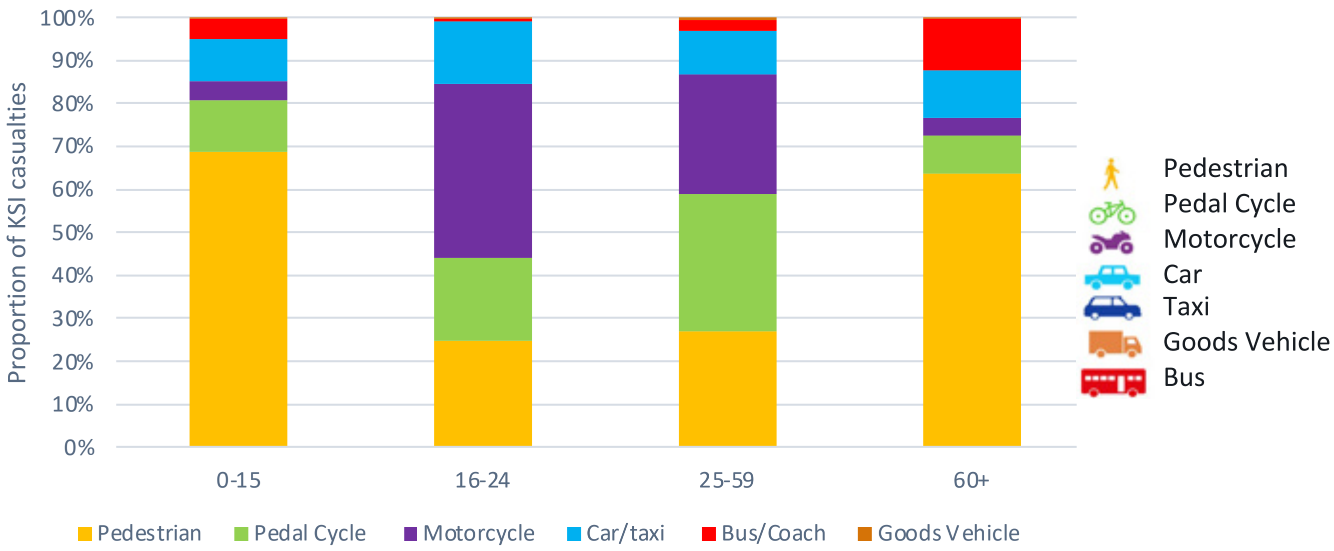
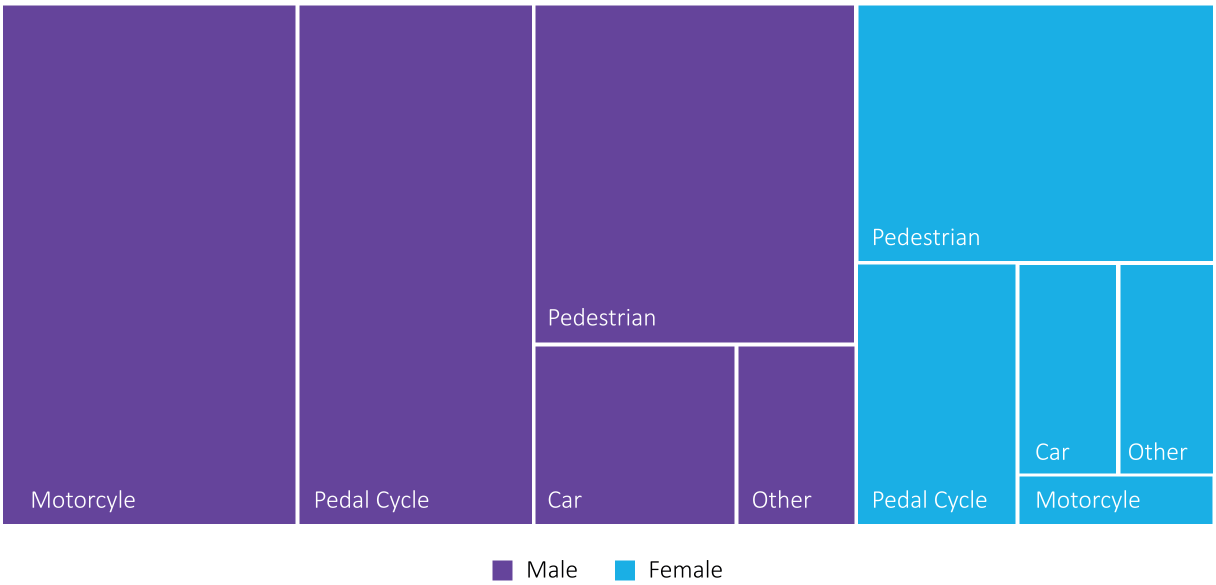


Figure 3.12 shows the distribution of casualties by mode and gender. The bigger the rectangle the higher the proportion of KSI casualties on each group. 94% of all KSI powered two-wheeler casualties were male, 75% of all KSI pedal cycle casualties were male, although pedestrian KSI casualties were more evenly split with 54% of those being male and 46% female. The only mode category where female casualties were over-represented was buses or coaches with 67% of the KSI casualties being female and 33% male (although the absolute number of these casualties is small in comparison to other modes).

Figure 3.12: KSI casualties by mode of travel and gender



Collisions by highway authority

In the five-year study period, 58% of F&S collisions took place on borough roads while 42% took place on TLRN roads (see Figure 3.13). The percentage of F&S (Fatal and Serious) collisions occurring on the TLRN network is therefore very high considering the fact that the TLRN network accounts for approximately just 7% of the total network in terms of road length in the ten London Boroughs. This is most likely related to increased traffic volumes and speeds on the TLRN network when compared to the borough roads, as well as the higher likelihood of conflicts between VRUs and large vehicles.

Further investigation should be undertaken considering traffic volumes carried by TLRN roads in comparison with traffic volumes carried by borough roads, as a way of taking exposure to road danger into account..

In the London Borough of Lambeth and London Borough of Wandsworth, over half of all collisions occurred on TLRN roads (58% and 53% respectively) (see Table 3.1 below).

Figure 3.13: Proportion of F&S collisions by highway authority

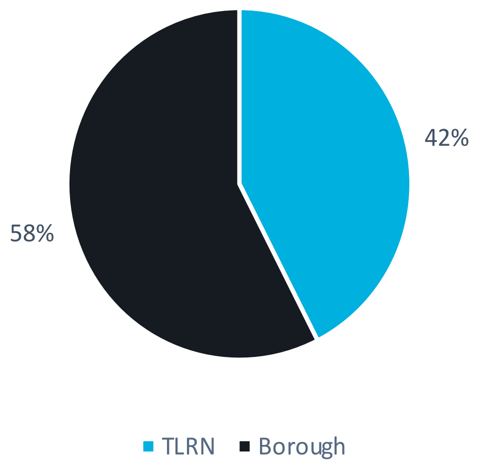


Table 3.1: F&S collisions by highway authority

	TLRN	Borough	Total	% TLRN	% Borough
Camden	178	442	620	29%	71%
City of London	143	154	297	48%	52%
Hackney	300	342	642	47%	53%
Islington	223	308	531	42%	58%
Kensington & Chelsea	145	344	489	30%	70%
Lambeth	514	368	882	58%	42%
Lewisham	244	266	510	48%	52%
Southwark	342	364	706	48%	52%
Wandsworth	376	333	709	53%	47%
Westminster	290	808	1098	26%	74%
Total	2755	3729	6484	42%	58%

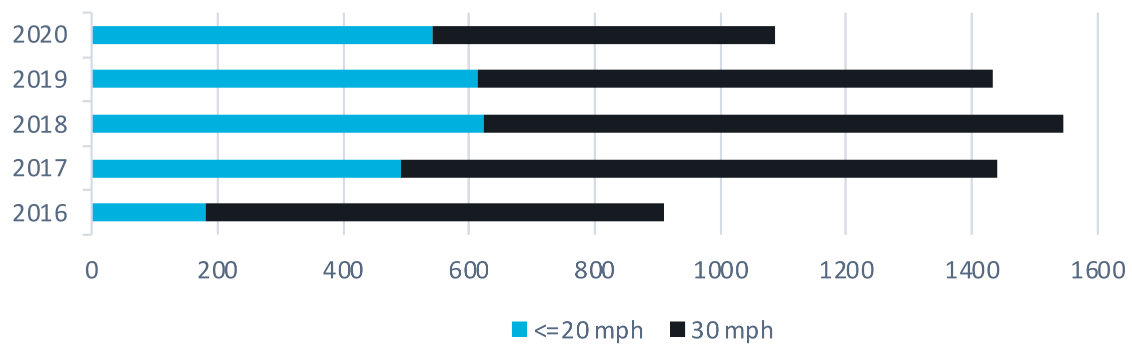
Collisions by speed limit

Research shows that on urban roads with low traffic speeds, any 1mph reduction in average speed can reduce the collision frequency by around 6% (Taylor, M.C., Lynam, D.A. and Baruya, A., 2000[9]) . One of the first studies of pedestrian injury and impact speed found that if a pedestrian is hit by a vehicle travelling at 20mph there is a 2.5% chance that they will be fatally injured, compared to a 20% chance at 30mph (Ashton, S. J. and Mackay, G. M., 1979[10]) . Slower speeds not only reduce the severity of injuries, but also the chance of a collision occurring as people have more time to react.

Overall, in the five-year study period, 61% of the F&S collisions took place on roads with a 30mph speed limit while 38% on roads with a 20mph speed limit. As shown on Figure 3.14, the proportion of collisions occurring on 20mph roads has been gradually increasing from 2016 to 2020, but this is likely due to the fact that the London Boroughs and TfL have been progressively implementing 20mph speed limits on all or almost all of their roads; as of 2015 the London Boroughs of Islington, Camden, City of London, Southwark and Hackney had introduced a borough-wide 20mph speed limit strategy. The London Boroughs of Lambeth and Lewisham followed in 2016, Wandsworth in 2017, while Westminster and Kensington & Chelsea followed in 2020.

TfL is also gradually introducing 20mph speed limits on the TLRN network as part of the Mayor's Vision Zero policy which aims to see no one killed or seriously injured on TLRN roads by 2041. In 2020 a 20mph speed limit was introduced on all TLRN roads within the London Congestion Charge Zone while several other roads within the TLRN network had their speed limits reduced in March 2022.

Figure 3.14: Number of F&S collisions by speed limit (comprising both TLRN and Borough Roads)



Collisions by junction types

In the five-year study period, the majority of F&S collisions for the ten London Boroughs within CLSRTP took place at junctions (see Figure 3.15). Junctions are the most common locations of collisions, especially in urban areas, as they are the locations where the majority of conflicting movements occur on the road network. The London Boroughs of Islington and Kensington & Chelsea are the CLSRTP Boroughs with the highest proportion of F&S accidents taking place at junctions (81%).

Figure 3.15 also shows a breakdown of these collisions by the junctions' method of control type. Give-way or uncontrolled junctions show the highest number of F&S collisions (45%) followed by signal-controlled junctions (28%).

Looking at the type of junction (see Figure 3.16), the majority of collisions occur at staggered T-junctions.

Figure 3.15: F&S collisions by junction control type

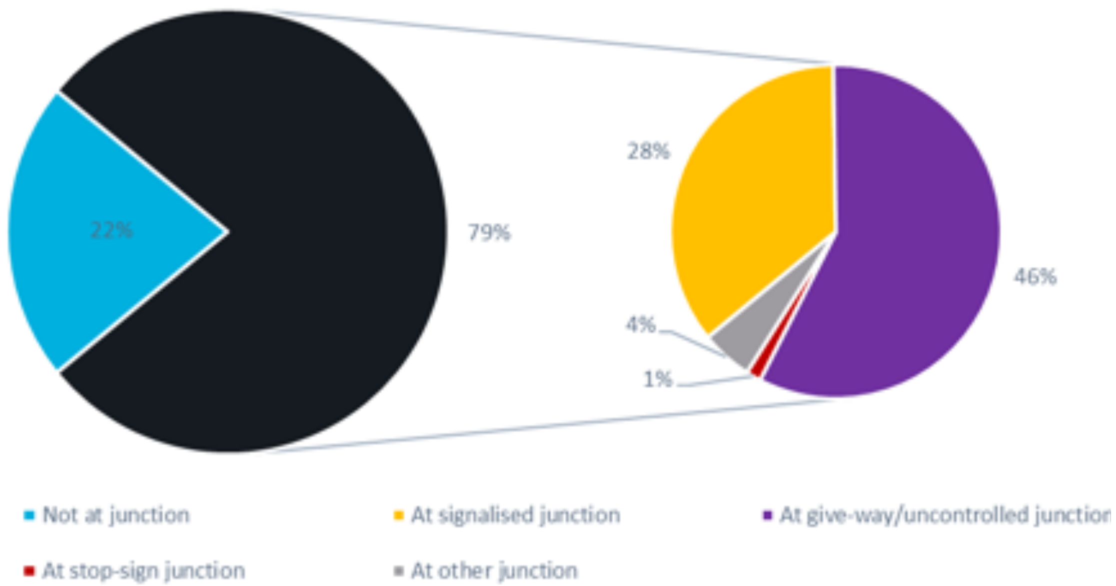
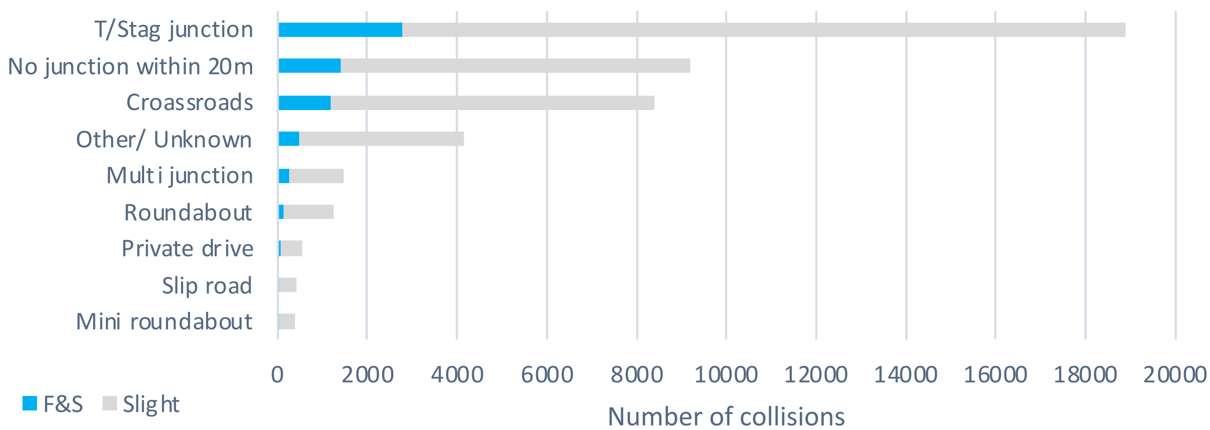


Figure 3.16: Collisions by junction type and severity



Contributory factors

Contributory factors are a subjective assessment by the Metropolitan Police processing staff as to the factors contributing to the collision, and the attending officer's judgement of what factors may have contributed to the collision. Each contributor is assigned a confidence level (coded with A, B or 0) in the STATS19 database. Our analysis has focused solely on those contributors with the highest confidence level (A).

It is worth noting that contributing factors data does not consider or provide detail on instances of suicide/self harm.

As seen in Table 3.2, almost all of the top contributors in the ten London Boroughs relate to the behaviour of drivers or riders, with 'Failing to look properly' and 'Failing to judge other person's path or speed' being the most common.

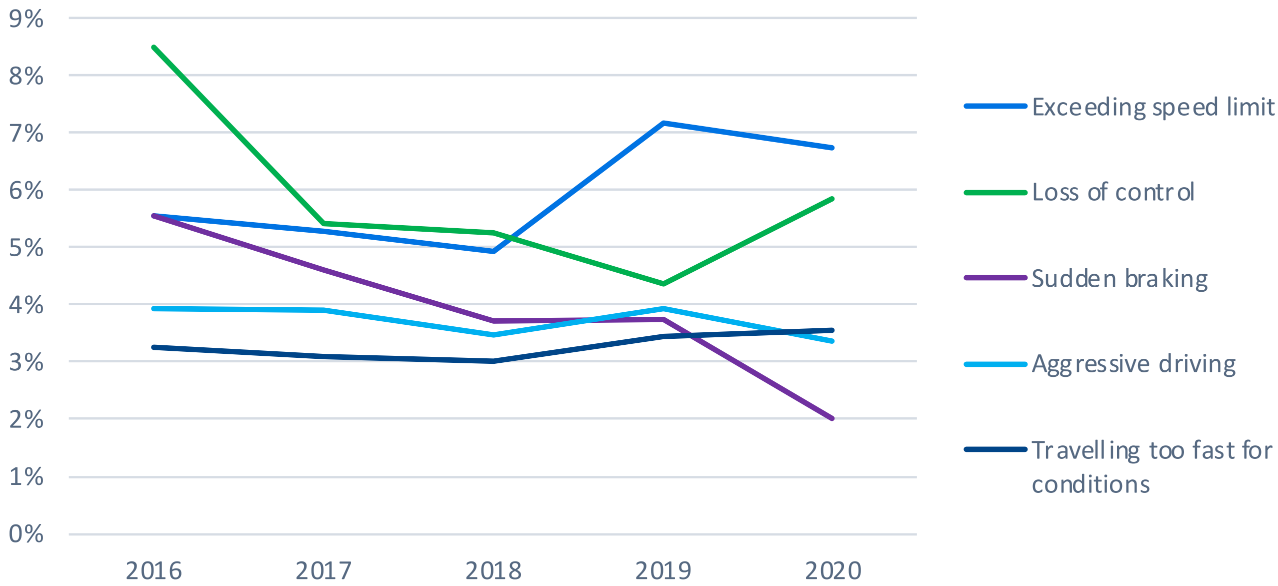
Looking at speeding-related contributory factors during the pandemic in 2020, there is no clear evidence that speeding has an increased importance as contributory factor since the start of the pandemic (see Figure 3.17).

When looking at the most frequently recorded contributory factors by mode of travel that they were assigned to, in most cases these were assigned to car and powered two-wheeler drivers.

Table 3.2: Most frequently recorded F&S collision contributory factors by year

	Year				
Contributory factor	2016	2017	2018	2019	2020
Driver/rider - Failed to look properly	497	549	632	522	425
Driver/rider - Failed to judge other person's path or speed	197	253	263	246	192
Driver/rider - Careless/reckless/in a hurry	294	182	193	188	127
Driver/rider - Poor turn or manoeuvre	224	187	203	168	110
Driver/rider - Exceeding speed limit	51	77	77	104	74
Driver/rider - Loss of control	78	79	82	63	64
Driver/rider - Vision Affected - Stationary or Parked Vehicle(S)	87	75	68	58	53
Driver/rider - Sudden braking	51	67	58	54	22
Driver/rider - Aggressive driving	36	57	54	57	37
Road conditions - Slippery Road (Due to Weather)	26	69	46	51	46
Driver/rider - Travelling too fast for conditions	30	45	47	50	39

Figure 3.17: F&S collision contributory factors related to speeding by year (frequency recorded out of the total contributory factors each year)



The following contributory factors were most frequently assigned to powered two-wheeler drivers suggesting there is an issue with speeding for this mode:

- Driver/rider - Exceeding speed limit
- Driver/rider - Loss of control
- Driver/rider - Sudden braking
- Road conditions - Slippery Road (Due to Weather)
- Driver/rider - Travelling too fast for conditions

Regarding bus or coaches, it seems that sudden breaking is the most frequently reported issue, causing bus passengers to fall.

Table 3.3: Most frequently recorded F&S collision contributory factors by mode of travel assigned to

	Mode assigned to					
Contributory factor	Bus Or Coach	Car	Goods Vehicle	Pedal Cycle	Powered 2-Wheeler	Taxi or Private Hire
Driver/rider - Failed to look properly	58	1341	324	443	561	214
Driver/rider - Failed to judge other person's path or speed	32	450	77	232	415	73
Driver/rider - Careless/reckless/in a hurry	8	440	74	148	371	46
Driver/rider - Poor turn or manoeuvre	17	452	106	113	228	90
Driver/rider - Exceeding speed limit	4	182	8	11	229	12
Driver/rider - Loss of control	0	144	12	95	170	7
Driver/rider - Vision Affected - Stationary or Parked Vehicle(S)	5	161	33	52	111	22
Driver/rider - Sudden braking	80	48	8	53	81	11
Driver/rider - Aggressive driving	1	166	14	7	82	5
Road conditions - Slippery Road (Due to Weather)	7	79	11	39	121	10
Driver/rider - Travelling too fast for conditions	1	61	6	44	126	6

4.

Case Studies

Methodology for selection

Following the statistical analysis of collisions across the ten CLSRTP Boroughs, a more in-depth analysis was undertaken in order to identify specific locations where there has been a significant year-on-year drop in collisions during the study period. The locations used for this analysis were Links or Nodes based on TfL´s STATS19 network:

- **Nodes** correspond to all main junctions in the road network
- **Links** are segments of the road network, defined by the nodes at either end

Only Links and Nodes with more than 20 collisions in the five-year period were considered. This value was not selected arbitrarily, but it is close to the sum of the average plus the standard deviation of the collisions for all locations.

