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Vulnerable Road Users  
Final Proposal of the  
Interactive Qualifying Project

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## **ABSTRACT**

Among European countries, child pedestrian fatalities are highest in the United Kingdom, and cycling is increasing there as an environmentally friendly yet hazardous form of transportation. We assisted the London Borough of Merton in addressing the safety of these two groups by determining areas of perceived risk, the existing threat of injury, and the relationship between these two types of data. Finally, we were able to propose reasons and solutions to the Borough to increase safety, and eventually, vulnerable road user numbers.

# EXECUTIVE SUMMARY

Among European countries, child pedestrian fatalities are highest in the United Kingdom. The Mayor of London has made efforts to set goals for all the Boroughs of London to decrease child pedestrian fatalities in their jurisdictions. Additionally, cycling has been promoted as an environmentally conscious form of transportation that is more compatible with the safe and environmentally aware future London is working toward.

The London Borough of Merton requested our assistance in addressing the safety concerns of child pedestrians and cyclists within the Borough. This project was appropriate for us to complete as an Interactive Qualifying Project due to its challenging nature, affect on public policy, and the benefit to society through safety and environmental concerns.

In order to gain the proper background for this project, we researched into several areas. We determined the most cost-effective traffic safety measures utilized around the world, the current plan of the Borough of Merton, the laws and suggestions of the London Boroughs, and perceived risk concerns. From this information, we were able to provide the best suggestions possible, understand what the Borough is currently undertaking to improve safety, rules and regulations pertaining to road safety, and how to best approach our determination of perceived risk.

We approached this problem by determining, through interviews, where these two groups of vulnerable road users feel at danger. Then, we compared this data with actual accident statistics in three ways. First, we compared the ranking given by respondents to the accident rates on each road. Then, we compared the comments from the interviews with the types of accidents that occurred in each area. Finally, we used traffic accident software to generate clusters of accidents, and compared the areas with those mentioned by the interviewees.

From the data we gathered and the accident reports the software generated, we were able to generate a comparative ranking of perceived risk versus objective risk, determine the relationship between the two types of risk, and propose measures to improve these two types of risk as well.

The conclusions we formed were dramatically different for child pedestrians and cyclists. The children seemed unaware of the actual risk of an accident on the roads they crossed, and ranked the roads as high risk based on traffic density and the vicinity of a convenient crossing. The percentage of roads that were ranked by pedestrians within one or two places of the objective ranking was 7%. Most accidents occurred through pedestrians stepping into the road when it was unsafe to cross.

Conversely, the cyclist data showed a relationship between perceived and objective risk. Based upon the cyclist rankings of the roads versus the number of accidents on the roads, 20% of the roads were ranked within two places of the objective ranking. However, the clusters generated showed a much higher relationship. Of the top five clusters generated by the software, three were cyclist sites of high perceived risk. From these two sets of data, we can say that measures taken to improve objective risk for cyclists will also improve perceived risk.

In order to propose solutions to improve safety conditions for child pedestrians and cyclists, we examined the suggestions made, dangerous areas, and accident trends over three periods of years for the last nine years. From this, we were able to generate a list of seven recommendations that would increase the safety of both child pedestrians and cyclists.

Our first recommendation is the use of school crossing patrols at roundabouts near schools. School crossing patrols help children judge gaps in traffic when crossing, and have the benefit of increasing the awareness of motorists, which will in turn aid cyclists.

We also propose replacing existing waiting restrictions with build-outs. Build-outs increase the ability of pedestrians to see motorists, and vice versa. They also decrease the number of parked cars and reduce the need for cyclists to swerve around vehicles and opening doors.

Next, we suggest replacing pedestrian refuges with Zebra or split Toucan crossings. Pedestrian refuges are too narrow to allow pushchairs, cycles, and wheelchairs to cross safely. The responses of pedestrians who were opposed to pedestrian refuges proposed the replacement with alternate crossings.

Utilizing alternate traffic calming measures instead of road humps, particularly in the town centres and the Savacentre roundabout has two benefits. Traffic calming measures such as build-outs and crossings assist pedestrians as well as slow traffic, and do not cause difficulties to cyclists.

Also, we propose increasing the number of cycle lanes, focusing first on the Wimbledon Centre. It increases the safety of cyclists, and reduces the number of cyclists using footpaths meant for pedestrians.

As a specific suggestion, we suggest an improvement to the intersection near the Collier's Wood Station. The angle of Christchurch/High Street Collier's Wood intersection is not conducive to visibility. Increased line of site reduces errors in giving way to both cyclists and pedestrians.