It needs to be noted that, for this selection, the total number of collisions was reviewed rather than only F&S collisions, in order to be able to undertake the statistical analysis on a bigger sample (given that in general, F&S collisions are relatively rare events, with a very small absolute number of these occurring on any individual node or link).

Two statistical tests were then performed on the Links and Nodes :

- **Test 1:** The average among year-on-year variations
- **Test 2:** The slope of the linear trendline across the period under investigation (2016 to 2019). Year 2020 was excluded from the statistical tests due to the potential impacts of the COVID-19 pandemic.

According to these two tests, a longlist of Nodes and Links was then produced (top 50 Links and top 50 Nodes) and presented to relevant officers at each local authority for comment. In particular, we sought to understand whether a scheme was implemented at each location and if so, the year of implementation. The Poisson test was also used to determine whether there was a statistically significant decrease in collisions at each location between the years 2016 to 2019, or if any change may have simply been attributable to random fluctuation.

This longlisting process served only as an initial selection mechanism. We then reviewed each location individually in detail, taking into account information received on schemes that may have been implemented in the area and other influencing factors.

To complement this methodology, a review of TfL's Traffic Accident Diary System for long-term collision monitoring (TADS) dataset was also undertaken. The benefit of the TADS system is that it monitors before and after collision data based on the actual scheme area, rather than using individual STATS19 network locations.

The case studies were then confirmed based on the steps outlined above, and we then liaised with officers at each local authority to understand more about each selected intervention.

Case studies identified

The ten interventions selected for additional analysis are set out in Table 4.1 below in summary. A more detailed description of the interventions, background and rationale including key success factors and learning, is provided in the following section.

In the analysis of these case studies, three years of collision data pre- and post- implementation have been used to investigate the effectiveness of the measures introduced. It is worth mentioning that the post-implementation data for those case studies implemented after 2017 includes 2020 and 2021 collisions.

The effect of the pandemic restrictions could not be factored in this assessment, but should be taken into account when reading through the outcomes.

As such, the robustness of the analysis of those case studies can be affected by COVID-19 related factors, and further analysis should be undertaken in the future, when larger sample of historical data will be available.

Table 4.1: Case studies identified

ID	Location	Scheme	Local Authority	Year of implementation
1	Bank Junction	'Bank on Safety' scheme bus and cycle only traffic restrictions	City of London	2017
2	Upper Holloway Road	20 mph speed limit	London Borough of Islington (TLRN)	2018
3	Farringdon Road/ Clerkenwell Road Junction	Junction redesign as part of the north-south Cycle Superhighway (CS6)	London Borough of Islington (TLRN)	2018
4	The Cut/ Blackfriars Road Junction	Junction redesign as part of the north-south Cycle Superhighway (CS6)	London Borough of Southwark (TLRN)	2015
5	Stockwell Road/ Clapham Road / South Lambeth Road Junction ('Stockwell Cross')	Junction redesign as part of Cycle Superhighway 7 (CS7)	London Borough of Lambeth (TLRN)	2016
6	Moor Lane to Queen Street	Cycle improvements as part of Quietway 11	City of London	2016
7	Grove Park Town Centre	Streetscape improvements	London Borough of Lewisham	2018
8	Waterloo Road/Westminster Bridge Road Junction & St George's Circus	Bus priority measures on Westminster Bridge Road and junction improvements as part of the north-south Cycle Superhighway (CS6) at St George´s Circus	London Borough of Southwark (TLRN)	2015
9	Millbank / Lambeth Bridge Roundabout	Safety improvements	London Borough of Westminster (TLRN)	2017
10	Manor Road/ Stamford Hill Junction	Safety improvements	London Borough of Hackney (TLRN)	2016

Bank Junction

Local authority **City of London**
Date of implementation **Experimental Scheme implemented in May 2017, Permanent Civil Works carried out between January and August 2020**

The development of the 'Bank on Safety' scheme began in 2016, to address some serious road safety concerns in this location with two fatalities at the junction between 2012 and 2015 and a high number of serious casualties, specifically concerning the most vulnerable road users. Prior to 2016, there had been a longer-term project ('All Change at Bank'), being developed to simplify junction operations and provide a better pedestrian environment. This was aligned with the time frame of the Bank Station Capacity upgrade completion (2021).

The 'Bank on Safety' scheme was initiated in order to provide a shorter-term solution to road safety issues, in anticipation of the delivery of the longer-term project which focuses on the simplification of the physical junction layout.

Figure 4.1: Bank Junction: Aerial View before and after implementation (Source: Google Earth)

It focused on reducing the number of movements through the junction rather than changing the geometry of the junction. It was implemented as an experimental scheme in May 2017. It restricted movement through the junction and westbound on Cornhill to buses and cycles only, Monday to Friday 7am to 7pm. The experiment was in place for 16 months and data was collected and monitored with a comprehensive public consultation undertaken during this time. A final decision to make the experiment permanent was taken in September 2018.

Figure 4.2: Traffic restriction signage at Bank

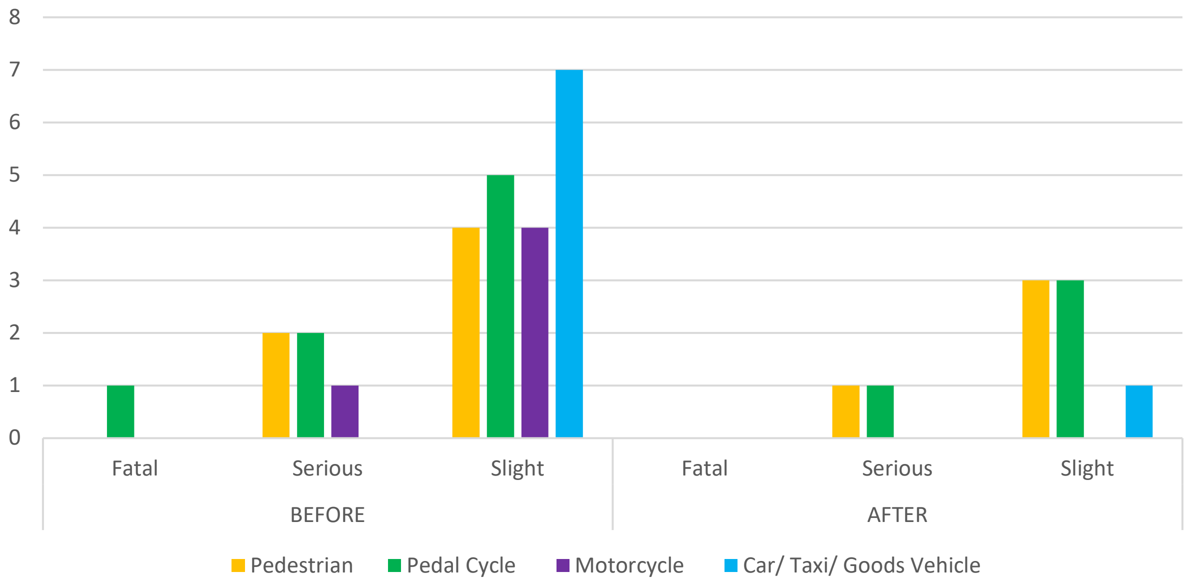
As part of this approval, it was also recommended that some physical changes should take place to complement the traffic order restrictions whilst the longer-term scheme, 'All Change at Bank', was developed: this included widening footways and crossings, and reducing the number of traffic lanes into the junction. Construction works started in January 2020 and were completed at the end of August 2020.

Scheme Description

The key features of the implemented scheme are:

- Restrictions to movements through the junction and westbound on Cornhill to buses and cycles only, Monday to Friday 7am to 7pm; movements between Threadneedle Street and Cornhill are allowed for local access, including deliveries;
- No motor vehicles other than buses are allowed to cross the junction, including powered two-wheelers;
- Footway widening along Cornhill in place of narrow advisory cycle lane; cyclists sharing lane with traffic; raised crossing on Cornhill;
- Footway widening on the corners of Lombard Street, lane narrowing and removal of central reservations to reduce crossing distance;
- Mansion House Street reduced from three to two lanes on the approach to the junction;
- Princess Street reduce from two to one lane on the approach to the junction;
- Left turn only out of Mansion House Place and raised treatment on the junction.

Figure 4.3: Comparison of casualties by mode and severity before and after the scheme implementation



Before and after results

The analysis of collisions occurring at the junction before and after implementation demonstrates the high effectiveness of the traffic reduction scheme. Comparisons have been carried out using 2014-2016 data as 'Before' and 2018-2020 data as 'After'. It is worth noting that throughout a significant proportion of 2020, construction works were being carried and might have affected collision patterns (jointly with the reduction in movement brought by the pandemic restrictions).

Figure 4.3 above shows the comparison of the casualties resulting from the collisions that occurred at the junction before and after the scheme implementation. There was a reduction of 65% in the total number of casualties in the three years following the implementation of the scheme and a 67% reduction in KSI casualties. There was a significant decrease in casualties across all motorised modes, a decrease in pedestrian and pedal cycle casualties, and no fatalities overall.

Table 4.2 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. As a result of the significant overall reduction in occurrences, most types of collisions have witnessed a decrease: among users, powered two-wheelers have witnessed the highest reduction, largely due to the implemented restriction. Collisions on turning movements have dropped by 60%.

While both collisions during the hour of darkness and on wet surface have dropped, this is likely to have been caused by the reduction in traffic volumes and conflicts, as the experimental scheme did not involve any change to lighting conditions and surface conditions.

Table 4.3 shows the total casualties in the before and after periods for the site. Total casualties reduced by 65%. Female casualties showed a greater reduction than male casualties. A very high reduction was seen in car occupant casualties, from 7 casualties to 1. Collisions involving bus occupants also decreased from 2 to 1.

Table 4.2: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**21**	**8**	**-13**	**-62%**
F&S collisions	6	2	-4	-67%
Pedestrian collisions	6	4	-2	-33%
Pedal cycle collisions	8	4	-4	-50%
Powered two-wheeler collisions	6	0	-6	-100%
Turning left collisions	1	0	-1	-100%
Turning right collisions	4	2	-2	-50%
All turning collisions	5	2	-3	-60%
Collisions during the hours of darkness	5	3	-2	-40%
Collisions on wet road surface	2	0	-2	-100%

Table 4.3: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**26**	**9**	**-17**	**-65%**
KSI casualties	6	2	-4	-67%
Male	17	6	-11	-65%
Female	9	3	-6	-67%
Pedestrians	6	4	-2	-33%
Pedal cyclists	8	4	-4	-50%
Powered two-wheeler riders/ passengers	5	0	-5	-100%
Car occupants	7	1	-6	-86%
Bus occupants	2	1	-1	-50%
Taxi occupants	1	0	-1	-100%
Goods vehicle occupants	1	0	-1	-100%

Figure 4.4: Bank Junction: conflicting pairs before and after implementation

Looking at conflicting pairs, the most common conflicts before the implementation (cycles with cars and goods vehicles, pedestrians with powered two-wheelers) have almost disappeared after implementation. This demonstrates how the restriction to most motorised vehicles has had an immediate positive effect on common sources of conflict.

Conclusions

- The restriction to all motorised traffic except buses is an effective measure to reduce conflicts and prevent the occurrence of collisions, F&S in particular;
- Traffic restrictions can generate displacement effects in the surrounding area, and this can translate into an increase in collisions away from the area of implementation of the restriction. However, an analysis of collision data in the surrounding area around Bank undertaken by the City of London after the first year of experimental implementation has shown that the benefits of the Bank scheme have extended further afield than the scheme boundaries, reducing the number of F&S collisions;
- Whilst effective, the reduction in traffic volumes alone has not been able to eliminate all risks of KSIs: narrow crowded footways and substandard cycle facilities on the approaches have contributed to the limited number of collisions affecting pedestrians and cyclists. The complementary measures delivered in 2020 have addressed some of these remaining issues and their effectiveness should be monitored going forward.

Figure 4.5: Lombard Street, Bank Junction

Grove Park Town Centre Streetscape Improvements

Local authority **London Borough of Lewisham**
Date of implementation **July-December 2018**

A comprehensive town centre regeneration scheme was implemented in Grove Park between July and December 2018. In line with the objectives set out by the Grove Park Neighbourhood Development Plan, the scheme was aimed at improving the pedestrian experience to/from the station and along the retail area, promoting sustainable and active travel, enhancing and celebrating areas and buildings of special character, and supporting the local retail economy.

After the town centre scheme was implemented, a wider traffic calming scheme was implemented along Baring Road, starting at the end of 2019, to improve speed compliance, following the introduction of a 20mph speed limit in 2016. The speed calming scheme involved features at 21 locations involving 34 cushions, four flat top road humps and two table junctions. For the purpose of this study and due to recent completion of the traffic calming programme, the analysis has focused on the town centre streetscape scheme.

Figure 4.6: Grove Park Town Centre: Aerial View before and after implementation (Source: Google Earth)

Scheme description

A major new scheme to improve vehicular and pedestrian circulation was implemented, including new kerbs, paving, carriageway surfacing, upgrading of crossings and traffic signals and improvements to drainage, together with streetscape enhancements including extensive new tree planting and installation of new street furniture. In particular the scheme encompasses the following features:

Along Downham Way:

- Colour contrasting pavement at informal and formal crossings;
- Footway widening with parking and loading bays on pads at footway level;
- Removal of parking bays in proximity to the junction;
- Bus stops on either side are in-lane rather than inset;
- Raised paved treatments at side roads (continuous footway however with contrasting colour and tactile paving on crossing desire line);
- Footway decluttering to enhance visibility;
- Tree planting, seating and cycle parking.

Downham Way junction with Baring Road:

- Junction raised treatment and paved treatments on crossings;
- Anti-skid surfacing on all approaches;
- Realigned and widened traffic islands;
- Granite spheres installed on the junction corners to dissuade vehicles from cutting corners or stopping on footway within the junction.

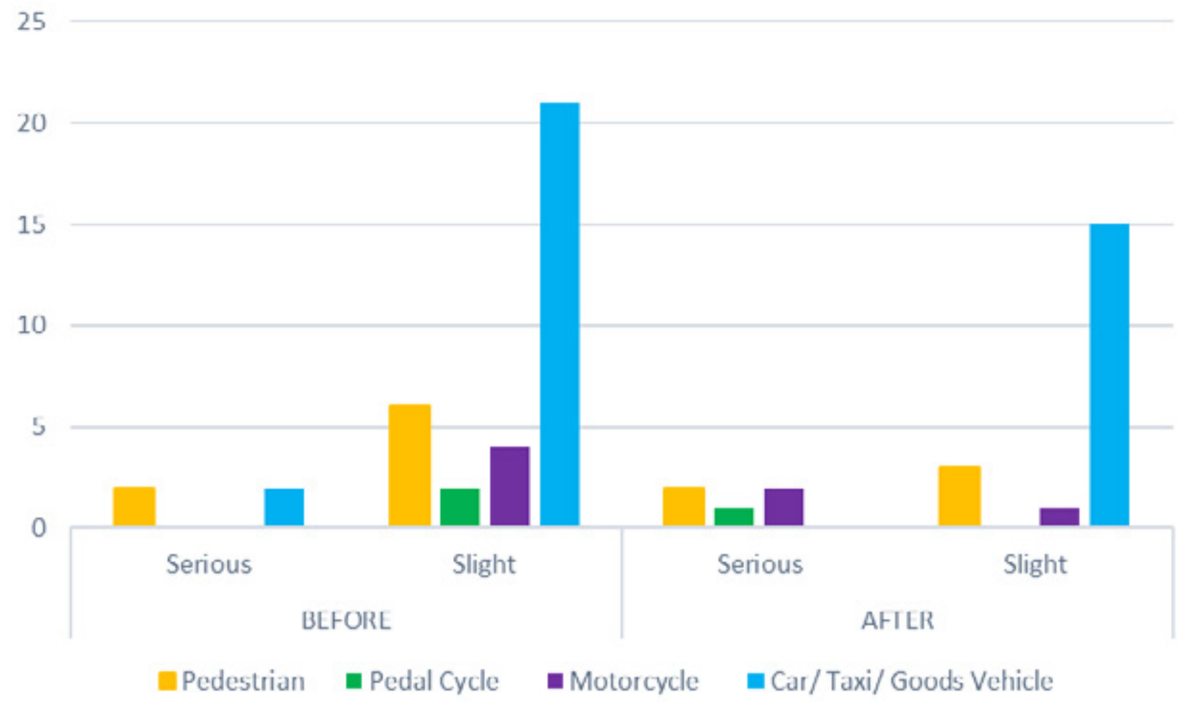
Chinbrook Avenue junction with Baring Road:

- Extended central island to prevent vehicles exiting the parking lane from travelling towards Chinbrook Avenue and southbound on Baring Road, forcing them to turn left into Baring Road;
- Junction raised treatment and paved treatments on crossings;
- Anti-skid surfacing on all approaches.

Along Baring Road:

- Colour contrasting pavement at informal and formal crossings;
- Footway widening with parking and loading bays on pads at footway level;
- Raised paved treatments at side roads (continuous footway however with contrasting colour and tactile paving on crossing desire line);
- Railing removal (partly replaced with trief kerbs to ensure impact protection);
- Footway decluttering to enhance visibility.

Figure 4.7: Comparison of casualties by mode and severity before and after the scheme implementation



Before and after results

The analysis of collisions occurring in the scheme area before and after implementation demonstrates how the streetscape scheme has supported a significant improvement in road safety, particularly for vulnerable users. Comparisons have been carried out using 2015-2017 data as 'Before' and 2019-2021 data as 'After'. It is worth nothing that throughout a proportion of 2019, construction works were being carried at one end of Baring Road and might have affected collision patterns.

Figure 4.7 shows the comparison of the casualties resulting from the collisions that occurred before and after the scheme implementation. There was a reduction of 35% in the total number of casualties the three years following the implementation of the scheme, however KSI casualties increased from 4 to 5. There was a significant decrease in casualties across all motorised modes, a decrease in pedestrian (-39%) and particularly in pedal cycle casualties (-50%).

Table 4.4 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. All types of collisions involving VRUs dropped. The most common manoeuvres observed in 2015-2017 were also common in the period after, however several collisions recorded between 2019 and 2021 do not provide detail on the users' behaviour.

Collisions during the hour of darkness and on wet surfaces have dropped, which is likely to be due to lighting improvements and resurfacing (including new paved treatments at crossings and anti-skid surfaces on approaches).

Table 4.5 shows the total casualties in the before and after periods for the site. The total number of casualties reduced by 35%. There were several collisions involving children before implementation, while data after implementation seems to suggest that the crossing improvements might have benefited young and old users. No collision involving goods vehicles occupants have been recorded between 2019 and 2021 – a surprising result in an area where loading and servicing trips linked to retail activities are numerous. Collisions involving buses have also dropped to zero between 2019 and 2021 – potentially due to the removal of the lay-by on the northern side and the parking inset on the south side.

Table 4.4: Comparison of collisions by type before and after the scheme implementation

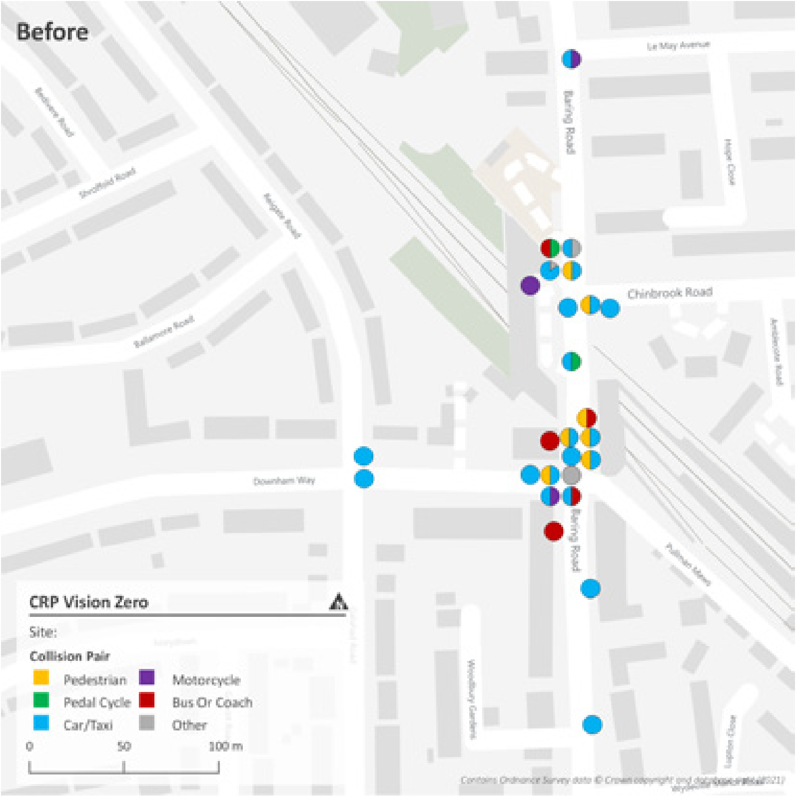
Collision Type	Before	After	Change	%
Total collisions	**27**	**21**	**-6**	**-22%**
F&S collisions	4	5	1	25%
Pedestrian collisions	8	5	-3	-38%
Pedal cycle collisions	2	1	-1	-50%
Powered two-wheeler collisions	4	3	-1	-25%
All 'going ahead' collisions	27	7	-20	-74%
Slowing/stopping' collisions	5	1	-4	-80%
All turning collisions	10	2	-8	-80%
Collisions during the hours of darkness	13	4	-9	-69%
Collisions on wet road surface	7	4	-3	-43%

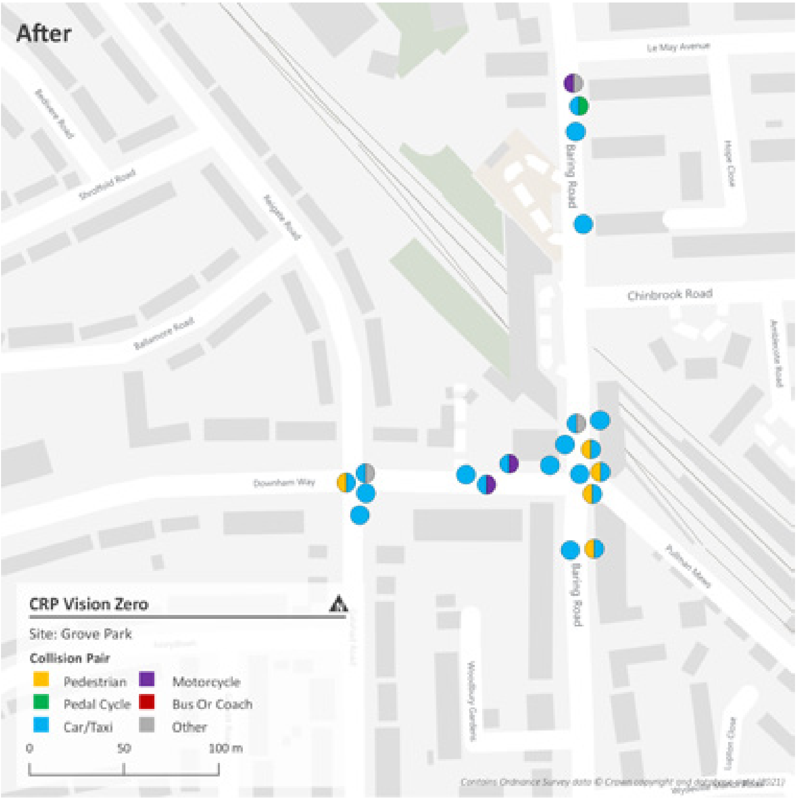
Table 4.5: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**37**	**24**	**-13**	**-35%**
KSI casualties	4	5	1	25%
Children (<16)	4	1	-3	-75%
Elderly (60+)	2	1	-1	-50%
Male	21	13	-8	-38%
Female	16	9	-7	-44%
Pedestrians	8	5	-3	-38%
Pedal cyclists	2	1	-1	-50%
Powered two-wheeler riders/ passengers	4	3	-1	-25%
Car occupants	18	12	-6	-33%
Bus occupants	3	0	-3	0%
Goods vehicle occupants	2	0	-2	-100%

Looking at conflicting pairs, car only collisions are the most common before and after implementation followed by car-pedestrian. All other conflicting pairs are involved in one or two collisions each, both before and after. No conflicts have been recorded between goods vehicles and pedestrians/cyclists.

Figure 4.8: Grove Park: conflicting pairs before and after implementation





Conclusions

- The raised treatment at Downham Way junction and the improvement to crossing facilities may have caused a reduction in collisions involving vulnerable users. However there has been a significant increase in collisions involving motorised vehicles, possibly due to change in configuration at the junction (which could be associated with users familiarising themselves with the new layout);
- Banning turning movements at the Baring Road/Chinbrook Avenue junction has drastically reduced collisions, both involving motorised vehicles and vulnerable users (from 12 collisions in three years to 1);
- Collisions involving goods vehicles have decreased across the town centre: improvements to the dedicated loading pads and introductions of street furniture discouraging servicing vehicles from stopping within or in proximity of the junction might have played a role.
- Despite increasing numbers of cyclists on the network, encouraged by the provision of new cycle parking across the town centre, cycle collisions have reduced in the last three years; however, there is still potential for improvements;
- The upgraded junction layouts appear safer for young users, with three pedestrian collisions in the age band 0-15 avoided in the three years 2019-2021 compared to 2016-2018;
- Collisions involving buses have dropped to zero between 2019 and 2021 – potentially due to the removal of the lay-by on the northern side and the parking inset on the south side.

Figure 4.9: Streetscape improvements on Downham Way (Source externalworksindex.co.uk)

Figure 4.10: Continuous footway on Galahad Road (Source tgram.co.uk)

Upper Holloway Road 20mph

Local authority **London Borough of Islington (TLRN)**
Date of implementation **Late 2018**

Islington Council was the first London Borough to introduce a borough-wide 20mph speed limit on its road network in order to reduce casualties through reducing speeds along streets where people live, work and shop. After gradually extending the speed limit to major roads that were initially excluded (such as Essex Road and Hornsey Road), the Council has been working with TfL to extend the 20mph speed limit on some of the key TLRN routes in the Borough.

In July 2018 the Council and TfL announced plans for City Road, Pentonville Road, Holloway Road and the Archway Gyratory, the Nag's Head gyratory and all TfL roads south of Pentonville Road and City Road to have 20mph limits as part of a programme of work between 2018 and 2024. The 20mph limit was then implemented along Holloway Road shortly after the announcement before the end of 2018.

Scheme Description

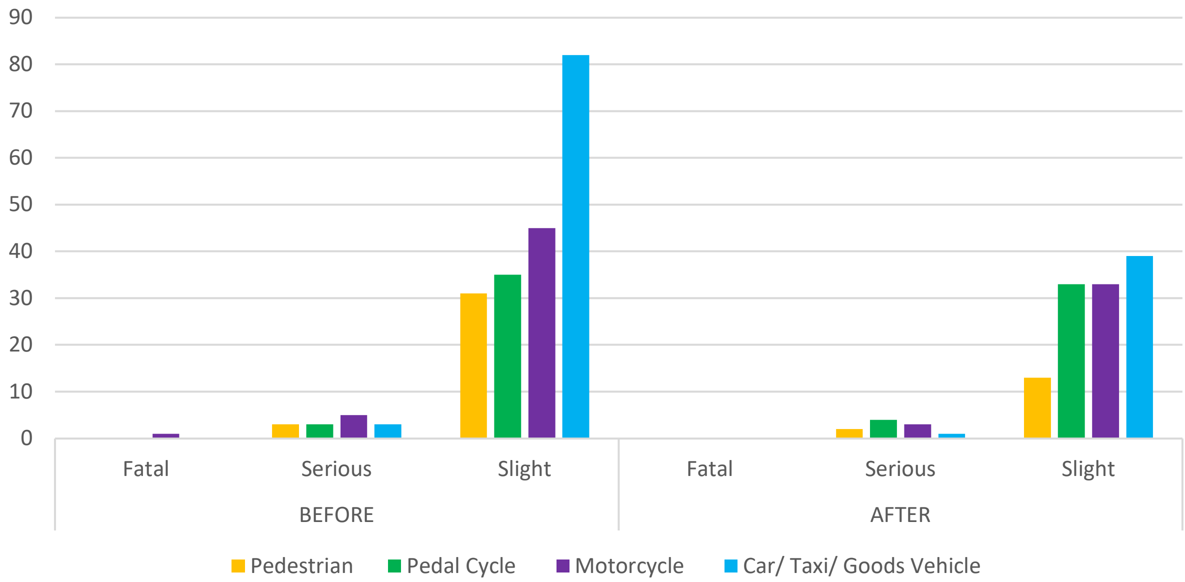
The main element of the scheme has been the introduction of a 20mph speed limit along the entire corridor, between Highbury Corner and Tufnell Park Road.

In addition, minor supplementary changes have been made to the street layout: for example, the overrunable hatched median between Holloway Road Station and Tollington Road has been replaced with a colour contrasting antiskid surface.

Figure 4.11: 20mph signage on Holloway Road

Figure 4.12: Holloway Road: Aerial view before and after implementation (Source: Google Earth)

Figure 4.13: Comparison of casualties by mode and severity before and after the scheme implementation



Before and after results

The analysis of collisions occurring before and after implementation demonstrates the high effectiveness speed calming on road safety. Comparisons have been carried out using 2014-2016 data as 'Before' and 2019-2021 data as 'After'.

Figure 4.13 above shows the comparison of the casualties resulting from the collisions that occurred along the link before and after the scheme implementation. There was a reduction of 38% in the total number of casualties the three years following the implementation of the scheme and a 33% reduction in KSI casualties. There was a significant decrease in casualties across all motorised modes (53%), a decrease in pedestrian (-56%) and powered two-wheeler casualties (-29%). The scheme was less effective with regards to cycle collisions (-3%).

Table 4.6 overleaf shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. As a result of the significant overall reduction in occurrences, most types of collisions have witnessed a decrease: among users, pedestrians and powered two-wheelers have witnessed the highest reduction. Cycle collisions have remained stable before and after implementation.

Collisions involving manoeuvres influenced by speed have recorded the highest decrease: overtaking collisions have dropped by 63%; collisions involving vehicles changing lanes have dropped by 75%; front to back collisions (going ahead) have decreased by 53%; collisions on turning movements have dropped by 48%.

Collisions during the hour of darkness and on wet surface have dropped, potentially due to the combined effect of the reduction in speed limit and resurfacing works along sections of the corridor.

Table 4.7 shows the total casualties in the before and after periods for the site. The total casualties reduced by 38%. Female casualties showed a greater reduction than male casualties. High reductions were recorded across all motorised modes, particularly goods vehicle occupants (-83%).

Table 4.6: Comparison of collisions by type before and after the scheme implementation

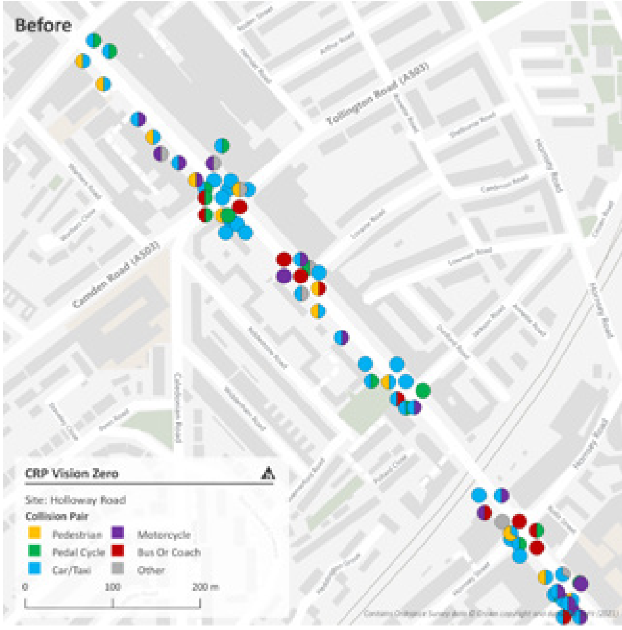
Collision Type	Before	After	Change	%
Total collisions	**170**	**128**	**-42**	**-25%**
F&S collisions	15	10	-5	-33%
Pedestrian collisions	34	15	-19	-56%
Pedal cycle collisions	39	39	0	0%
Powered two-wheeler collisions	62	45	-17	-27%
All 'going ahead' collisions	148	70	-78	-53%
All 'overtaking' collisions	19	7	-12	-63%
Changing Lanes collisions	8	2	-6	-75%
All turning collisions	52	27	-25	-48%
Collisions during the hours of darkness	65	32	-33	-51%
Collisions on wet road surface	33	19	-14	-42%

Table 4.7: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	208	128	-80	-38%
KSI casualties	15	10	-5	-33%
Children (<16)	4	4	0	0%
Elderly (60+)	10	4	-6	-60%
Male	141	89	-52	-37%
Female	66	37	-29	-44%
Pedestrians	34	15	-19	-56%
Pedal cyclists	38	37	-1	-3%
Powered two-wheeler riders/ passengers	51	36	-15	-29%
Car occupants	50	28	-22	-44%
Bus occupants	18	6	-12	0%
Taxi occupants	7	3	-4	-57%
Goods vehicle occupants	6	1	-5	-83%

Looking at conflicting pairs, the most common conflicts before and after the implementation involve cars (Cars only; cars with powered two-wheelers; cars with cycles). In particular, there has not been a significant decrease in the number of conflicts between cars and cycles (21 before and 22 after) and between cars and powered two-wheelers (28 before and 24 after). Interactions between buses and vulnerable users and between goods vehicles and vulnerable users have dropped.

Figure 4.14: Holloway Road: conflicting pairs before and after implementation



Conclusions

- The reduction in speed limit has had a significant impact on the number of collisions along the corridor, with high reductions both in slight and serious casualties;
- The benefits are mostly observed in collisions resulting in pedestrian casualties (-56%), car occupants casualties (-44%) and goods vehicles occupants casualties (-83%); Cycle collisions have seen the lowest reduction among modes of travel
- Collisions involving manoeuvres influenced by speed (overtaking, changing lanes, front to back collisions) have recorded the highest decrease:

Lambeth Bridge / Millbank Junction

Local authority **City of Westminster**
Date of implementation **2017**

In 2017, Westminster City Council supported a TfL scheme to improve the roundabout located at the northern end of Lambeth Bridge, where Millbank meets Horseferry Road.

The changes were intended to improve safety through easily and speedily implementable changes, in response to a series of serious (and one fatal) collisions involving cyclists. Rubber kerbs have been used to extend footways and islands and narrow down the carriageway on all approaches. The space between existing kerbs and rubber kerbs was then in-filled with porous asphalt.

The roundabout is planned to be replaced with a signalised 4-arm junction in 2023, with segregated cycle facilities on all approaches and protected cycle turning movements.

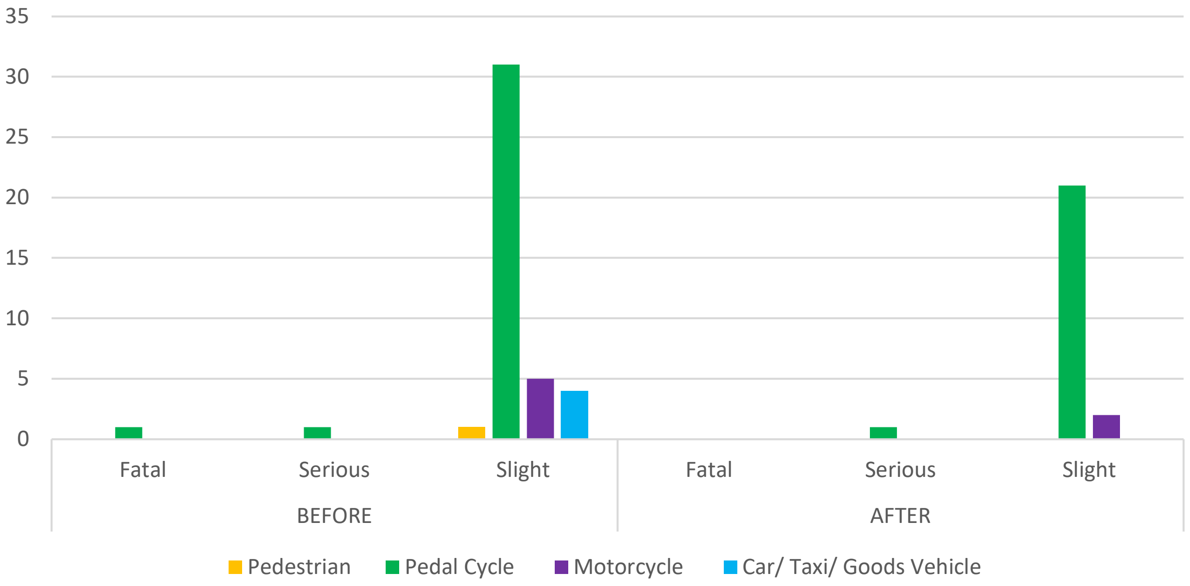
Scheme Description

The key features of the implemented scheme are:

- Widened footways and extended traffic islands to reduce traffic speeds and provide more space for pedestrians; the two-lane approaches have been reduced to 6m width to encourage cyclists to retain the primary position when cycling through the roundabout, discouraging vehicles from overtaking them;
- Raised zebra crossings on all four sides of the junction to slow traffic on the approach to the roundabout;
- Clearer lane markings at the roundabout;

Figure 4.15: Millbank Roundabout: Aerial view before and after implementation (Source: Google Earth)

Figure 4.16: Comparison of casualties by mode and severity before and after the interim scheme implementation



Before and after results

The analysis of collisions occurring at the junction before and after implementation demonstrates that, whilst not transformational, the interim scheme has had a very positive impact on the number of collisions. Comparisons have been carried out using 2014-2016 data as 'Before' and 2018-2020 data as 'After'.

Figure 4.16 above shows the comparison of the casualties resulting from the collisions that occurred at the junction before and after the interim scheme implementation. There was a reduction of 44% in the total number of casualties over the three years following the implementation of the scheme and a 50% reduction in KSI casualties. Cycle collisions are the most significant contributor across both analysis periods, but there is a 33% reduction after implementation. No collisions involved pedestrians after implementation.

Table 4.8 overleaf shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. As a result of the overall reduction in occurrences, most types of collisions have witnessed a decrease. The most common manoeuvre remains 'going ahead' followed by 'turning' – however these are the manoeuvres recording the highest reductions (over 65%) demonstrating how the narrower carriageway encourages drivers to slow down while entering and exiting the roundabouts and discourages them from overtaking cyclists while turning. While both collisions during the hour of darkness and on wet surface have dropped, this can only be marginally linked with the scheme due to the low number of occurrences.

Table 4.9 shows the total casualties in the before and after periods for the site. The total casualties reduced by 44%. The narrowing and raising of zebra crossings has removed any collision resulting in pedestrian casualties; remaining casualties are either cyclists or motorcyclists.