Finally, we propose the Borough expand current educational programs to include alternate traffic calming measures, cyclists' right to the road, and the dangers of opening doors into a cyclists' path. Including alternate traffic calming measures increases public awareness of

the many ways the Borough increases safety. Increasing acceptance of cyclists on the road will help decrease accidents from impatience and unawareness.

With the completion of this project, these suggestions we were able to propose will help the Borough of Merton decrease child pedestrian fatalities and cyclist injuries as well.

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The London Borough of Merton wishes to increase the safety of vulnerable road users. If safety conditions do not improve, the Borough will face a governmental funding loss. The Borough is also interested in reducing vehicular congestion, which is a side effect of increasing the safety in alternate forms of transportation, specifically, cyclists and pedestrians. In order to reduce congestion, cyclist, pedestrian, and transit (public transportation) traffic use will need to increase to accommodate persons no longer utilizing automobiles as a means of regular transportation. We examined current safety measures and conditions in our efforts to improve safety and thereby reduce vehicular congestion.

There are many obstacles to increasing non-vehicular traffic. Potentially, vulnerable road users (VRU) face dangers from vehicles while walking, cycling, and travelling to transit access points. VRU also consider many external discouragements to adopting non-vehicular forms of transportation. External discouragements are outside inconveniences that do not endanger a person, but still influence the decision-making process. Personal danger, discomfort, and inconvenience can persuade commuters to opt for traditional automobile transportation.

The most important of these considerations is personal danger. We researched citizens' perceptions of dangerous areas and their reasons for these perceptions. Once a ranking was given of the most dangerous areas, methods of improving sites and providing incentives to alternate forms of traffic were suggested. Specific areas of high risk were examined for the types and reasons for the present risk, and the appropriate improvements were recommended to the Borough of Merton.

The measure of personal risk felt by commuters is the perceived risk. Determining perceived risk was accomplished through VRU input. By tracking and interviewing cyclists and pedestrians, an accurate portrayal of the total perceived risk and areas of high perceived risk was determined. Through interviews and observation, an accurate ranking of perceived risk sites was obtained.

To determine the relationship between objective and perceived risk, we used two methods. First, we used information from interviews to determine where VRU feel threatened the most. Then, the measure of objective risk was determined from accident reports. Through accident rates and public opinion, an accurate ranking and description of dangerous areas was determined.

There are many methods for increasing non-vehicular transportation use. The three main areas of concentration are increased safety, incentives, and public awareness. To increase safety, improved crossing designations, traffic calming, and cyclist traffic control are very effective to decrease objective and perceived risk. In addition to decreasing risk, it is important to provide incentives for non-vehicular forms of travel as well as to discourage automobile use. This can be accomplished through monetary rewards, increased convenience, and creating public awareness. Creating slogans and public messages encourages cycling and transit by making the benefits widely known and also advertising any incentives that may be in place. It is also necessary that improvements to objective safety be well-stated and publicly known to decrease perceived risk. These methods must be combined to decrease traffic congestion.

This project was appropriate for an Interactive Qualifying Project (IQP) because it required an analysis of community opinion, it affected public policy, and its results will improve the society because of enhanced safety and reduced vehicle emissions. We gathered information

about perceptions and danger in the VRU community of the Borough of Merton in order to best assess their needs and fears. With an accurate picture, we were able to form a plan of action to help remove barriers to non-vehicular transportation. We assisted the Borough of Merton in improving its safety and traffic problems through input from residents.

In order to propose effective solutions, we researched four areas of concern. First, the Highway Code was read to understand current measures in place for the protection of VRU. Second, the current plan of action for the Borough of Merton was reviewed to gain a better awareness of goals and desired outcomes. Third, past effective measures for increasing safety of VRU were examined to propose the best methods for improvement. Lastly, perceived risk and issues concerning evaluation, definition, and decision-making influences were researched.

In Chapter 2, the literature we researched will be discussed. This will cover the Highway Code, the current plan of the Borough of Merton, measures to improve traffic flow, and finally risk. Chapter 3 will explain our methods and reasons for data collection. Next, Chapter 4 will present the data we collected and the conclusions we drew. Finally, in Chapter 5 the implications of the data and the recommendations for the Borough of Merton will be concluded.

To increase safety of pedestrians, we ranked sites through interviews and statistical data adequate to help us propose solutions. In order to know the best solutions, we researched four areas of concern: the Highway Code, the current plan of action, effective measures, and perceived risk.