Table 4.8: Comparison of collisions by type before and after the scheme implementation

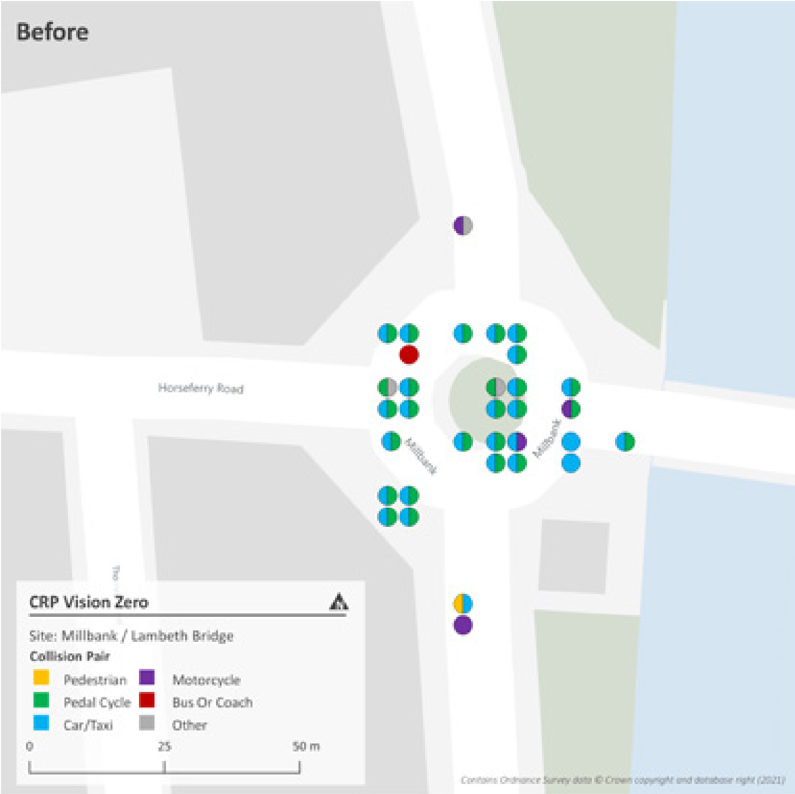
Collision Type	Before	After	Change	%
Total collisions	**41**	**24**	**-17**	**-41%**
F&S collisions	2	1	-1	-50%
Pedestrian collisions	1	0	-1	-100%
Pedal cycle collisions	33	22	-11	-33%
Powered two-wheeler collisions	6	2	-4	-67%
All 'going ahead' collisions	52	16	-36	-69%
Moving off' collisions	5	8	3	60%
All turning collisions	18	7	-11	-61%
Collisions during the hours of darkness	15	10	-5	-33%
Collisions on wet road surface	6	3	-3	-50%
Collisions on wet road surface	33	19	-14	-42%

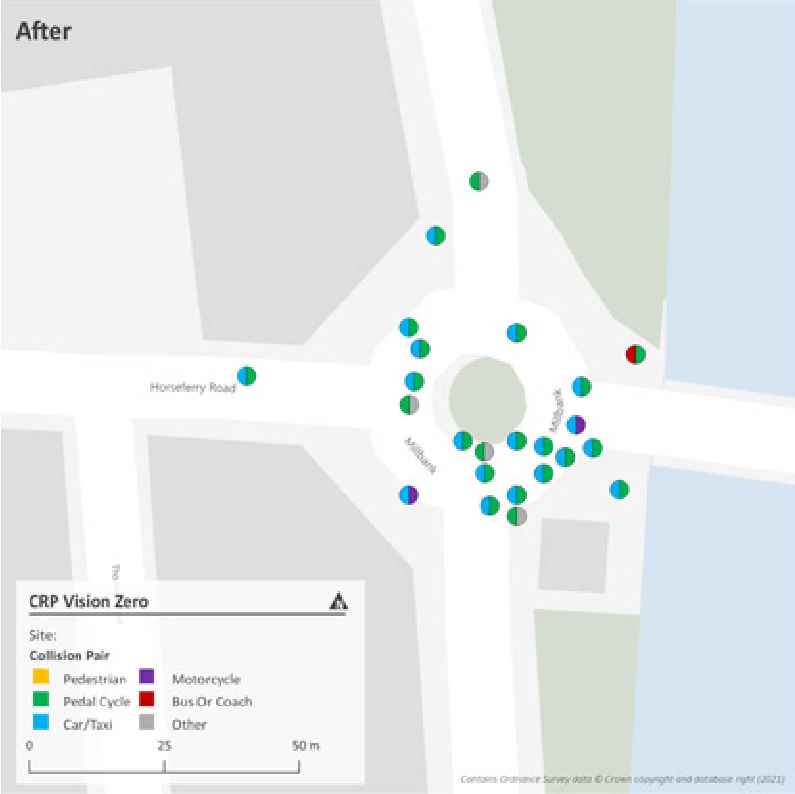
Table 4.9: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**43**	**24**	**-19**	**-44%**
KSI casualties	2	1	-1	-50%
Male	27	15	-12	-44%
Female	16	9	-7	-44%
Pedestrians	1	0	-1	-100%
Pedal cyclists	33	21	-12	-36%
Powered two-wheeler riders/ passengers	5	2	-3	-60%
Car occupants	3	0	-3	-100%
Bus occupants	1	0	-1	-100%
Car occupants	50	28	-22	-44%
Bus occupants	18	6	-12	0%
Taxi occupants	7	3	-4	-57%
Goods vehicle occupants	6	1	-5	-83%

Looking at conflicting pairs, the most common conflict before the implementation (cycles with cars) is still the most critical issue within the junction, and it is effectively the only conflict that is not been fully mitigated by the changes introduced, although it has recorded a reduction by over 40%.

Figure 4.17: Millbank Roundabout: conflicting pairs before and after implementation





Conclusions

- Narrowing the lane widths on all approaches has had a very significant impact on drivers' behaviour, encouraging them to approach the junction more carefully and allowing cyclists to ride in primary position rather than attempting to overtake them;
- Raised crossings and clear marking on all approaches have resulted in no pedestrian collisions across the three years after implementation; moreover, they are likely to have contributed more generally to make the junction safer for all vulnerable users;
- While the number of serious collisions has dropped to only one in three years, slight collisions involving cyclists are still numerous, and so are likely to be the near misses. The future upgrade of the junction to a signalised crossroad should help reducing the number of collisions at the junction further;
- This demonstrates how even temporary interventions can have a noticeable positive impact on road safety (although some issues remain). This suggests that in certain cases it may be worth considering interim interventions to gain some benefits more quickly, ahead of more permanent works that may take longer to develop and implement.

Figure 4.18: Interim island widening and raised crossing

Figure 4.19: Proposal for the signalisation of the roundabout (Source TfL)

Quietway 11

Local authority **City of London**
Date of implementation **End of 2016**

The scope of the Quietway project was to deliver a continuous north-south cycle route through the City, as directly as possible, that provided adequate provision to cater for increased number of cyclists.

The scheme runs along Moor Lane from the junction with Chiswell Street, along Fore Street and Wood Street. It then crosses London Wall and doglegs along Gresham Street. From Gresham Street the route links into King Street, past Cheapside and into Queen Street. The route runs through the sections of Queen Street closed to traffic and joins CS3 along Upper Thames Street.

Figure 4.20: Quietway 11: Aerial view before and after implementation (Source: Google Earth)

The developed scheme has adhered to the design principles that TfL has set for Quietway routes, in particular:

- Quietways generally run along streets with low traffic, low speed streets, typically without bus routes;
- They have low impact, discrete yet effective designs with limited requirement for segregation and should be well aligned and direct;
- They provide significant permeability improvements such as opening up one-way streets for contraflow cycling; and
- They have clear wayfinding.

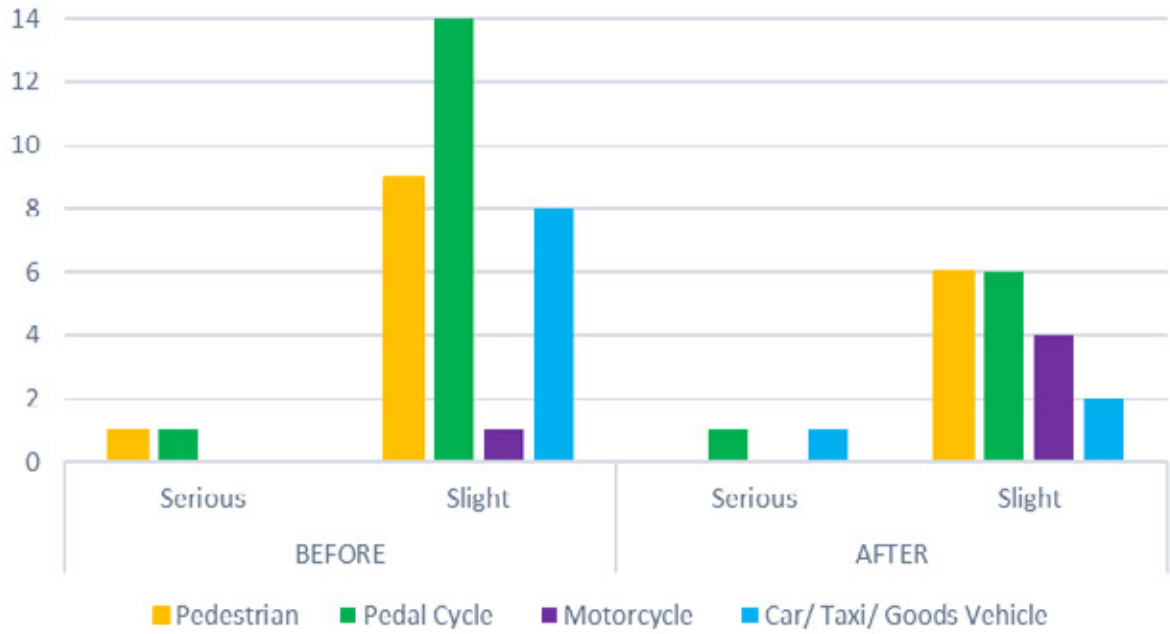
Scheme Description

The key features of the implemented scheme are:

- Improvements to wayfinding and road marking along the route;
- Raised entry treatments with carriageway narrowing at junction between Chiswell Street and Milton Street and junction between Chiswell Street Moor Lane;
- Build out and raised treatment at the junction between Moor Lane and Fore Street;
- Advanced stop lines at the London Wall junction;
- Segregated entry to contraflow cycle lane along Wood Street near the junction with London Wall;
- Raised entry treatment at the junction between Wood Street and Gresham Street;

Figure 4.21: Paved treatment along Moor Lane

Figure 4.22: Comparison of casualties by mode and severity before and after the scheme implementation



- Larger Advanced stop lines at junction between Gresham Street and King Street, and King Street/ Queen Street with Cheapside;
- Wider 1.5m advisory cycle lanes along Queen Street
- These features build upon the pedestrian and cycle priority measures delivered along the route in various stages, in particular:
- The two 'blended roundabouts' introduced along Moor Lane at the junctions with Silk Street and Ropemaker Street around 2012;
- Footway widening at the Moor Lane junction with Fore Street introduced in 2012;
- Entry treatments on side roads along Gresham Street and Wood Street delivered in 2009;
- Pedestrian priority and streetscape improvements delivered throughout the last 10 years along sections of Queen Street closed to traffic.

Before and after results

The analysis of collisions occurring along the route before and after implementation demonstrates the high effectiveness of the Quietway. Comparisons have been carried out using 2013-2015 data as 'Before' and 2018-2020 data as 'After'. The delivery of the scheme took place in the second half of 2016.

Figure 4.22 above shows the comparison of the casualties resulting from the collisions that occurred along the route before and after the scheme implementation. There was a reduction of 41% in the total number of casualties the three years following the implementation of the scheme however KSI casualties have remained stable (2 before and 2 after). There was a significant decrease in casualties across all motorised modes except powered two-wheelers, a decrease in pedestrian (-40%) and pedal cycle casualties (-53%).

Table 4.11 shows the total casualties resulting from collisions in the before and after periods for the site. The total number of casualties dropped by 41%. A very high reduction was seen for cyclists and pedestrians. Collisions involving motorised users other than motorcyclists have decreased (with no collisions involving taxi users and goods vehicles drivers).

Table 4.10: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**29**	**18**	**-11**	**-38%**
F&S collisions	2	2	0	0%
Pedestrian collisions	10	6	-4	-40%
Pedal cycle collisions	19	10	-9	-47%
Powered two-wheeler collisions	3	5	2	67%
Goods vehicle collisions	5	7	2	40%
All 'going ahead' collisions	29	21	-8	-28%
Parking/Reversing/U-turning collisions	4	1	-3	-75%
All turning collisions	10	6	-4	-40%
Collisions during the hours of darkness	11	8	-3	-27%
Collisions on wet road surface	1	3	2	200%

Table 4.11: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**34**	**20**	**-14**	**-41%**
KSI casualties	2	2	0	0%
Children (<16)	1	0	-1	-100%
Elderly (60+)	4	1	-3	-75%
Male	24	11	-13	-54%
Female	10	9	-1	-10%
Pedestrians	10	6	-4	-40%
Pedal cyclists	15	6	-9	-60%
Powered two-wheeler riders/ passengers	1	4	3	300%
Car occupants	2	1	-1	-50%
Bus occupants	1	1	0	0%
Taxi occupants	3	0	-3	-100%
Goods vehicle occupants	1	0	-1	-100%

Looking at conflicting pairs, the most common conflict before the implementation (cycles with cars) is still the most critical issue within the junction, and it is effectively the only conflict that is not been fully mitigated by the changes introduced, although it has recorded a reduction by over 40%.

Figure 4.23: Quietway 11: conflicting pairs before and after implementation

Conclusions

- The measures introduced as part of the Quietway 11 route improvements have resulted in a significant decrease in the number of collisions, particularly those involving cyclists.
- Locations showing the highest reductions are the junction between London Wall and Wood Street and the junction between Cannon Street and Queen Street;
- It is worth noting that whilst the measures appear to have been very effective in regard to pedestrians and cyclists, there are issues remaining with powered two-wheelers casualties;
- The significant reduction in cycle collisions should be read in conjunction with the likely significant increase in cycle volumes along the route.

Figure 4.24: Shared pedestrian and cycle section of Q11

Manor Road / Stamford Hill Junction

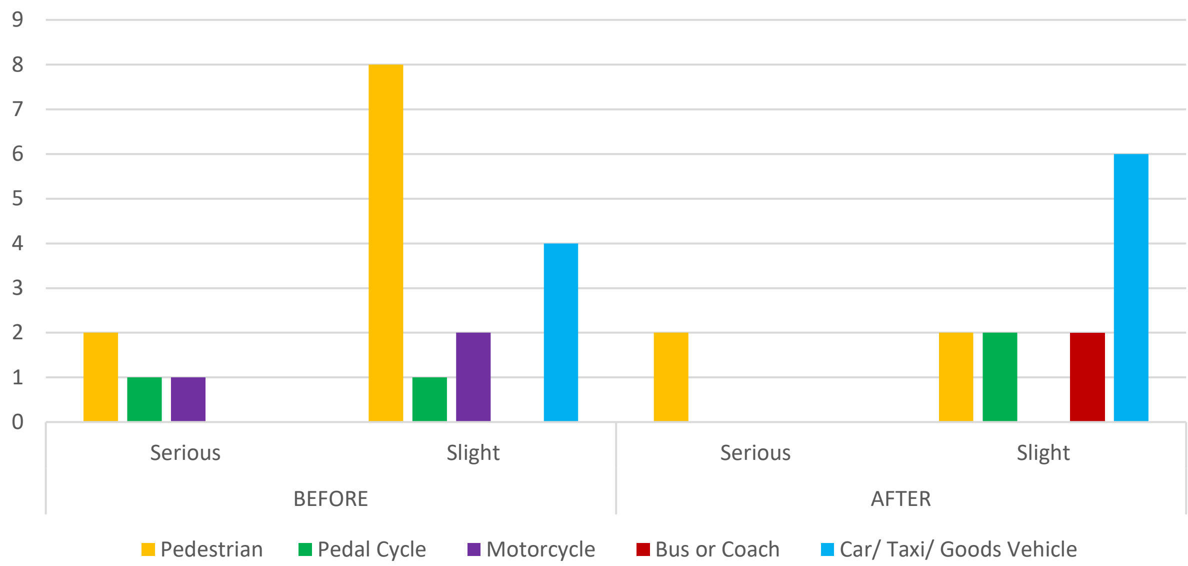
Local authority **London Borough of Hackney (TLRN)**
Date of implementation **2016**

The key features of the implemented scheme are:

- New advanced stop lines on north, south and west approaches
- Widening of existing pedestrian crossings
- Pedestrian countdown signals
- The offside lane on the north approach changed to right turn only (it was formerly ahead and right)
- Southbound exit becomes one lane only
- West approach pedestrian refuge island and look left, look right markings removed
- West approach one wide lane converted to two, nearside ahead and left, and offside right turn only

Figure 4.25: Manor Road / Stamford Hill: Aerial view before and after implementation (Source: Google Earth)

Figure 4.26: Comparison of casualties by mode and severity before and after the scheme implementation



Before and after results

Figure 4.26 above shows the comparison of the casualties resulting from the collisions that occurred at the junction between the years 2013 to 2015 (before the scheme implementation) and years 2017 to 2019 (after the scheme implementation). There was a reduction of 26% in the total number of casualties the three years following the implementation of the scheme and a 50% reduction in KSI casualties. The most notable decrease was the one of powered two-wheelers casualties with no reported powered two-wheelers casualties post implementation of the scheme compared to 3 before (one of which was a KSI). There was also an overall reduction of pedestrian casualties following the implementation of the scheme, nevertheless, there was no change in pedestrian KSI casualties.

Table 4.12 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. Collisions involving vehicles turning right reduced by 100% which is the most notable reduction.

Table 4.13 shows the total casualties in the before and after periods for the site. The total casualties reduced by 26% while KSI casualties halved from 4 to 2. By mode, the greatest absolute reduction was seen in pedestrian casualties which dropped from 10 to 4.

Table 4.12: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**18**	**11**	**-7**	**-39%**
F&S collisions	4	2	-2	-50%
Pedestrian collisions	10	4	-6	-60%
Pedal cycle collisions	3	2	-1	-33%
Powered two-wheeler collisions	3	3	0	0%
All overtaking collisions	3	3	0	0%
Changing lane collisions	1	1	0	0%
Turning right collisions	4	0	-4	-100%
All turning collisions	6	0	-6	-100%
Collisions during the hours of darkness	7	2	-5	-71%
Collisions on wet road surface	1	0	-1	-100%

Table 4.13: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**19**	**14**	**-5**	**-26%**
Total casualties	19	14	-5	-26%
KSI casualties	4	2	-2	-50%
Male	15	8	-7	-47%
Female	4	6	2	50%
Pedestrians	10	4	-6	-60%
Pedal cyclists	2	2	0	0%
PTW riders/passengers	3	0	-3	-100%
Car occupants	3	2	-1	-33%
Bus occupants	0	2	2	100%

Regarding conflicting pairs, car-pedestrian collisions were the most frequent prior to the scheme (8 out of 18). These reduced by 88% following implementation of the scheme.

Post scheme, powered two-wheelers -pedestrian collisions stand out since not only they increased from 1 to 3 but also the two serious collisions during this period were powered two-wheelers -pedestrian ones.

Figure 4.27: Manor Road / Stamford Hill: conflicting pairs before and after implementation

Conclusions

- Pedestrian collisions did drop significantly following the implementation of the scheme, most likely as a result of wider pedestrian crossings and pedestrian countdown signals;
- Powered two-wheeler casualties also reduced, possibly due to the lane reconfiguration benefiting powered two-wheelers, less weaving and reduced lane changes;
- Nevertheless, the number of collisions involving powered two-wheelers did not change as there were three powered two-wheeler -pedestrian collisions recorded in the "after" scheme study period;
- Both of the serious collisions in the "after" scheme study period were between pedestrians and powered two-wheelers, resulting in a serious injury of the pedestrian. In both cases the pedestrians were crossing informally (not at a pedestrian crossing), therefore a possible pedestrian desire line south of the junction to get to the bus stops could be investigated further;
- Right turning collisions reduced from 4 to 0, this is probably due to the dedicated right turn lanes on the north and west arms;
- Pedal cycle collisions did not change, the addition of the advanced stop lines without any cycle lanes feeding to them does not appear to have contributed to any noticeable impact cyclists' safety.

Figure 4.28: Cyclists turning from Manor Road

Farringdon Road / Clerkenwell Road Junction

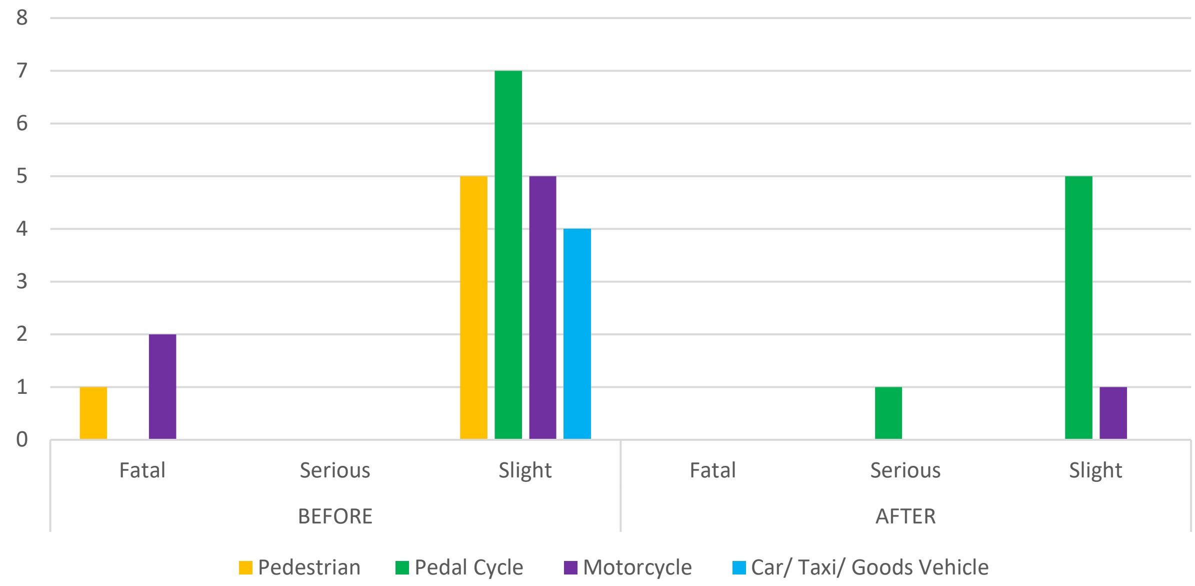
Local authority **London Borough of Islington (TLRN)**
Date of implementation **2018**

Figure 4.29: Farringdon Road / Clerkenwell Road: Aerial view before and after implementation (Source: Google Earth)

The key features of the implemented scheme are:

- Removal of the left turn slip lane from Clerkenwell Road (west) to Farringdon Road (north) and replacement with a cycle bypass;
- Cut back of the northern footway on Clerkenwell Road (east) to accommodate mandatory eastbound and westbound cycle lanes along Clerkenwell Road;
- New stepped southbound cycle track on Farringdon Road (north arm);
- Widening of the existing southbound cycle lane on Farringdon Road (south arm) and conversion to mandatory;
- New Advanced Stop Lines on Clerkenwell Road west and east approaches to the junction and widening of existing Advanced Stop Lines on Farringdon Road approaches;
- Introduction of two-stage right turns for cyclists on all four approaches;
- Diagram 1010 (dashed line) and cycle markings within the junction to mark the eastbound, westbound and southbound cycle movements;
- Introduction of a left turn ban (except cycles) from the Farringdon Road (north) approach to Clerkenwell Road (east);
- Southbound bus stop relocation from the northern arm of Farringdon Road to the south.