### **2.1 United Kingdom/London Highway Code**

The Highway Code is the set of laws, rules, suggestions, and penalties that apply to pedestrians, cyclists, motorcycles, and automobiles in the United Kingdom. It, however, does exclude commercial vehicles such as taxis and lorries, which have more requirements than are necessarily listed in the Highway Code. The most vulnerable road users are pedestrians, cyclists, motorcyclists and horse riders, particularly, children, elderly and disabled people, and learner and inexperienced riders (Highway Code, page 48), (Traffic Calming and VRU, Part 1 and 2 1997-1998).

The laws covered are important to vulnerable road users for two reasons. Primarily, they raise the awareness of VRU by providing some safety precautions and making VRU aware of their rights. Secondly, they also raise the awareness of motor vehicle operators (MVOs) about VRU. In addition, they help lay a framework for road use by both VRU and MVO. These laws and suggestions will be explained in the following sections.

### 2.1.1 Pedestrian Suggestions

The Highway Code lists the laws for pedestrians, but offers safety suggestions as well. The suggestions cover areas to walk, improving visibility, safety guidelines for children, and precautions to take with large vehicles.

The first topic covers suggestions for areas in which to walk in various circumstances. The Highway Code states, 'Pavements and footpaths should be used if provided' (Highway Code, page 5). In the cases where there are no pavement or footpaths, walking on the right-hand side of the road is suggested. By walking to the right-most side, the VRU is most visible to oncoming traffic and oncoming traffic is most visible to the VRU.

Another important consideration is maximising visibility through clothing. Wearing bright colours or even fluorescent materials will increase a VRU's visibility to other road users, especially in inclement weather as well as at night. By appearing as noticeable as possible, VRU will give MVO the maximum time to react to their presence and be aware enough to avoid any possible collisions.

The Highway Code lists precautions for small children. When they are out, an adult should walk between them and the road, being sure to hold their hand firmly. Very young children should be strapped into pushchairs or use reins. It is critical to the child's safety that they are well supervised at all times.

Larger vehicles can be more dangerous to VRU, having less control and visibility than the average motor vehicle. These larger vehicles include emergency vehicles, buses, and trams. VRU must take special care when crossing near hospitals, fire and police stations, or near any emergency vehicles. Proper procedure is to wait until there are no longer emergency vehicles

passing and then cross the road. In the case of buses, VRU should always enter and exit only when the bus is stationary. Also, they must be careful never to cross directly in front of or directly behind the bus, instead waiting until it has left before crossing the road. They should also be cautious of cyclists that may be overtaking the bus while it is stopped. Care should also be taken when crossing tram paths. Since the trams move silently and cannot steer, crossing should be done only at designated areas, where amber lights allow VRU to know when a tram is coming. It should also be emphasised that one should never walk along the tracks because trams move quickly and silently. These larger vehicles must be shown more concern than the average motor vehicle due to their size and the operator's loss of sight.

#### 2.1.2 Pedestrian Crossing Procedure

Crossings are the most dangerous areas for VRU. It is common for a VRU to look down the street they are crossing, but very rarely behind them for vehicles entering the street. When crossing, they must be aware of turning vehicles. VRU often have difficulties at staggered or island crossings. They may assume that time is allowed for crossing from one side to another, when it is not. Rather, these are two separate crossings and must be treated as such. A VRU that reaches the middle island must then wait and follow the green crossing code again (Highway Code, page 6). In the case of Pelican, Puffin, and Toucan crossings, one must wait for the light again before crossing. Ignorance of these concerns can lead to additional VRU danger.

Advice for the green cross code is given in the form of suggestions for crossing the road and is highly recommended that it be taught to children. It is a five-step system and has some details that one might take for granted. At a quick glance the steps include: find a safe place to cross, stop at the kerb, then look and listen for traffic, wait until all the traffic has passed and



then when it is safe go straight across the road, without running. These steps are covered in detail below.

The first step in crossing the road is finding a safe place to cross. The Highway Code recommends using subways, footbridges, islands, or crossings such as the Zebra, Pelican, Toucan or Puffin. In addition, any controlled crossing point where a police officer, a school crossing patrol or traffic warden is positioned, is another safe place to cross (Highway Code, page 6). If none of these options are convenient, VRU should find a place where traffic travelling in both directions can be watched and avoid crossing between parked cars or on blind curves.