Figure 4.30: Comparison of casualties by mode and severity for 36 months before and after the scheme implementation



Before and after results

Figure 4.30 shows the comparison of the casualties resulting from the collisions that occurred at the junction between the years 2015 to 2017 (before the scheme implementation) and the second half of 2018 up until and including the first half of 2021 (after the scheme implementation). There was a reduction of 71% in the total number of casualties the three years following the implementation of the scheme and a 67% reduction in KSI casualties. The most notable reductions are for pedestrian casualties and car/taxi casualties which dropped to zero in the three years after the scheme. Powered two-wheeler casualties also reduced significantly (86%). The only mode with a less significant reduction in casualties were pedal cyclists, nevertheless considering the likely significant increase in cycle volumes as a result of the scheme this reduction would be much higher if it was related to exposure.

It needs to be highlighted that all 3 KSI casualties in the before implementation study period were fatalities (a powered two-wheeler rider, a powered two-wheeler passenger and a pedestrian) while in the post implementation study period the only KSI casualty was a serious one involving a pedal cyclist.

Table 4.14 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. Vehicle manoeuvre statistics are not included in the table as most of the manoeuvres in the after period were recorded as “Unknown” (8 out of 13).

Table 4.15 shows a comparison of casualties by category in the before and after periods for the site. Total casualties reduced by 71%. Male casualties showed a greater reduction than female casualties. In terms of mode of travel, the greatest absolute reduction was seen for pedestrians and PTW user casualties. Pedal cycle casualties only decreased by 14% following the implementation of the scheme, and there was one serious pedal cycle casualty post scheme compared to no pedal cycle KSIs before.

Table 4.14: Comparison of collisions by type before and after the scheme implementation

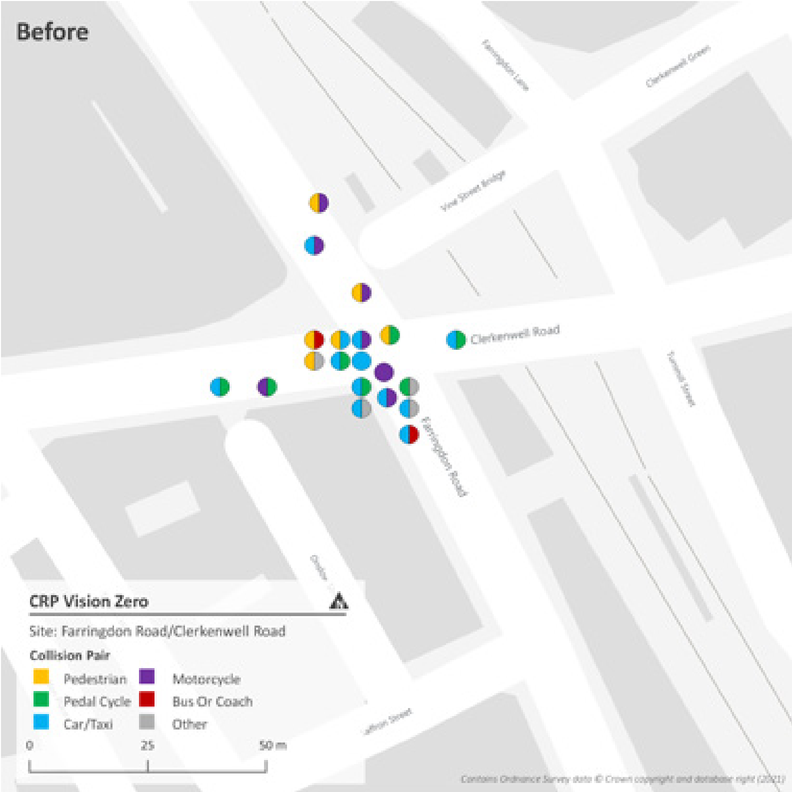
Collision Type	Before	After	Change	%
Total collisions	**20**	**7**	**-13**	**-65%**
F&S collisions	2	1	-1	-50%
Pedestrian collisions	6	0	-6	-100%
Pedal cycle collisions	7	6	-1	-14%
Powered two-wheeler collisions	7	2	-5	-71%
Collisions during the hours of darkness	7	2	-5	-71%
Collisions on wet road surface	2	2	0	0%

Table 4.15: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**24**	**7**	**-17**	**-71%**
KSI casualties	3	1	-2	-67%
Male	17	4	-13	-76%
Female	7	3	-4	-57%
Pedestrians	6	0	-6	-100%
Pedal cyclists	7	6	-1	-14%
Powered two-wheeler riders/ passengers	7	1	-6	-86%
Car occupants	3	0	-3	-100%
Bus occupants	0	0	0	0%
Taxi occupants	0	0	0	0%
Goods vehicle occupants	1	0	-1	-100%

Regarding conflicting pairs, the most common collisions before the implementation of the scheme were pedal cycle-car ones with 4 out of 20, while in the post scheme implementation study period there were 2 pedal cycle-car collisions out of 7.

Figure 4.31: Farringdon Road / Clerkenwell Road: aerial view before and after implementation



Conclusions

- Despite the fact that the improvements at the junction were made with the aim of improving conditions for cyclists, based on the before and after collision analysis it appears that all modes benefited from these improvements in terms of safety. There were collision reductions recorded across all modes, mainly pedestrians, powered two-wheelers and other motorised modes. In fact, pedal cycles showed the least reduction in casualties, but this is also related to the likely increase in pedal cycle volumes as a result of the scheme;
- As additional turning movement was banned as part of this scheme, three out of four approaches of the junction are now “Ahead only” for general traffic. This appears to have contributed to the reduced number of collisions in the junction. However, possible displacement of these collisions should be investigated at nearby junctions;
- Nevertheless, there is still room for improvement as 6 out of 7 casualties in the post scheme study period were pedal cyclists. Two-stage right turns may not be respected by cyclists due to the increased delay. Furthermore, although there are cycle early release signals, a separate signal phase for cyclists could further improve their safety.

Figure 4.32: View of the junction from Clerkenwell Road

Stockwell Cross

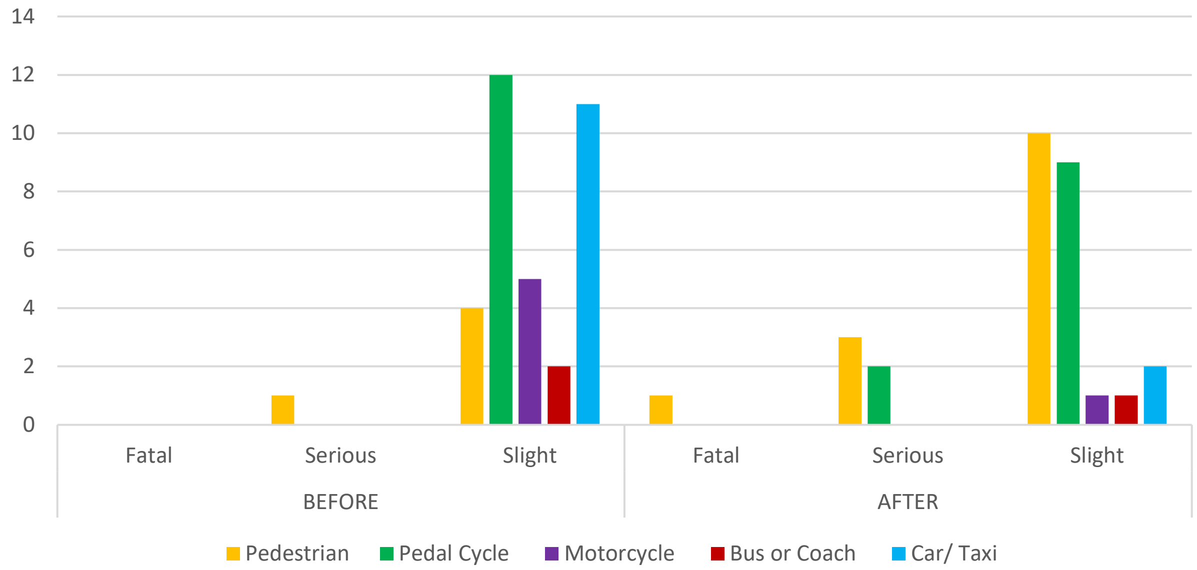
Local authority **London Borough of Lambeth (TLRN)**
Date of implementation **2016**

The Stockwell Road/ Clapham Road / South Lambeth Road junction, known as 'Stockwell Cross', underwent safety improvements in 2016 as part of London's Road Modernisation Plan.

The aim of the scheme was to encourage walking and cycling in the area by providing a dedicated cycle route and creating a new public space around the Stockwell Memorial Gardens. These changes were made in order to enhance the existing Cycle Superhighway 7 (CS7), and complement other key improvement works at Oval and Elephant & Castle. The removal of the Stockwell gyratory system, a vital gateway into both Brixton and Clapham, would support ongoing local investment in the area, helping to create new retail, residential, employment and educational opportunities.

Figure 4.33: Stockwell Cross: Aerial view before and after implementation (Source: Google Earth)

Figure 4.34: Comparison of casualties by mode and severity for 36 months before and after the scheme implementation



The key features of the implemented scheme are:

- Removal of the gyratory system and streets converted back to two-way working;
- New landscaped public space created by closing the southern end of South Lambeth Road, connecting it to the Stockwell Memorial Garden, which used to lie in the centre of the gyratory system;
- New segregated cycle tracks along Clapham Road (part of CS7);
- New 'hold the left' arrangement on the south-westbound approach of Clapham Road to Stockwell Road;
- Number of general traffic lanes on Stockwell approach to the junction reduced from three to two and a cycle lane.

The scheme was constructed in 2016, therefore, this year was excluded from the before & after comparison of collisions.

Before and after results

Figure 4.34 above shows the comparison of the casualties resulting from the collisions that occurred at the junction between the years 2013 to 2015 (before the scheme implementation) and years 2017 to 2019 (after the scheme implementation). There was a reduction of 17% in the total number of casualties the three years following the implementation of the scheme, however, the number of KSI casualties increased from 1 to 6. There was a significant decrease in casualties of motorised modes (powered two-wheeler, car/taxi, bus or coach) and a slight decrease in the total number of pedal cycle casualties, nevertheless there was an increase in pedestrian and pedal cycle KSI casualties.

Table 4.16 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. Total collisions reduced from 30 to 28 while F&S collisions increased from 1 to 6. A high increase was reported in collisions occurring on wet road surface. Collisions involving vehicle manoeuvres such as overtaking, slowing or stopping and moving off (which can also be linked to speeding) did reduce post-scheme.

Table 4.17 shows the total casualties in the before and after periods for the site. Total casualties reduced by 17% and there was a reduction in casualties across all modes of travel apart from pedestrian casualties which increased from 5 to 14. 4 out of the 6 KSI casualties in the 'after' study period were also pedestrians.

Table 4.16: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**30**	**28**	**-2**	**-7%**
F&S collisions	1	6	5	500%
Pedestrian collisions	5	14	9	180%
Pedal cycle collisions	12	13	1	8%
PTW collisions	7	1	-6	-86%
Turning left collisions	5	4	-1	-20%
Turning right collisions	6	6	0	0%
Pedal cycle right turning collisions	0	2	2	100%
All turning collisions	11	10	-1	-9%
Slowing or Stopping collisions	5	2	-3	-60%
Moving off collisions	6	2	-4	-67%
Overtaking collisions	6	0	-6	-100%
Collisions during the hours of darkness	7	11	4	57%
Collisions on wet road surface	1	11	10	1000%

Table 4.17: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**35**	**29**	**-6**	**-17%**
KSI casualties	1	6	5	500%
Children (<16)	3	2	-1	-33%
Elderly (60+)	1	2	1	100%
Male	26	17	-9	-35%
Female	9	12	3	33%
Pedestrians	5	14	9	180%
Pedal cyclists	12	11	-1	-8%
PTW riders/passengers	5	1	-4	-80%
Car occupants	7	2	-5	-71%
Bus occupants	2	1	-1	-50%
Taxi occupants	4	0	-4	-100%
Goods vehicle occupants	0	0	0	0%

Looking at conflicting pairs, the most common one before the implementation of the scheme was between a car and a pedal cycle accounting for 8 out of the total 30 collisions, with half of those taking place at the Clapham Road/ Stockwell Terrace junction. Post scheme, the most common conflicting pair was between a car and a pedestrian (10 out of 28 collisions).

Overall, the pair with the largest increase reported following the scheme was the car-pedestrian one (150%), while the one with the largest decrease was the car-car one (-80%).

The two serious pedal cycle casualties during the post-implementation period were the result of a pedal cycle-goods vehicle collision.

In terms of location, during the 'after' study period at appear that there is a cluster of pedal cycle collisions in the section of Clapham Road northeast of Binfield Road, and another cluster at the junction with Stockwell Terrace. Regarding pedestrian collisions, these are concentrated at the junction of Clapham Road with Binfield Road and Stockwell Road. Most pedal cyclists involved in the collisions post scheme implementation were travelling along Clapham Road from southwest to northeast.

Figure 4.35: Stockwell Cross: conflicting pairs before and after implementation

Conclusions

This junction was completely reconfigured to address existing safety issues, with the removal of the gyratory and the introduction of cycle improvements. This appeared to result in a decrease in the number of collisions between motor vehicles, nevertheless, there was an increase in pedestrian casualties and an increase in both KSI pedestrian and pedal cycle casualties post scheme implementation. Although this may partially be explained by the increased exposure of vulnerable road users, it may also due to safety issues that the scheme has not addressed:

- There appears to be a concentration of collisions along Clapham Road southwest of Binfield Road, where there is no segregated cycle infrastructure. Northbound cyclists need to use the shared bus & cycle lane and overtake any stationary buses before approaching the advanced stop lines outside the underground station. Southbound cyclists also need to negotiate the junction unprotected and join the shared bus & cycle lane.
- Under the new layout, there are two staggered crossings at the junction of Clapham Road with Stockwell Road, and another two at the junction with South Lambeth Road. Staggered crossings and increased traffic signal cycle times can cause frustration to pedestrians waiting to cross.
- The internal stop line on the approach to the pedestrian crossing outside the station is close to the corner with Stockwell Road and any vehicles turning left into Clapham Road south may fail to stop at the second set of signals. Also, the visibility to the crossing from this approach is poor. The same applies for the internal stop line of the pedestrian crossing across Stockwell Road arm.
- There was a significant increase in collisions occurring in wet road surface post-scheme implementation, therefore the quality of road surfacing and drainage could be reviewed as well as other factors such as increased speeding.
- There were two collisions involving pedal cyclists turning right from South Lambeth Road into Clapham Road and motor vehicles travelling in the same direction. Early release signals for cyclists from this approach and segregation of the cycle lane could have potentially avoided these collisions.

Figure 4.36: Clapham Road from Binfield Road

Waterloo Road / Westminster Bridge Road Junction

Local authority **London Borough of Southwark (TLRN)**
Date of implementation **2015**

Scheme description

Bus priority measures on Westminster Bridge Road

The existing eastbound bus lane on Westminster Bridge Road, which formerly ran east of the junction with Baylis Road and up to the junction with Gerridge Street, was extended in 2015 at the section between Gerridge Street and Dodson Street. A bus gate was introduced on Westminster Bridge Road on the approach to Waterloo Road as part of these works. It should be noted that the bus lane and bus gate can be also used by powered two-wheelers, pedal cycles and taxis, and that it is now operating 24 hours a day while prior to the 2015 works it used to operate only Monday to Saturday from 7am to 7pm with the same restrictions.

The approach of Westminster Bridge Road to Waterloo Road was reduced from four lanes to three (a nearside wide bus lane and two general traffic lanes).Dodson Street also became northbound only.

St George's Circus North-South cycle superhighway

St George's Circus is part of Cycle Superhighway 6, which runs from Kings Cross to Elephant & Castle via Blackfriars Road.

There is a signalised two-way cycle crossing across the Westminster Bridge Road arm of St George´s roundabout linking the 2-way cycle track on Blackfriars Road with Lambeth Road, while cyclists wishing to continue towards Elephant & Castle via London Road can join the advanced stop line on Blackfriars approach via a gap on the segregation.

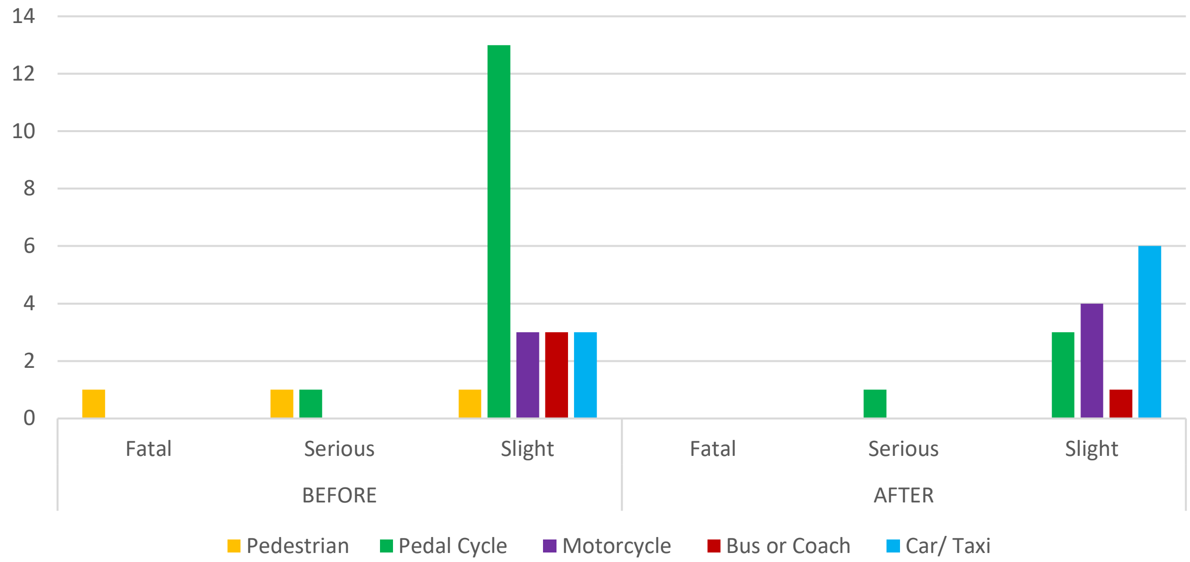
As the two junctions are in close proximity, it was considered appropriate to include both of them in this case study, as well as the section of Westminster Bridge Road between Gerridge Street and Waterloo Road.

The scheme was constructed in 2015, so the entire year was excluded from the subsequent before & after comparison of collisions.

Figure 4.37: Westminster Bridge Road bus gate

Figure 4.38: Waterloo Road / Westminster Bridge Road: Aerial view before and after implementation (Source: Google Earth)

Figure 4.39: Comparison of casualties by mode and severity for 36 months before and after the scheme implementation



Before and after results

Figure 4.39 above shows the comparison of the casualties resulting from the collisions that occurred at the junction between the years 2012 to 2014 (before the scheme implementation) and years 2016 to 2018 (after the scheme implementation). There was a reduction of 42% in the total number of casualties the three years following the implementation of the scheme and a 67% reduction in KSI casualties (2 serious and 1 fatal before, 1 serious after). There was a significant decrease in pedal cycle casualties (14 before compared to 4 after), especially considering the likely increase in pedal cycle volumes as a result of the scheme, and therefore increased exposure. Pedestrian and bus passenger casualties also decreased, however, there was a slight increase in powered two-wheeler casualties, and a doubling of casualties involving cars.

Table 4.18 overleaf shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. Pre-implementation there was a very high percentage of collisions involving pedal cycles as well as collisions occurring during the hours of darkness. There was a significant decrease in both of these collision categories following the scheme. Collisions involving buses also dropped from 7 to 1.

It needs to be noted that in the three years examined prior to the implementation of the scheme, 8 out of the 25 collisions were “nose to tail” collisions, where a vehicle collides with the rear of the vehicle in front. These are often due to the vehicles in front slowing or stopping abruptly and/or vehicle behind travelling too close to the vehicle in front. It is thought that these collisions were related to the zebra crossings on the northern and eastern arm of St George´s Circus possibly causing queuing on the circulatory carriageway. In the three years following the implementation of the scheme there was only one such collision recorded and as shown on Table 4.18, slowing or stopping collisions reduced by 83%.

Table 4.19 shows a comparison of various casualty categories in the before and after periods for the site. Total casualties reduced by 42%. The most notable decrease was for pedestrian and pedal cycle casualties.