The next step in crossing the road is to stop right before stepping into the road. This is a good location from which to observe traffic. Even if traffic is not moving in one lane, another lane may have a turn signal to flow freely where a VRU would be crossing, and they should observe traffic flow to be aware of this.

The third step in crossing the road is to watch and listen for traffic. It is an important step because traffic can come from all directions. Listening allows for the consideration of traffic that may be out of sight.

Fourth, if traffic is approaching, it should be allowed to pass before the VRU enters the roadway to cross. Even if traffic is a good distance away, it could be travelling at high speeds. They should simply make sure that the gap in traffic is large enough to safely cross the road.

Finally, once the VRU is ready to cross the road, they must continue to look and listen for traffic in case some section might have been overlooked. Traffic may appear suddenly, and being aware is important in order to safely cross the road. These five steps can help any pedestrian cross safely.

### 2.1.3 Specific Laws for Pedestrians

There are three laws stated in the Highway Code specific to pedestrians. The Highway Code mandates, ‘You must not walk on motorways or slip roads except in an emergency’ (Highway Code, page 6). Secondly, ‘You must not get on to or hold on to a moving vehicle’ (Highway Code, page 8). Finally, ‘You must not loiter on Zebra, Pelican or Puffin crossings’ (Highway Code, page 8). All of these rules are in place to help ensure the safety of pedestrians.

### 2.1.4 Suggestions for Cyclists

Suggestions for cyclists include general clothing considerations and travelling recommendations. Cyclists are advised to wear a helmet that conforms to current regulations. Along with a helmet, clothing that is safe, in the sense that it will not get tangled with the wheels or chain and is visible for other road users, is highly recommended. Using cycling paths and lanes is also recommended when provided, though care must be taken to share them with other cyclists and be aware of pedestrians travelling nearby. Collisions with other VRU can be just as hazardous as some low-speed collisions with MVO.

Cyclists should be aware of certain riding recommendations to avoid accidents. To begin with, cyclists should keep both hands on the handlebars except when signalling or changing gear. Next, they should keep both feet on the pedals and not ride more than two abreast. To help decrease risk, another recommendation is to ride in single file on roadways that are busy or narrow and make sure not to follow too closely behind another vehicle. In addition, cyclists must be sure that any cargo that they carry on their cycle is safe and will not affect balance or control. Finally, consideration of other cyclists will help prevent collisions.

Following these suggestions will help reduce risk, not just for the cyclist, but also for all VRU and MVO.

#### 2.1.5 Laws for Cyclists

The laws for cyclists are clearly laid out in the Highway Code and must be obeyed by cycle users at all times. The first law concerns visibility of the cyclist. When operating a cycle at night it must have front and rear lights lit. It must be fitted with a red rear reflector (and amber pedal reflectors, if manufactured after 1/10/85). Flashing lights and other reflectors may help the cyclist to be seen, but must not be used alone (Highway Code, page 13).

The second law for cyclists is concerning cycle tracks. These are normally located away from the road, but may occasionally be found alongside footpaths or pavements. Cyclists and pedestrians may be segregated or they may share the same space (unsegregated). When using segregated tracks, cyclists must keep to the side intended for them. They must take care when passing pedestrians, especially children, elderly or disabled people, and allow them plenty of room. It is important that cyclists always be prepared to slow down and stop if necessary (Highway Code, page 14).

Certain laws are identical to both cyclists and MVO. Cyclists must obey all traffic signs and traffic light signals. They must not ride in a dangerous, careless, or inconsiderate manner or ride when under the influence of alcohol or drugs (Highway Code, pages 14-15).

In addition, they must not carry a passenger unless the cycle has been built or adapted to carry one. Holding onto a moving vehicle or trailer is also prohibited (Highway Code, pages 14-15).

Some location-based laws for cyclists include where to cycle. Cyclists must not cycle on pavement, or leave the cycle where it would endanger or obstruct other road users or pedestrians, for example, lying on the pavement. Cycle parking facilities must be used where provided.

There are two final laws for cyclists, both of which involve crossing the road. The first law states that they must not cross the stop line when the traffic lights are red. Some junctions have an advanced stop line to enable them to be positioned ahead of other traffic (Highway Code, page 15). The second law involves crossing roads with cycle-only crossings. Cycle tracks on opposite sides of the road may be linked by signalled crossings. They may ride across but must not cross until the green cycle symbol is showing (Highway Code, page 16).

#### 2.1.6 Motor Vehicle Laws Applying to VRU

This section provides detailed explanations of the motor vehicle laws applying to VRU and areas through which VRU may be travelling.

A motorist must not drive or park in a cycle lane during times of operation. A motorist must not drive over pavement, footpaths or bridleways except to gain lawful access to property (Highway Code, page 31).

Drivers are to practice caution and be aware of traffic-calming measures. These features include roads humps, chicanes and road narrowing that aids in reducing the speed of traffic.

Drivers are also to be cautious of cyclists. If a cyclist looks over his or her right shoulder while riding it can mean that they intend to turn right. A driver should be aware of this and give the cyclist room to do so. Cyclists may suddenly need to avoid uneven road surfaces and obstacles such as drain covers or oily, wet or icy patches on the road (Highway Code, page 50).

Also, care should be taken when overtaking a cyclist, and as much room as another vehicle is given should be given to the cyclist.

Drivers at road junctions should be particularly cautious in watching for cyclists and pedestrians. Extreme observance should be used when cornering because pedestrians may have already entered the crosswalk and have the right of way.

Advanced stop lines should be paid notice. Motorists must wait behind the first white line reached, and not encroach on the marked area. They must allow cyclists and buses time and space to move off when the green signal shows.

Motorists must not park in crossings or in areas covered by zigzag lines. Overtaking the moving vehicle nearest the crossing, or the vehicle nearest the crossing that has stopped to give way to pedestrians, is prohibited (Highway Code, page 45).

Care must be taken when approaching Zebra crossings. A motorist must be on the lookout for people about to enter the Zebra crossing and be ready to slow for them. As a motorist, one must give way when a pedestrian has moved onto the crossing. Motorists should not wave a pedestrian across a crosswalk because other vehicles may not stop, since the pedestrians have not yet entered into the crosswalk.

Pelican crossings are street crossings with stoplights and amber crossing lights. A motorist must stop when the red lights show. When the amber light is flashing, the motorist still must give way to the pedestrians in the crossing. If there are no pedestrians in the crossing when the light is blinking, then the motorist may proceed but be sure to do so with caution. Note must be made that Pelican crossings that go straight across the road are one crossing and time must be given to those pedestrians crossing from the other side of an island. Toucan and Puffin crossings are similar to Pelican crossings, although there is no blinking light.

Motorists must stop when a school crossing patrol shows a 'Stop' for children sign. However, in urban areas there is a risk of pedestrians, especially children, stepping unexpectedly into the road. Motorists 'should drive with the safety of children in mind at a speed suitable for conditions' (Highway Code, page 49).

Particularly vulnerable pedestrians include children and elderly pedestrians who may not be able to judge motorist speed and could step into the road in front of moving traffic. At 40 mph, a vehicle hitting a pedestrian will probably cause a fatality. At 20 mph, there is only a 1 in 20 chance of the pedestrian being killed (Highway Code, page 48).

#### 2.1.7 Conclusions

By examining the laws and suggestions, we determined what measures are currently in effect and what areas are lacking. It was also possible for us to determine which current laws are not as effective as VRU would like them to be. We also determined the adherence to these laws and suggestions among the VRU. From this, we provided insights into improvements and decisions on appropriate areas of VRU education.

## **2.2 Current Plan of Action**

The London Borough of Merton is continuously changing, adding, and revising plans to help improve and create safer roads, both for vehicle road users and non-vehicle road users. Today, the Borough of Merton has a very specific plan to reduce the risk of road injuries for all types of transportation, including motorists, pedestrians, and cyclists. The main points that the Borough of Merton is working on include plugging the public transport accessibility gap, expanding green transport initiatives, reducing casualties and sense of danger, enhancing the

highway asset, working in partnerships, strengthening Wimbledon as a regional gateway, and managing town centres. Although these are all key points to look at, we will concentrate on the first three.

First, we will discuss the Borough's plans for plugging the public transport accessibility gap. Public transportation in the Borough of Merton is not as extensive or as detailed as the centre of London's public transportation, and is trying to catch up within the next few years. According to the Interim Transport Plan, the 'mayor's priority [is to] reduce traffic congestion, increase bus use, improving interchange [of the rail connections, and make] healthy town centres' (ITP, page 2). With this thought in mind, the Borough of Merton is working hard to increase the Croydon Tramlink. The Borough has also found a very important passageway to Wimbledon from Mitcham via Colliers Wood, where most types of transportation are deficient for this area. The Borough of Merton is planning on locating other gaps similar to Wimbledon from Mitcham to help reduce the need for its residents to have to walk over one kilometre to their next station (ITP, page 26). Although the rail lines are relatively helpful, the Borough of Merton also is planning on looking at 'increasing the passenger capacity and train frequency on certain routes' (ITP, page 42).