Regarding the F&S collisions prior to the implementation of the scheme, all three of them involved buses. Two of them were pedestrian-bus collisions (one fatal and one serious) and one of them was a pedal cycle-bus collision (serious). Two of them took place at the Westminster Bridge Road junction with Waterloo Road, while the other one occurred at St George´s Circus. Following the implementation of the scheme there was just one serious collision reported, and it was a single-vehicle one; involving a male 54-year-old pedal cyclist commuting to work in the morning peak, however further details on how this collision occurred are unknown.

Table 4.18: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**25**	**11**	**-14**	**-56%**
F&S collisions	3	1	-2	-67%
Pedestrian collisions	3	0	-3	-100%
Pedal cycle collisions	14	4	-10	-71%
Powered two-wheeler collisions	3	4	1	33%
Bus collisions	7	1	-6	-86%
Turning left collisions	4	1	-3	-75%
Turning right collisions	3	1	-2	-67%
All turning collisions	8	2	-6	-75%
Slowing or Stopping collisions	6	1	-5	-83%
Collisions during the hours of darkness	15	5	-10	-67%
Collisions on wet road surface	6	1	-5	-83%

Table 4.19: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**26**	**15**	**-11**	**-42%**
KSI casualties	3	1	-2	-67%
Male	18	10	-8	-44%
Female	8	5	-3	-38%
Pedestrians	3	0	-3	-100%
Pedal cyclists	14	4	-10	-71%
Powered two-wheeler riders/ passengers	3	4	1	33%
Car occupants	3	5	2	67%
Bus occupants	3	1	-2	-67%
Goods vehicle occupants	0	0	0	0%

Regarding conflicting pairs, pedal cycle - car collisions were the most common pair prior to the implementation of the scheme, accounting for 11 out of the 25 collisions in total. These have significantly dropped by 82% post scheme implementation. After the implementation of the scheme there is a generally even distribution of collisions among the different conflicting pairs, with no particular predominant pair highlighted in the data.

Figure 4.40: Waterloo Road / Westminster Bridge Road: conflicting pairs before and after implementation

Conclusions

- The scheme resulted in an important reduction of cycle casualties, not only on St George´s Circus which saw significant cycle improvements, but also at the junction of Waterloo Road with Westminster Bridge Road with the lane reconfiguration, new advanced stop lines and footway build outs. However, there is still room for improvement as 3 out of the 4 collisions involving cyclists in the "after" period examined took place at St George´s Circus near London Road and Borough Road arm, where there is no segregated cycle infrastructure and there is a strong desire line for cyclists from Blackfriars Road to London Road and towards Elephant and Castle which is the most direct route, rather than going via Lambeth Road and St George´s Road which is the Cycle Superhighway routing.
- Collisions involving buses decreased from 7 to 1 indicating that the removal of the confusing layout of Westminster Bridge Road likely addressed the existing safety issues related to buses. The new bus gate also allows for safe lane changing of buses on the approach to Waterloo Road whilst general traffic is being held.
- The conversion of the zebra crossings on St George´s Circus to signalised crossings and the overall changes to the method of control of the junction seem to have reduced "nose to tail" collisions on the roundabout as a result of reduced exit blocking at the circulatory carriageway.
- There have been no pedestrian collisions following implementation of the scheme. The new signalised crossing on the west arm of St George´s Circus in combination with the improved crossings on the remaining arms and at the Waterloo Road junction seem to have contributed, accommodating all pedestrian desire lines and reducing pedestrian delay. It needs to also be noted that two of the pedestrian collisions in the "before" scheme study period took place on zebra crossings during the hours of darkness. Therefore, the conversion of the zebra crossings appears to have benefited pedestrian safety.

Figure 4.41: Cyclists at St George Circus

Blackfriars Road / The Cut Junction

Local authority **London Borough of Southwark (TLRN)**
Date of implementation **2015**

The Blackfriars Road / The Cut / Union Street junction is a four-arm junction which underwent improvements in 2015 as part of the north-south cycle superhighway 6 (King's Cross to Elephant & Castle).

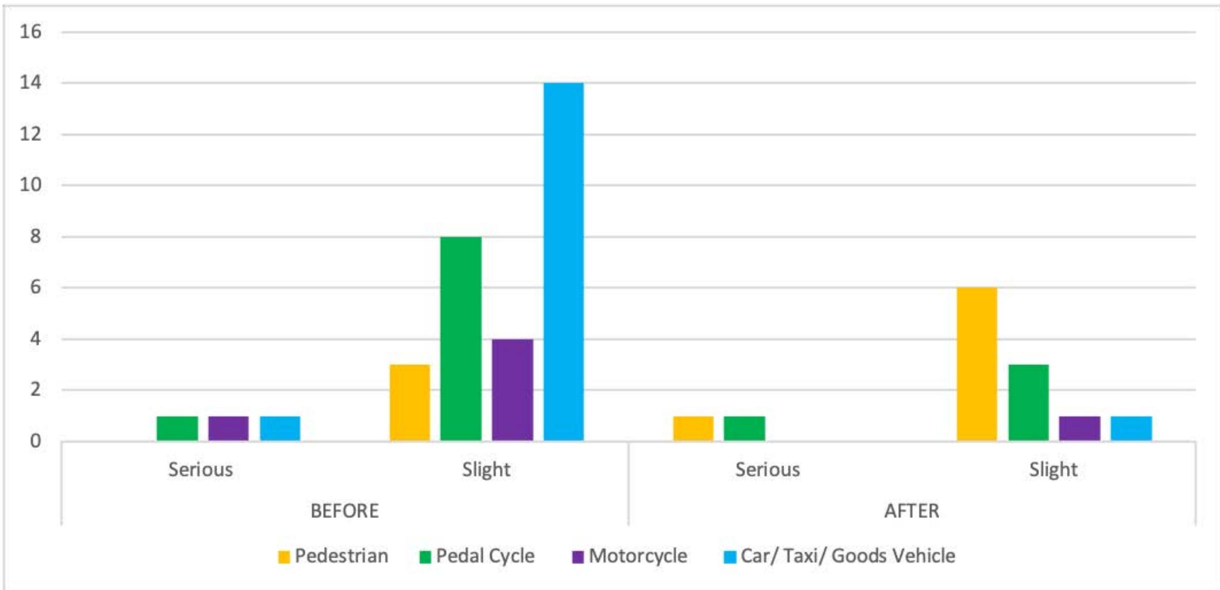
The key features of the implemented scheme are:

- New two-way segregated cycle track on the western side of Blackfriars Road
- Banned left turn from Blackfriars Road (south arm) into the Cut (west arm)
- North approach: reduction of the number of traffic lanes from three to two
- South approach: reduction of the number of traffic lanes from two to one
- West approach (The Cut): Removal of hatched markings, widening of the advanced stop lines
- Right turning pockets for traffic from Blackfriars Road turning right into the Cut / Union Street
- Relocation of the southbound bus stop on Blackfriars Road on the approach to Union Street to downstream of the junction

The scheme was constructed during the second half of 2015. Both years 2015 and 2016 were excluded from the subsequent before & after comparison of collisions.

Figure 4.42: Blackfriars Road: Aerial View before and after implementation (Source: Google Earth)

Figure 4.43: Comparison of casualties by mode and severity for 36 months before and after the scheme implementation



Before and after results

Figure 4.43 above shows the comparison of the casualties resulting from the collisions that occurred at the junction between years 2012 to 2014 (before the scheme implementation) and years 2017 to 2019 (after the scheme implementation). There was a reduction of 59% in the total number of casualties the three years following the implementation of the scheme and a 33% reduction in KSI casualties. There was a significant decrease in casualties of motorised modes and pedal cycle casualties, nevertheless there was an increase in pedestrian casualties which went up from 3 to 7 potentially due to a more confusing layout for pedestrians.

Figure 4.44: Cyclists along Blackfriars Road

Table 4.20 shows a breakdown of the collisions by type for the three years before and after the implementation of the scheme. Collisions involving vehicles turning right reduced by 89% which is the most notable reduction.

Table 4.21 shows the total casualties in collisions in the before and after periods for the site. Total casualties reduced by 59%. Male casualties showed a greater reduction than female casualties, and pedal cycle casualties reduced by 56%. PTW user casualties decreased by 80%. The greatest reduction was seen for car occupant casualties, from 12 casualties during the three years prior this was reduced to 0 the three years after.

Table 4.20: Comparison of collisions by type before and after the scheme implementation

Collision Type	Before	After	Change	%
Total collisions	**28**	**13**	**-15**	**-54%**
F&S collisions	3	2	-1	-33%
Pedestrian collisions	3	7	4	133%
Pedal cycle collisions	9	6	-3	-33%
Powered two-wheeler collisions	6	2	-4	-67%
Turning left collisions	2	2	0	0%
Turning right collisions	18	2	-16	-89%
Pedal cycle right turning collisions	1	1	0	0%
All turning collisions	20	3	-17	-85%
Collisions during the hours of darkness	9	4	-5	-56%
Collisions on wet road surface	7	2	-5	-71%

Table 4.21: Comparison of casualties before and after the scheme implementation

Casualties	Before	After	Change	%
Total casualties	**32**	**13**	**-19**	**-59%**
KSI casualties	3	2	-1	-33%
Children (<16)	1	0	-1	-100%
Elderly (60+)	2	0	-2	-100%
Male	21	8	-13	-62%
Female	11	5	-6	-55%
Pedestrians	3	7	4	133%
Pedal cyclists	9	4	-5	-56%
Powered two-wheeler riders/ passengers	5	1	-4	-80%
Car occupants	12	0	-12	-100%
Bus occupants	0	0	0	0%
Taxi occupants	1	1	0	0%
Goods vehicle occupants	2	0	-2	-100%

Looking at conflicting pairs, the most common conflicts before the implementation involve cars (20 collisions out of the 28). Amongst the collisions involving cars the most common conflicting pairs were car with pedal cycle (6) and car with car (6).

The conflicting pairs following the implementation of the scheme have completely changed, with a significant decrease in the number of conflicts involving cars (20 before 6 after) and an increase in collisions involving pedestrians (3 before 7 after). It also needs to be noted that collisions involving powered two-wheelers dropped from 6 to 2 following the implementation of the scheme. Regarding pedal cycles, there were two collisions between a pedestrian and a pedal cycle post scheme implementation (compared to none before) while collisions between pedal cycles and motorised vehicles dropped to less than half (9 before 4 after).

The two serious casualties during the post-implementation period were the result of a pedal cycle-car collision and a goods vehicle-pedestrian collision, respectively. One of the serious casualties was a result of a vehicle disobeying a no left turn sign, and the other one due to a pedestrian disobeying a traffic signal.

Figure 4.45: Comparison of conflicting pairs before and after the scheme implementation

Conclusions

- The design of the junction with a two-way segregated cycle track with separate signals (and phases) for cyclists resulted in a substantial reduction in pedal cycle casualties especially considering the increase in pedal cycle volumes negotiating the junction.
- It also appears that the scheme improved safety not only for pedal cyclists but for other road users too. There was a significant reduction in collisions and resulting casualties of motorised vehicles occupants (powered two-wheelers, car, taxis, goods vehicles) post implementation of the scheme.
- Post-scheme, there was a significant reduction in right-turning collisions. For example, the right-turn filtering issue that existed before the implementation of the scheme has now been addressed. There was a collision involving a powered two-wheeler who filtered on the offside of the northbound queue, then sat in front of a large goods vehicle who failed to see the rider and progressed, resulting in serious injury. The new layout means that overtaking the queue to access the right turn pocket has been discouraged by providing a narrow lane and hatched markings as well as southbound lane arrows.
- The relocation of the bus stop downstream of the junction (used to be upstream) has also led to improved visibility at the junction and benefited the safety of all users.
- Nevertheless, it appears that the scheme had an adverse impact on pedestrian safety (although before and after pedestrian volumes would need to be examined to confirm whether this is due to increased pedestrian exposure). Despite the fact that pedestrian crossings have been designed to be wide and straight across rather than staggered, the width of the traffic island may not be sufficient to accommodate pedestrians waiting to cross, and there is also no refuge island provided between the cycle track and northbound traffic. Moreover, the layout of the junction can now be more confusing for pedestrians who need to cross the two-way cycle track as well as the main carriageway.
- Southwark station is very heavily used and therefore there are high pedestrian volumes on the footways as well as a high number of pedestrians crossing. In addition to that, pedestrians are mainly commuters entering or exiting the underground station who are usually in a hurry and as a result may be impatient and disobey the pedestrian signals. This was likely the case for the serious collision involving a pedestrian disobeying the signals post-scheme.

5.

Guidelines

The following guidelines have been developed using the findings of the analysis of collision statistics across the ten CLSTRP Boroughs and of the ten case studies as a starting point. The guiding principles of these Guidelines have also been informed by a workshop with officers from the Municipality of Oslo, who shared with consultants and CLSTRP partners their experience in addressing road safety issues and achieving Vision Zero. In fact, the city of Oslo has recorded no fatalities on its road network in 2019 and 2020.The Guidelines have been organised into seven themes.

The themes can help in navigating through the range of potential road safety measures available to designers and highway authorities. However, a key finding has been that there is no ‘one size fits all’ solution to achieving Vision Zero. Rather, the most appropriate mix of measures in any location will need to be tailored to its specific context and challenges.

Another overarching finding is that ambitious action will be needed to achieve Vision Zero. The context of central London means that its road network is intensively used by a range of road users, inevitably leading to conflicts. As such, measures that remove conflicts are likely to be essential, including those that seek to reduce motorised traffic.

It is important to note that this chapter does not aim to provide an exhaustive listing of solutions to all road safety topics and issues that can be encountered on Central London’s road network.

Theme 1 – Pedestrian priority

Pedestrian casualties account for 18% of all casualties across CLSTRP Boroughs and 31% of KSIs, the most involved user group across all modes of travel.

This is not surprising, as the nature of Central London means that there is a high level of pedestrian activity. Furthermore, when pedestrians are involved in a collision in Central London, they are more likely than average to be killed or seriously injured due to their vulnerability. As such, a focus on improving pedestrian safety is essential in achieving Vision Zero.

All Local Authorities across Central London have already been putting in place various measures to improve pedestrian safety along road links and at junctions, improve pedestrian comfort along footways and increase permeability through provision of new/better crossing facilities.

The analysis of the ten case studies undertaken as part of this report confirms that these features can result in significant improvements and relevant reductions in the number of collisions resulting in pedestrian casualties. In particular, a review of factors influencing pedestrian safety, commissioned by TfL, highlighted how crossing improvements are the most effective measure[11]. As such, it is important that safety assessments of proposed pedestrian crossing facilities are undertaken as part of all new highway improvement schemes. However, it is clear that crossing improvements need to take into account actual pedestrian desire lines in order to provide maximum benefit.

TfL has recently released a guidance document to support the planning and design of pedestrian infrastructure called 'The Planning for Walking Toolkit' (2020)[12]. It provides a link between TfL's Walking Action Plan[13] and more TfL detailed design guidance and assessment tools included in the Streetscape Guidance[14], the Pedestrian Comfort Level Assessment[15] and the Healthy Streets Assessment[16].

Among the guidelines and suggestions provided by such documents, the following considerations have been drawn together by combining guidance with the analysis of the 10 case studies.The key improvements to signalised crossing facilities that have resulted in road safety risk reduction include:

- Raised treatments and surface treatments improving visibility and encouraging vehicles to lower their speeds;
- Realignment of facilities to meet pedestrian desire lines, including, where possible, the conversion of staggered crossings into straight crossings;
- Introduction of pedestrian countdown signals at busy crossing locations;
- Removal of visual clutter to/ from the crossing;
- Enhancement of crossing visibility through clearer and more prominent road marking (e.g., zig-zags);
- Appropriate lighting and anti-skid surfacing on the approaches.

▶ Improvements to informal crossing facilities that have resulted in road safety risk reduction include:
  - Provision of uncontrolled facilities (dropped kerbs, footway buildouts, central refuges) at regular intervals, and along key pedestrian desire lines;
  - Provision of dropped kerbs and tactile paving in line with Streetscape Guidance;
  - Provision of side road entry treatments enhancing pedestrian priority, particularly along high streets and near stations/interchange areas;
  - Raised treatments and surface treatments improving visibility and encouraging vehicles to lower their speeds;
  - Appropriate lighting and anti-skid surfacing on the approaches.

▶ Footway widening and decluttering at busy locations can be crucial in reducing the risk of pedestrians stepping onto the carriageway and entering in conflict with motorised users;

▶ Designing facilities actually align with pedestrian desire lines and are legible and convenient to use is key to ensure that pedestrian comply with the street layout rather than crossing in risky and hazardous locations/situations;

▶ The analysis demonstrates that children and the elderly are among the age groups most affected by pedestrian casualties. As such, the design of pedestrian improvement should take into account users of all walks of life, particularly in proximity of attractors such as schools, leisure centres, and care facilities;

▶ Provision of appropriate kerb upstands, delineator kerbs and tactile paving to help impaired users navigate the space with minimal risk of conflicts with other road users, including cyclists that might be sharing the space with pedestrians or riding alongside them;

▶ Traffic management/traffic reduction strategies and speed calming strategies can indirectly influence pedestrian safety positively, as outlined in Theme 6.

Table 5.1: Theme 1 Potential Measures

Measure	Cost	Complexity
Undertake safety assessments of pedestrian crossing facilities as part of all new highway improvement schemes	£	**Low – to be combined with other improvement projects**
Footway widening and decluttering especially at locations with high pedestrian volumes	££	**Varies – depending on type of street furniture that might require removal, or carriageway space available for footway widening**
Anti-skid surfacing treatment on the approach to pedestrian crossings	£	**Low**
Pedestrian crossing locations to meet pedestrian desire lines & appropriate type of crossing for location	££	**Varies – depends on the type of crossing that needs to be implemented and the location**
Staggered crossings at junctions should ideally be converted to straight across ones to minimise pedestrian delay.	££	**Medium/High – Impact on junction´s capacity**
At signalised junctions, cycle time should be kept to a minimum in order to minimise pedestrian delay at crossings	£	**Medium/High – Impact on junction´s capacity**
For some crossings, either controlled or uncontrolled, pedestrian refuge islands are required, and these should be wide enough to cater for pedestrian demand	££	**Medium – depends on carriageway space available**
Traffic calming measures at locations with high volume of pedestrians or with vulnerable pedestrians (i.e., children)	£	**Low**
Traffic restrictions at locations with high volume of pedestrians or with vulnerable pedestrians (i.e., children) to minimise conflicts	£	**High – Impact on traffic which will require alternative routes / public acceptability**
Side road entry treatments enhancing pedestrian priority (i.e., continuous footways)	£	**Low**
Appropriate lighting levels (including footway level lighting) at footways, crossings and bus stops	££	**Low**
Appropriate visibility levels at crossings and junctions	£	**Medium – Depending on the layout, trees might need to be removed or parking restrictions might need to be introduced**

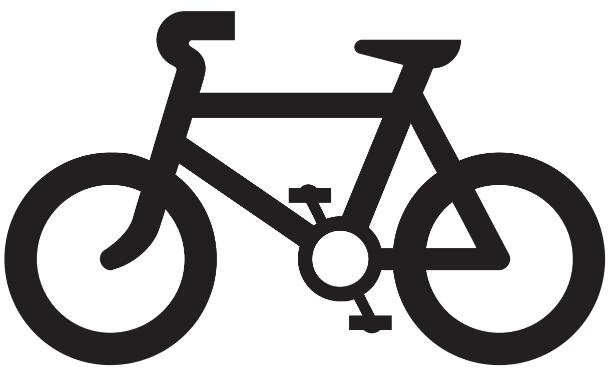
Figure 5.1 Pedestrian Crossing with countdown at Blackfriars Road

Figure 5.2 Informal crossing with coloured surface treatment in Ealing

Theme 2 – Cycle Facilities

Cycle casualties account for 25% of all casualties across CLSTRP Boroughs (the most involved VRU group) and 30% of KSIs,

Reflecting this growing demand, a large proportion of highway improvements delivered in recent years and of the ten case studies selected for this report have focused on the provision of high-quality cycle facilities or included some form of improvements to cycle quality.



Considering that the cycle mode share has been constantly growing in recent years, cycle casualties are only likely to grow in number and proportion, unless mitigated through continuous implementation of cycle safety strategies (encompassing both infrastructure and behavioural measures).

Guidance for the planning and design of cycle infrastructure, including of safety considerations and recommendations, is mainly provided by the recent Cycle Infrastructure Design Guidance LTN 1/20[17], and by TfL's London Cycle Design Standards (2014[18]). Both documents include tools to measure the suitability of proposed cycle infrastructures to the context and to the existing/expected traffic and movement conditions (Cycle Level of Service, Junction Assessment Tool, etc.). These tools are also useful in establishing how road safety risks are mitigated through design solutions.

The following considerations have been drawn by combining guidance provided by these documents with the analysis of the 10 case studies:

- Wherever possible and justifiable by expected cycle volumes and traffic volumes, the provision of segregated cycle infrastructure (one-way or bidirectional) is preferred as opposed to mixing cycles with motorised traffic;
- Alternatively, encouraging cycles to choose quieter roads by providing them with high quality wayfinding signage and cycle markings, combined with traffic calming measures (that limit motorised vehicles flows and speeds) can be

extremely effective in reducing exposure to conflicts with motorised traffic;

- Where cyclists are sharing lanes with traffic, the geometry of the carriageway is crucial in encouraging safe behaviour (for example, narrow lanes can encourage drivers to slow down and let cyclists ride in primary position rather than attempt to overtake them);
- Complex junction layouts requiring cyclists to turn/cross in multiple stages should be minimised to reduce the risk of low-compliance; this effort will obviously need to be balanced with the impact that the provision of a fast and direct cycle connection can have on other modes, including pedestrians, public transport and general traffic;
- Protection of turning movements (both at signalised and uncontrolled junctions) is crucial in reducing the risk of collisions: for example, the provision of islands protecting cyclists at the start/end of contraflow cycle lanes has greatly improved safety along Quietway 11);
- Solutions that provide cyclists with an advantage over general traffic at signalised junctions (ASLs, early release cycle signals) can also be effective in reducing the risk of conflicts;
- The design of cycle facilities should take into account not only the risks connected with conflicts with moving traffic, but also those relating to stationary vehicles and other kerbside activities, providing sufficient buffers between these activities and the cycling space;
- Road marking and surface treatments, increasing prominence and visibility of the cycle facility, play a key role in reducing risk of conflicts (as shown in both in the Stockwell Cross and in the Millbank Roundabout example);
- Traffic management/traffic reduction strategies and traffic calming strategies can indirectly influence cycle safety positively, as outlined in Theme 6.

Figure 5.3 Contraflow cycle laneon Snowfields, Southwark

Table 5.2: Theme 2 Potential Measures

Measure	Cost	Complexity
Undertake Cycle Route Quality Criteria assessment as part of all new highway improvement schemes	£	**Low – to be combined with other improvement projects**
Provision of segregated cycle infrastructure along key routes based on cycle desire lines	£££	**High – Would require the reallocation of carriageway space, impact on traffic capacity, bus journey times, might require removal of parking spaces etc.**
Provision of 'Quietway' type of routes for cyclists which would include wayfinding, cycle markings, traffic calming measures and potentially traffic restrictions	££	**Medium**
Along links where there is no cycle provision and cyclists are sharing lanes with general traffic or buses, lane widths should not be within the critical range (3.2m-3.9m) that encourages dangerous overtaking of cyclists	£	**Low**
Measures to reduce conflicts at junctions (i.e., dedicated signal phase for cyclists, 'hold the left' arrangement, banned turning movements for general traffic)	££	**Varies – Impact on junction´s capacity, traffic reassignment etc.**
Measures that provide cyclists with an advantage over general traffic at signalised junctions (i.e., early release signals, ASLs)	£	**Low/Medium – Early release signals can have some impact on junction´s capacity**
Measure to improve safety for cyclists related to kerbside activity (i.e., provision of a buffer zone between the cycle facility and parking/loading bay)	£	**Low/Medium – It depends on carriageway space available**

Figure 5.4 Segregated cycle track within pedestrian zone, Archway

Theme 3 – Powered Two-Wheelers

Motorcyclists are the second group of vulnerable users most involved in road casualties across CLSTRP Boroughs after cyclists (22%).

Most collisions involving motorcyclists occur either at a T-junction or crossroads, and often involved motor vehicles turning right, across the path of the motorcyclists who were going straight ahead.

Several collisions also occur on streets or at junctions with multiple lanes, where lane weaving and overtaking put motorcyclists at risk of side collisions with larger vehicles. Another growing area of concern is the conflict between motorcyclists and pedestrians along streets with high footfall, particularly where there might be heavy use of mopeds for deliveries and other business-related activities.

Several London Boroughs have been adopting strategies to raise motorcyclists' awareness of safety risks, providing motorcyclists with basic tips on how to stay safe while riding on the road network.

Additional measures that can be considered are:

- Targeting and prioritising interventions on nodes and links with a high number of collisions involving motorcyclists;
- Developing a 'powered two-wheelers readiness' audit to be used on safety hotspots and all new major highway improvement schemes (following TfL's Urban Motorcycle Design Handbook). This should specifically look at ensuring the following elements of highway schemes are suitable for motorbikes (as highlighted in Table 5.3).
- Working with Business Improvement Districts (BIDs) and business owners (employing motorcyclists for deliveries) to ensure that vehicles and equipment meet legal requirements, and drivers undertake CBT training.

**Table 5.3 Design considerations for motorcycles
(Source TfL's Urban Motorcycle Design Handbook)**

Key Design Issues	Issues	Key Design Considerations
Factors affecting grip	Surface material choice and surface conditions. Large areas of thermoplastic road markings. Unexpected road markings or surface treatments. Worn High Friction Surfacing. Location, design and maintenance of service covers. Surface Debris in areas used by Powered Two-Wheelers.	**Avoid locating different materials at turning points or places where individuals are likely to brake.** **Consider how many markings are required and where they are positioned.** **Minimise the number of surface types used.** **Regular inspection routine to examine surface suitability.** **Install suitable service covers (applies to cyclists)**
Visibility	Restricted sideways and forward visibility at junctions.	**Ensure appropriate visibility splays are provided and unobstructed by street furniture.**
Roadside features	Inconspicuous, poorly delineated kerbs/ islands. Design and location of highway infrastructure and street furniture. Light segregation cycle facilities	**Consider the need for roadside features in the first instance. If necessary, ensure they are clearly visible.** **Use 'two-wheelers friendly' infrastructure where possible (Including in the design of Bollards, segregation and crash barriers).**
Traffic calming	Speed Cushions Material Choice at side road entry ramps treatment Proximity of side-road entry ramps/ treatments to junctions.	**Consider need, spacing and shape.** **Material should be similar to carriageway where possible.** **Consider locating ramps away from junctions / turning movements.**
Filtering	Constrained traffic lane widths. Filtering within advisory cycle Lanes.	**Clear lane geometry that aids motorcyclists choosing whether to ride in primary or secondary position (also applies to cyclists)**

Table 5.4: Theme 3 Potential Measures

Measure	Cost	Complexity
Undertake a 'powered two-wheelers readiness' audit as part of all new highway improvement schemes	£	**Low – to be combined with other improvement projects**
Appropriate high-friction carriageway surfacing and other surfacing improvements (i.e., suitable service covers) to reduce issues affecting grip	££	**Low**
Ensure appropriate visibility splays are provided, especially at junctions	£	**Medium – Depending on the layout, trees might need to be removed or parking restrictions might need to be introduced**
Motorcycle-friendly traffic calming measures along links where speeding is an issue	£	**Low**
Advance signage and destination markings to discourage lane weaving	£	**Low**
Appropriate lane widths on the approaches to junctions to discourage filtering of motorcycles through traffic	£	**Low**

Figure 5.5 Antiskid surface at junctions improves safety on turning movements

Figure 5.6 Changes in friction such as road marking and utility covers can represent an hazard for motorcycles when turning

Theme 4 – Speed

As demonstrated by the analysis of case studies, vehicle speed is one of the most important factors not just in determining the severity of a collision but in determining whether one happens in the first instance (see, for example, the significant reduction in the number of collisions observed along Holloway Road after the introduction of a 20mph speed limit).

This is all the more true for vulnerable users, who cannot count on a vehicle body as protection and deceleration buffer. Consequently, speed mitigation policies clearly benefit VRUs in particular. When struck by a car at 30mph, less than 50% of pedestrians or cyclists survive. At 20 mph, more than 90% survive, according to research by the European Transport Safety Council[19].

This is supported by the analysis of contributory factors before and after implementation of the speed reduction along Holloway Road: collisions involving manoeuvres influenced by speed recorded the highest decrease: overtaking collisions dropped by 63%; collisions involving vehicles changing lanes dropped by 75%; front to back collisions (going ahead) decreased by 53%; and collisions on turning movements have dropped by 48%.

All ten CLSRTP Boroughs have already introduced 20mph limits on all local roads and some of them are now working in collaboration with TfL to extend the limit to streets located within the TLRN network.

The benefits of 20mph zones and borough-wide restrictions are corroborated by several pieces of research: a 2007 review of half of the 20mph zones which had been implemented in London (78 zones) found that they reduced injury accidents by about 42% and fatal or serious accidents by 53%[20]. Research conducted across England and Wales has also highlighted how reduced traffic speeds encourage people to switch to active modes of travel, such as cycling and walking, with likely greater reductions in air pollution. The study concluded that health and costs savings are substantial, and the costs of implementing 20mph limits are likely to be far lower than the benefits that reduced speeds bring.

Acknowledging the fact that 20mph speed limits are already in place along most of Central London's streets, the following paragraphs provide a recommended approach to identifying and implementing traffic calming measures to address areas where actual speeds may still be high and could therefore be posing a risk.

Monitoring

Actual speeds should ideally be monitored, to identify areas that may have a persistent speeding issue:

- Identify survey locations across a range of the targeted links and nodes and undertake yearly monitoring;
- Sites with high number of collisions with 'high speed' as contributing factor should be targeted in this monitoring exercise;
- Monitoring can be combined with other monitoring activities undertaken by Local Authorities;
- Liaise with TfL on monitoring strategy along TLRN roads.

Addressing speeding issues

Where surveys highlight mean speeds above the limit, supplementary measures should be considered, including:

- Enhance 20mph signage, by increasing the number of signs and installing larger signs, enhance road marking;
- Install Vehicle Activated Signs that warn drivers that they are exceeding the speed limit;
- Consider infrastructure measures to support traffic calming these can include:
  - road humps;
  - pedestrian refuges;
  - raised tables;
  - reduced lane width (bearing in mind minimum requirements for buses and other large vehicles, LCDS and LTN 1/20 guidance on road widths for on-street cycling, shared lanes etc..);
  - localised road narrowing/buildouts and other type of physical or visual pinch points (including introduction of raised medians in place of hatched medians along sections of carriageway);
  - surface treatments;
  - removal of centrelines;
  - reduced corner radii on side roads and at junctions;
  - introduction of street trees along footways[21] .

Figure 5.7 Buildout and raised treatment, Hathfields, Southwark

Table 5.5: Theme 4 Potential Measures

Measure	Cost	Complexity
Introduce 20mph speed along streets	£££	**High – requires stakeholders and public engagement, roll out strategy, enforcement**
Identify high priority locations across the network to be monitored; commission surveys	££	**Low – identification of sites can be based on collision analysis or review of historical hotspots;**
Monitoring can be combined with other monitoring activities undertaken by Local Authorities or by TfL	£	**Medium – Depending on the layout, trees might need to be removed or parking restrictions might need to be introduced**
Review 20mph signage provision at speeding hotspots	£	**Low**
Enhance road markings at speeding hotspots	£	**Low**
Install Vehicle Activated Signs at speeding hotspots	££	**Low – technically feasible, consider ongoing operational cost**
Install infrastructure measures to support traffic calming at speeding hotspots, including road humps; pedestrian refuges; raised tables;reduced lane width; localised road narrowing/buildouts and other type of physical or visual pinch points; surface treatments; removal of centrelines; reduced corner radii on side roads and at junctions; introduction of street trees	££	**Low to high depending on location – Consider impact on noise and pollution, deflections to be designed in line with London Buses Traffic Calming guidance**

Figure 5.8 Speed calming achieved using raised median on Southall Broadway, Ealing

Theme 5 – Public Transport

Improving safety on public transport can play a role in encouraging more users to prefer this mode of travel over private motorised vehicles, supporting traffic reduction strategies. Moreover, traffic management strategies that restrict motorised vehicles from portions of the road network, combined with bus safety improvements, can generate a virtuous circle of collision reduction.

Collisions involving bus users are a relatively smaller proportion than those involving vulnerable users (5% of all casualties within CLSTRP Boroughs and 3% of Fatal and Serious Casualties); however, there are a number of strategies that local authorities can put in place to mitigate the risk of them.

There are two guidance documents developed by TfL to guide designers in the development of safe and accessible design solutions for bus infrastructure: the Accessible Bus Stop Design Guidance (2017)[22] and the Traffic Calming Measures for Bus Routes (2005)[23].

The following considerations have been derived from such documents and from the analysis of case studies:

- The removal of lay-bys in favour of in-lane bus stops has proven successful in reducing the number of bus-related collisions at Grove Park. The key benefits of in-lane stops are lower delays and faster journey times, but they appear to also have positive implications on road safety;
- Several collisions involving buses have 'sudden breaking' as the main contributory factor. Strategies to mitigate such occurrences include speed reduction/calming; provision of bus lanes to reduce likelihood of buses driving mixed with general traffic; discouraging lane weaving by providing advance signage and destination marking;

Figure 5.9 Floating Bus Stop, Archway

Figure 5.10 Shallow Raised Crossing, Clapham Old Town

- Some traffic calming measures can be suitable to deter high speeds among most motorised vehicles but can have negative impacts on safety for bus users. Following the Traffic Calming Measures for Bus Routes Guidance can help in selecting the appropriate vertical and horizontal deflection devices;
- The Waterloo Road case study showed how the removal of a confusing layout with a bus lane on the nearside up to the junction leading to a bus lane on the offside, addressed the existing safety issues related to buses;
- The same case study showed that bus gates can be an effective strategy to reduce conflicts by allowing for safe lane changing of buses whilst general traffic is being held.

Table 5.6: Theme 5 Potential Measures

Measure	Cost	Complexity
Replacement of bus stop lay-bys with in-lane bus stops (careful consideration should be made to the design in order to avoid dangerous overtaking of buses at bus stops)	££	**Medium –Negative impact on general traffic journey times**
Provision of bus lanes to reduce conflicts between buses and general traffic (consistent provision without frequent 'breaking' of the bus lanes)	£	**Medium/ High – Impact on general traffic journey times**
Provision of bus priority measures (i.e., bus gates)	££	**Medium/ High – Impact on junction capacity**
Advance signage and destination marking to discouraging lane weaving	£	**Low**
Traffic calming measures (suitable for buses) to reduce speeding and therefore sudden breaking of buses	£	**Low**
Ensure appropriate visibility splays are provided, especially at junctions	£	**Medium – Depending on the layout, trees might need to be removed or parking restrictions might need to be introduced**

Theme 6 – Freight vehicles

Collisions involving freight vehicles (vans and rigid lorries as well as two wheelers) make up a non-negligible proportion of the total number of collisions occurring in Central London, particularly along those streets where there is significant kerbside activity.

In particular, large lorries can pose a serious threat to vulnerable users when they are involved in collisions: the proportion of serious collisions over the total number of collisions is higher among conflicting pairs such as 'goods vehicles – pedestrians' and 'goods vehicles – cycles' than among other user groups.

TfL's Streetscape Guidance provides suggestions and parameters for the design of appropriate loading and servicing facilities on street. Reducing the need for goods vehicles to perform hazardous manoeuvres when parking, and allowing sufficient buffers for unloading and loading operations is the first step towards minimising risk of conflicts between stationary traffic and vehicles travelling on the road.

There are additional tools that can make an impact on road safety by encouraging safe behaviours and practices among freight operators and lorry drivers: while these are outside the direct control of local authorities, take-up can be encouraged through promotion and incentives.

Figure 5.11 Footway loading pad, Chester Square, Westminster

Fleet Operator Recognition Scheme (FORS)

FORS is an accreditation scheme owned by TfL which aims to incentivise and reward higher standards of safety and reduced environmental impact within the freight industry. FORS accreditation allows operators to prove their environmental and safety credentials, allowing them to compete on quality as well as price. Achievement of the FORS standards is rewarded with Bronze, Silver or Gold accreditation.

Achieving this requires operators to undertake a range of training programmes, including Manager Training for fleet, fatigue, drivers' hours, and collisions. Operators adhering to the scheme are also given access to a range of toolkits and guides, helping them to manage their workforce and operations in a more efficient manner and achieve industry best practice. Although these elements allow operators to reduce operating costs (for example by improved fuel efficiency and fleet utilisation), FORS also influences operators and specifiers to raise safety and environmental standards, to the benefit of the industry and wider society. These offerings further incentivise operators to become involved with the scheme and achieve the FORS standards.

Local authorities can incentivise and advertise FORS among businesses and Business Improvement Districts (BIDs), supporting more of them to gain accreditation and follow the training programmes. Moreover, they can require their suppliers to sign up (e.g., waste collection, maintenance contractors etc..).

Direct Vision Standard

The Direct Vision Standard (DVS) requires all goods vehicles over 12 tonnes to have a permit to drive into Greater London, including vehicles from outside of the UK. Enforced by Transport for London (TfL), the legislation is based on a 'star rating' indicating how much a driver can see from the cab in relation to other road users.

The vehicle manufacturer will issue a star rating for a vehicle. This rating (0-5) is based on how the vehicle left the production line and will not take into account any aftermarket safety systems that have been fitted. HGVs that do not meet the minimum requirement of 1 star need to comply with the Safe System which requires the installation of extra devices for indirect vision to alert drivers to vulnerable road users who are in a vehicle's blind spot. Complying with the Safe System will not alter the vehicle's star rating but will permit a vehicle to be driven into Greater London.

The legislation came into force in October 2020 and by 2024 DVS minimum star requirements will increase to three stars. Local authorities can support the enforcement of this requirements by conducting awareness campaigns with local businesses and Business Improvement Districts (BIDs). In addition, local authorities can lead the way by requiring their suppliers to use vehicles that exceed the minimum requirement.

Table 5.7: Theme 6 Potential Measures

Measure	Cost	Complexity
Introduce appropriate loading bays and buffers for servicing activities between loading bays and live traffic	££	**Medium – can be challenging if there are significant kerbside constraints**
Incentivise and advertise FORS among businesses and Business Improvement Districts (BIDs), supporting more of them to gain accreditation and follow the training programmes	£	**Low**
Require Local Authorities' suppliers to sign up to FORS (e.g., waste collection, maintenance contractors)	£	**Low**
Support the enforcement of this requirements by conducting awareness campaigns with local businesses and Business Improvement Districts (BIDs)	£	**Low**
Work with businesses and BIDs to encourage consolidation of deliveries, strategies using Cargo Bikes and pedestrian porters for Last Mile deliveries	££	**Medium - requires liaison with businesses and suppliers as well as availability of centralised spaces for consolidation**
Implement kerbside strategies and traffic management strategies aimed at re-routing/re-timing servicing and delivery operations	££	**Medium - requires liaison with businesses and suppliers; night time deliveries and impact of re-routing on surrounding streets requires community engagement.**

Figure 5.12 Waste vehicle turning across continuous footway

Theme 7 – Traffic Management

In Central London, where traffic congestion and competition for constrained road space among users can be particularly acute, traffic management strategies are increasingly playing a crucial role in improving road safety.

These strategies can include:

- Permanent or timed road closures (to all traffic or to certain user classes);
- Modal filters (including point closures except cycles, bus gates etc..);
- One-way restrictions (with or without contraflow cycling);
- School Streets;
- Low Traffic Neighbourhoods (which can be made up of a combination of the measures above);
- Removing conflicts at junctions.

These types of measures can often prove controversial, especially when implemented on a widespread basis. On the one hand, implementing them at specific locations can help to address very localised issues. The road network in central London is very intensively used, inevitably leading to conflicts between different users. Whilst the road safety risks associated with such conflicts can be managed and mitigated, ultimately achieving Vision Zero will necessitate removing as many of these conflicts as possible. Conflicts with motorised vehicles are much more likely to result in a serious outcome, and therefore reducing the amount of motorised traffic in central London will have a positive impact on road safety.

The following paragraphs discuss impacts that such measures can have on road safety. Most of these traffic management strategies can either be implemented using physical changes to the road layout (e.g., bollards, islands, planters) or through signage, road markings and camera enforcement. In any case, it is important to consider any change to circulation on an area-wide basis, envisioning and measuring potential traffic displacement caused by the new restriction to surrounding roads.

Road closures

Road closures are generally introduced to enhance pedestrian (and cycle) priority in an area with a relevant 'place' function and a significant footfall. The space resulting from the closure of the road space can be re-purposed in favour of features such as landscaping, public realm interventions, and dwelling and seating opportunities.

A subgroup of road closures are timed closures and closures limited to a specific group of users (for example, the Bank Junction case study is a timed road closures that allows bus, cycles and servicing vehicles to access the area). Such closures can only allow a minimal re-purposing of the road space but can still have significant impacts on road safety, as demonstrated by this case study.

Modal Filters

Modal filters are point road closures limited to a very short section of road, preventing some road users from travelling through the closure. Their effect in regard to traffic volumes and road safety can be similar to that of road closures. They maintain permeability for certain user classes (often cyclists and pedestrians, and sometime buses) and can thus encourage modal shift.

Introducing modal filters at the entry/exit of a side road along a major road minimises the number of turning movements in and out of the side road, with safety benefits for pedestrians and cyclists walking along the major road; and reducing collisions among vehicles travelling in the opposing direction along the major road.

Figure 5.13 Modal filter with collapsible bollards and planters

One-way streets

The introduction of one-way restrictions along streets that used to be two-way can have multiple benefits to road safety:

- It removes the risk of conflicts between vehicles moving in opposing directions, particularly along narrow streets;
- It can free up space for the introduction of contraflow cycle facilities (see Quietway 11 example) or wider pavements, particularly around busy interchange areas (see Stockwell Cross example);
- It can reduce the risk of conflicts between turning vehicles and vulnerable users; for example, restricting side roads along busy High Streets to 'exit only' removes the issue of vehicles turning from the main road into the side roads across pedestrians and cyclists.

School Streets

Areas outside schools are natural hotspots for potential VRU collisions at specific times of the day, when children crowd footways and crossing points, increasing the risk of conflicts with motorised vehicles. Specific traffic management measures can be taken to make these locations safer.

The primary goal of School Streets is to reduce congestion by limiting motor vehicle access to schools. In turn this will increase air quality in the vicinity of schools and also encourage individuals to walk and cycle to school. In addition, implementing school streets can also have a positive effect on road safety in the vicinity of schools as the number of motor vehicles is drastically reduced.

The benefits of School Streets are not limited to road safety: recent TfL monitoring research found that 18% of parents reported choosing to walk and cycle instead of driving, with consequent improvements to congestion and air quality (nitrogen dioxide reduction by 23% during drop-off hours)[24].

Figure 5.14 Time restriction enhanced with pavement treatment, Francis Road Waltham Forest

It is recommended that School Street restrictions implemented so far should be monitored as part of any Vision Zero Strategy, to understand the effectiveness at each location. Should they prove effective, then additional streets/ areas where school streets measures would be beneficial should be identified. It will be important to work with schools to identify opportunities and liaise with all stakeholders (including residents, businesses and emergency services) to implement new schemes and work on transforming experimental proposals in permanent schemes.

Low Traffic Neighbourhoods

Low traffic neighbourhoods (LTNs) create areas that are easier to walk and cycle through by removing or limiting access to motor vehicles in the areas they encompass. Implemented correctly, they create a safe environment for active travel and remove those vehicles seeking to use residential areas as 'rat runs'. LTNs have already been implemented across a range of London Boroughs, and recent research has shown how they have been effective in reducing the number of casualties: pedestrian related collisions appear to have decreased by 50% in areas where LTN measures have been introduced when compared to the London average[25].

Existing LTNs should be monitored to understand the impact and effectiveness on road safety. In addition, analysis of traffic patterns on each London Borough's Road Network should be undertaken to identify other opportunities by assessing the potential presence of popular through routes affecting residential areas.

Removing conflicts at junctions

As demonstrated by some of the case studies (for example Farringdon Road/Clerkenwell Road junction, Chinbrook Road junction in Grove Park and Stamford Hill/Manor Road junction), banning turning movements and removing slip lanes at junctions is an alternative Traffic Management Strategy able to reduce conflicts between opposing movements.

Additionally, preventing motorised vehicles from performing certain turning movements at signalised junctions minimises the risk of left hook / right hook cycle collisions, particularly along busy cycle routes (and where a two-way cycle track runs along one side of the carriageway). As for all other strategies, it is important to consider any change to junction operations on an area-wide basis, envisioning and measuring potential traffic displacement caused by the new restriction to the surrounding junctions.

Table 5.8: Theme 7 Potential Measures

Measure	Cost	Complexity
Introduce permanent or timed road closures	£££	**High – requires extensive engagement with residents and local stakeholders, assessment of impacts on the surrounding road network and on users' journeys**
Introduce modal filters	££	**Medium – depending on impact on surrounding streets; requires engagement with residents and local stakeholders**
Consider changes to one-way streets	££	**Medium – depending on impact on surrounding streets; requires engagement with residents and local stakeholders**
Implement School Streets	££	**Medium – depending on impact on surrounding streets; requires engagement with residents and local stakeholders**
Banning turning movements at junctions	££	**Medium – depending on locations; requires assessment of impacts on the surrounding road network and on users' journeys**
Low Traffic Neighbourhoods	£££	**High – requires extensive engagement with residents and local stakeholders, assessment of impacts on the surrounding road network and on users' journeys**

Theme 8 – Behavioural Change and Enforcement

As described in previous chapters, as well as introducing physical interventions across the road network, a comprehensive Vision Zero Strategy should target as many components of the Safe System approach as possible.

It should therefore include supporting measures involving behavioural change programmes, increasing people's awareness about road danger and interaction with other road users.

Several local authorities already employ some of the strategies listed below, but it is important to emphasise that they should continue and form a fundamental part of their Road Danger Reduction Strategies. Some examples include:

- School Travel Planning: School travel plans are a list of actions that a school agrees and commits to run, including measures to support active travel among pupils and staff, commitments to work with the Local Authority to improve safety on the street network surrounding the school, campaigns to promote road safety and cycle training. The target should be for all schools in the CLSTRP Boroughs to have a Travel Plan, with the Travel Planning Officers to work closely with schools who have not developed one yet. The travel plans can be used to inform the prioritisation of measures to improve road safety near schools. They could also be linked to School Streets, as discussed in Theme 6 above.
- Cycle Training: Local authorities should introduce or continue to support cycle training programmes within schools and for families, to teach essential bike riding skills, hazard awareness and safe road habits. Training should also continue to be provided to adults who live, work or study within the Boroughs. Research has proved the positive impact of cycle proficiency training on cycle-related behaviours and accidents[26].
- Pedestrian Skills Training: Local authorities should introduce or continue to support training programmes within schools and for families, to teach children about road hazard awareness, safe walking behaviours and essential skills to make safe independent journeys. These training programmes have been proven by research to rapidly increase children's awareness, and that skills are maintained year-on-year[27].

- Motorcyclists Skills Training: Local Authorities should introduce or continue to support training programmes within the London Boroughs to improve riding skills, promote safe road habits and hazard awareness. Training is demonstrated to increase the use of personal protective equipment among motorcyclists.

Targeting key risk groups

Most of the training opportunities normally introduced in order to tackle road safety focuses on school children/youths, as communication channels are easier to set up through schools and educational institutions. The preliminary analysis of collision trends highlighted that the majority of collisions, including those involving vulnerable users, affect young/adult males between 16 and 59, who make up the largest group of cycle and powered two-wheelers users. As such, targeted strategies should look for alternative ways of communicating with these age groups. These could include:

- Organising pop-up events near collision hotspots to raise awareness;
- undertaking free safety checks on bicycles and powered two-wheelers;
- distributing safety equipment such as hi-visibility vests;
- Providing incentives (working in partnership with local businesses) to encourage powered two-wheelers owners to maintain their vehicles and to use appropriate safety equipment;
- Working with Business Improvement Districts (BIDs) and business owners (particularly those employing cyclists/motorcyclists for deliveries) to ensure that vehicles and equipment meet legal requirements.

It is also useful to consider how individuals can be encouraged to actually take up the initiatives and opportunities that are available, perhaps as part of a broader engagement and exploration of the alternative travel options that are relevant to them/their own circumstances. For example, engaging with individuals in a personalised way, e.g., as part of a personalised travel planning approach, helping them to explore the alternative travel options that are available, and providing them with support to try them out (which might include some of the training opportunities above) can be effective in helping people to make a change.

Enforcement

Traffic law enforcement strategies are a separate component of behavioural strategies, targeting dangerous behaviour as an instrument to discourage negligence and minimise the risk of reoccurrence of bad practices. There is considerable evidence that substantial changes in the extent of police enforcement are correlated to changes in the number or severity of traffic accidents; more enforcement is associated with fewer accidents[28].

Local Authorities can work in collaboration with Transport for London, the Metropolitan Police and City of London Police to define the most appropriate strategies and tools to adopt. These include:

- Police Patrolling - This consists of police officers recording traffic offences in road traffic from the roadside and stopping offenders immediately for sanction. The physical presence of police officers on the roads has a positive deterrence effect on road users. Police checks can be done randomly, systematically, or with a focus on particular groups of drivers, depending on the police capacity and the traffic situation.

- Automated Traffic Enforcement (using detectors such as cameras) is mainly applied to speed and red-light violations; bus lane violations; and traffic restrictions such as pedestrian zones, turning bans, bus gates. The increased use of digital video and image processing technology, as well as the electronic identification of vehicles, has paved the way for extending the applications to a wider spectrum of violations.

Technology and vehicle features

In order to complement enforcement, technology can also play a role in positively influencing driver behaviour. While the use of these tools is largely outside the responsibility and control of local authorities, they can still play a role in promoting them. In addition, local authorities can also lead by example, for example by specifying the use of such measures in their own vehicle fleets, and the vehicle fleets used by their contractors (e.g., for highway maintenance vehicles or refuse collection vehicles). These measures include:

- In-car technologies built into vehicles by manufacturers either as optional safety features or to comply with legal requirements (Intelligent speed assistance, distance warnings, seat belt reminders);
- Tracking apps measuring compliance with speed limits and other traffic restrictions (these are sometimes used by freight providers to monitor behaviour of their employees and encourage compliance but have been recently marketed as opportunities for individual drivers to prove their traffic law compliance and obtain discounts on car insurance costs).

Figure 5.15 Cycle Training Campaign (Source TfL)

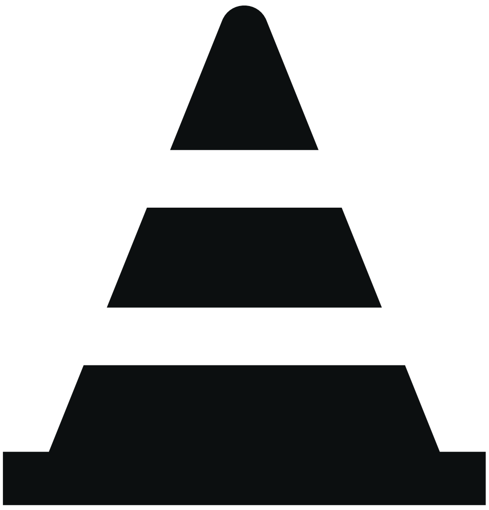
Table 5.9: Theme 8 Potential Measures

Measure	Cost	Complexity
Pedestrian Skills Training	$$	**Moderate – requires engagement with schools**
Cycle Training Programme	$$	**Moderate – requires engagement with schools**
Motorcyclists Skills Training	$$	**Moderate**
Introduce school travel plans	$	**Moderate – requires engagement with schools**
Organise pop-up events near collision hotspots; undertake free safety checks on bicycles and powered two-wheelers; distribute safety gadgets such as hi-visibility vests	$	**Low**
Provide incentives (working in partnership with local businesses) to encourage powered two-wheelers owners to maintain their vehicles and to use appropriate safety equipment	$$	**Moderate/High**
Work with BIDs and business owners (particularly those employing cyclists/motorcyclists for deliveries) to ensure that vehicles and equipment meet legal requirements	$$	**Moderate/High**

Figure 5.16 Speed enforcement along the TLRN (Source TfL)

Theme 9 – Temporary, interim and experimental interventions

While temporary and interim interventions cannot address all existing road safety issues, they can still make a noticeable positive impact and provide a quick and effective demonstration of the potential impact of more permanent solutions. This is especially applicable in the context of limited funding / resources.



Some of the measures investigated as part of the 10 Case Studies were originally implemented as temporary changes/restrictions and confirmed as permanent only after a trial period.

For example, the ‘Bank on Safety’ scheme was implemented as an experimental order initially, and then made permanent through the introduction of further improvements (footway widening etc..). In a similar vein, the Millbank Roundabout improvement have been delivered using rubber kerbs retrofitted onto the old junction layout as an interim scheme. The intention is to then subsequently deliver a more comprehensive transformational scheme that will look at signalising the junction.

While temporary and interim interventions cannot address all existing road safety issues, they can still make a noticeable positive impact and provide a quick and effective demonstration of the potential impact of more permanent solutions. This is especially applicable in the context of limited funding / resources: addressing all road safety hotspots in a Borough at the same time, through permanent schemes can be extremely costly and lengthy. More transformational schemes also require more time to engage with the community and stakeholders. In certain circumstances, temporary solutions can tackle existing and pressing issues in the short term, while permanent schemes are planned and developed taking the appropriate time to engage with the community, undertake surveys and analyses, and consider range of options.

An important element of temporary and experimental interventions is combining design and delivery with the development of an effective monitoring and evaluation strategy, able to capture all the benefits and impacts of the scheme. This evidence can then be used to inform the design and development of a permanent scheme.

The COVID-19 Emergency Response Strategies that local authorities across London have had to implement in a very short period of time throughout the last two years have highlighted how temporary schemes can address short term issues and have required local authorities to develop methodologies and protocols for the roll-out and monitoring of temporary schemes. This experience can constitute the basis for the development of similar approaches in the implementation of road safety focused experimental schemes.

Useful reference documents published by TfL on the topic of experimental schemes and Monitoring and Evaluation Strategies are the 'Guidance for delivery of experimental Healthy Streets schemes' (2021)[29] and the 'Borough monitoring guidance for Healthy Streets schemes' (2021)[30], even though their primary focus is not on road safety.

Figure 5.17 Temporary footway extension, Bankside Boardwalk (source Better Bankside)

Figure 5.18 Temporary footway extension with cycle parking, Epping High Street

Conclusions

Road Safety Trends and Patterns 2016-2020

The analysis of STATS 19 Collision Data for the period 2016-2020 across the ten CLSTRP Boroughs confirmed the substantial plateau in the number of collisions (and particularly Fatal and Serious Collisions) recorded pre-pandemic year on year. This suggests that, despite the great efforts made by local authorities in the past few years to tackle road danger, significant additional work will be required in the upcoming years in order to achieve Vision Zero by 2041, as targeted by the Mayor Transport Strategy.

- The analysis highlighted how pedestrians, cyclists and motorcyclists are still by far the most involved and most affected users in collisions across Central London, calling for more action oriented towards protecting these groups.
- The gradual introduction of 20mph speed limits across the majority of Central London's road network is proving effective in reducing the number and severity of collisions. London Boroughs and TfL should continue to work on speed reduction strategies, including enforcement and behavioural change.
- Junctions are the key hotspots for collisions across all Boroughs. Managing conflicts and reducing them as far as possible (either through traffic management strategies or infrastructure improvements) should continue to be a priority.

Analysis of Ten Case Studies

All case studies witnessed reductions in the number of collisions and/or in the proportion of Fatal and Serious, supporting the efforts towards the achievement of Vision Zero.

The most common reasons for the success of these case studies are:

- speed reduction strategies;
- traffic management strategies;
- improvements to crossings and footways;
- provision of high-quality cycle facilities;
- removal/reduction in conflict between user groups (e.g., cycles and general traffic; buses and general traffic; pedestrians and cycles…).

Guidelines

A set of Guidelines has been developed using the findings of the analysis of collision statistics across the ten CLSTRP Boroughs and of the ten case studies as a starting point. The Guidelines have been organised into seven themes:

- Theme 1 – Pedestrian priority
- Theme 2 – Cycle Facilities
- Theme 3 – Powered Two-Wheelers
- Theme 4 – Speed
- Theme 5 – Public Transport
- Theme 6 – Freight vehicles
- Theme 7 – Traffic Management
- Theme 8 – Behavioural Strategies and Enforcement
- Theme 9 – Temporary and Experimental Interventions

The themes can help in navigating through the range of potential road safety measures available to designers and highway authority. However, a key finding has been that there is no 'one size fits all' solution to achieving Vision Zero. Rather, the most appropriate mix of measures in any location will need to be tailored to its specific context and challenges.

Another overarching finding is that ambitious action will be needed to achieve Vision Zero. The context of central London means that its road network is intensively used a range of road users, inevitably leading to conflicts. As such, measures that remove conflicts are likely to be essential, including those that seek to reduce motorised traffic.

Abbreviations

Abbreviation	Full Name
ASL	Advanced Stop Line
BID	Business Improvement District
CBT	Compulsory Basic Training
CLSRTP	Central London Sub-Regional Transport Partnership
CRP	Cross River Partnership
CS	Cycle Superhighway
DVS	Direct Vision Standard
EU	European Union
F&S	Fatal and Serious
FORS	Fleet Operator Recognition Scheme
HGV	Heavy Goods Vehicle
KSI	Killed or Seriously Injured
LCDS	London Cycle Design Standards
LTN	Local Transport Note
LTN	Low Traffic Neighbourhood
MPH	Miles per hour
PTW	Powered Two-Wheeler
RoSPA	Royal Society for the Prevention of Accidents
STATS19	Statement of Administrative Sources, personal injury road traffic accidents
TfL	Transport for London
TLRN	Transport for London Road Network
UK	United Kingdom
USA	United States of America
VRU	Vulnerable Road User

References

1 Available here: https://www.london.gov.uk/what-we-do/transport/our-vision-transport/mayors-transport-strategy-2018

2 Available here: https://crossriverpartnership.org/projects/central-london-sub-regional-transport-partnership/

3 Matts-Åke Belin, Per Tillgren & Evert Vedung (2012) Vision Zero – A Road Safety policy innovation, International Journal of Injury Control and Safety Promotion, 19:2,171-179, DOI: 10.1080/17457300.2011.635213

4 Ellen Kim, Peter Muennig, Zohn Rosen (2017) Vision zero: a toolkit for road safety in the modern era, Injury Epidemiol. 2017;4(1):1–9. - PMC - PubMed

5 Available here: https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf

6 Available here: https://content.tfl.gov.uk/vision-zero-action-plan-progress-report-2021.pdf

7 RoSPA, Road Safety Factsheet, July 2018, https://www.rospa.com/rospaweb/docs/advice-services/road-safety/roads/safe-system.pdf

8 Parliamentary Advisory Council for Transport Safety (PACTS) (Not dated) 'Safe System' http://www.pacts.org.uk/safe-system/

9 Taylor, M.C., Lynam, D.A. and Baruya, A. (2000). The effects of driver´s speed on the frequency of road accidents. TRL Report 421. Transport Research Laboratory, Crowthorne.

10 Ashton, S. J. and Mackay, G. M. (1979) 'Some characteristics of the population who suffer trauma as pedestrians when hit by cars and some resulting implications' URL: http://www.ircobi.org/wordpress/downloads/irc1979/pdf_files/1979_4.pdf

11 A. Martin, Factors Influencing Pedestrian Safety - A Literature Review (Commissioned by Transport for London in 2006) http://content.tfl.gov.uk/factors-influencing-pedestrian-safety-literature-review.pdf

12 Planning For Walking Toolkit available here: https://content.tfl.gov.uk/the-planning-for-walking-toolkit.pdf

13 Walking Action Plan available here: https://content.tfl.gov.uk/mts-walking-action-plan.pdf

14 Streescape Guidance available here: https://content.tfl.gov.uk/streetscape-guidance-.pdf

15 Pedestrian Comfort Level Guidance available here: https://content.tfl.gov.uk/pedestrian-comfort-guidance-technical-guide.pdf

16 Healthy Streets Policies avaliable here: https://tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/healthy-streets

17 TN 01/20 can be found here: https://www.gov.uk/government/publications/cycle-infrastructure-design-ltn-120

18 London Cycle Design Standards are available here: https://content.tfl.gov.uk/lcds-chapter1-designrequirements.pdf

19 ETSC. Brussels: European Transport Safety Council; 2005. Motor vehicle speed in the EU. http://www.etsc.eu/documents/FS_speed.pdf

Constant, A., & Lagarde, E. (2010). Protecting vulnerable road users from injury. PLoS medicine, 7(3), e1000228. https://doi.org/10.1371/journal.pmed.1000228

20 Webster, D. and R. Layfield (2007), Review of 20 mph zones in London Boroughs, UK: TRL.

21 Harthoorn, Maggie, "Influence of Street Trees on Roadway User Safety" (2017). Community and Regional Planning Program: Student Projects and Theses.

22 Accessible Bus Stop Design Guidance available here: https://content.tfl.gov.uk/bus-stop-design-guidance.pdf

23 Traffic Calming Measures along Bus Routes available here: https://content.tfl.gov.uk/trafficcalmingmeasuresleaflet-rev-final.pdf

24 Available here: https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/school-streets-air-quality-study

25 Impacts of 2020 Low Traffic Neighbourhoods in London on Road Traffic Injuries https://findingspress.org/article/25633-impacts-of-2020-low-traffic-neighbourhoods-in-london-on-road-traffic-injuries

26 McLaughlin, Karen & Glang, Ann. (2009). The Effectiveness of a Bicycle Safety Program for Improving Safety-Related Knowledge and Behaviour in Young Elementary Students. Journal of paediatric psychology.

27 Yeaton, William & Bailey, Jon. (1978). Teaching pedestrian safety skills to young children: An analysis and one-year follow-up. Journal of applied behaviour analysis.

28 Tapani Mäkinen, David M. Zaidel et al. Traffic enforcement in Europe: effects, measures, needs and future April 2003

29 Available here: https://content.tfl.gov.uk/guidance-for-delivery-of-experimental-healthy-streets-schemes-oct21.pdf

30 Available here: https://content.tfl.gov.uk/monitoring-guidance-for-healthy-streets-schemes-boroughs-oct21.pdf

Towards Vision Zero: Guidelines to help Local Authorities in the development of Road Danger Reduction Strategies and Action Plans - 2022

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