Expanding green transport initiatives is another objective that the Borough of Merton is working toward. In London, the responsibilities of the Mayor include an 'Air Quality Strategy [or] the Environmental Act 1995, which places duties on local authorities to review and assess air quality to determine whether national air quality objectives are likely to be met by 2005' (ITP, page 26). The Borough of Merton has a few programs like the 'Don't Choke London Campaign', however, it plans to continue and increase its efforts to improve air quality. An effective approach is for the Borough of Merton to look at the main cause of air pollution, which

is traffic. In order to decrease the traffic, the Borough is planning to continue the idea of the Green Travel Plan (GTP) in the hope that within a year or so, many companies will adopt their own GTP. The GTP is a management approach that analyses the key transport challenges and opportunities facing an employer. It provides the structure to develop an integrated, strategic response (DETR, 1999). The adoption of the GTP would be a giant step to reduce the traffic, and therefore air pollution, in the Borough of Merton.

The other key point that we will consider is reducing casualties and sense of danger. There are many targets that the Borough of Merton plans to look at in order to reduce casualties in the near future. The first is the school zones where many children are at great risk due to walking and cycling to and from school each day. According to 'Tomorrow's Roads — Safer for Everyone' (TRSfE 2000), Great Britain had the second highest child pedestrian fatality in a 1997 international comparison, with approximately 121,000 deaths. The target is a 50% reduction of deaths and serious injuries to children by 2010 (TRSfE 2000, page 11), (Pearce, page 16). The Borough of Merton is already heavily working on this area, and another IQP group from Worcester Polytechnic Institute (WPI) has worked with six particular schools to help improve safety for the children, including a School Travel Plan campaign (ITP, page 51). Secondly, the Borough of Merton plans on looking into different areas where casualties are higher than average. Once these areas are located, many provisions will occur, including reduction of speed limits, addition of road safety monitoring, and other accident-reduction measures. Also, the Borough has recently acquired map-based accident analysis software, which enables the Borough of Merton to identify accident locations and to plot them onto a map background (ITP, page 65). The Borough also plans on working with the community to find out where citizens feel they are the most in danger and why they feel this way. To reduce casualties



and the sense of danger, Merton will be working with schools and danger zones with the hope that within the next nine years, the casualty rates will decrease by 40% in the number of people killed or seriously injured, with a 50% reduction in the rates for children (ITP, page 2). Our goal is to help the Borough of Merton realise this reduction in casualty rates through our research in the community.

In conclusion, the Borough of Merton wishes to reduce casualties and would also like to continue the goal of reducing air pollution. With these goals in mind, we have seen the intent of this project, which helped us to accomplish the task at hand more efficiently and effectively.

### **2.3 Measures to Improve Traffic Flow**

Past statistical data shows many reasons for VRU injuries. Driver and VRU risk perception, collisions between automobiles and VRU, as well as collisions between VRU when cycles flee to sidewalks, and lack of adherence to road laws are the main reasons. In a study of perceived risk versus modal choice, it was determined that drivers do not perceive cyclists as a potential danger, and are therefore not as aware of them as they are of other motorists (Mannering et al, page 32). It is often observed that both motorists and pedestrians ignore laws, often due to a lack in understanding of risk and reasons for regulations (Noland 1995). This causes collisions from lack of caution on the part of both drivers and VRU, particularly with turning vehicles and intersections with poor line of site.

#### **2.3.1 Safety Improvements to Traffic Flow**

In an ideal traffic situation, motorists and VRU would be separated completely by pathways for VRU and overpasses at intersections. However, this is very rarely feasible. There

are many ways to help improve current traffic situations to make VRU and MVO safer and more regulated than existing conditions.

Standard Zebra markings are diagonal lines across a road that can be easily missed by vehicles travelling at higher speeds. There are several alternatives to the standard crossing areas. For cyclists, raised cycle crossings painted in bright colours have the dual effect of slowing traffic speeds and increasing visibility. An effective way to increase perceived safety for pedestrians is the use of traffic signals. A study, cited in a cost analysis of road safety measures, determined that pedestrians believe that traffic signals reduce the number of accidents by 80% (Leden et al, page 5).

More sophisticated crossings can also be implemented, such as Pelican, Toucan, and Puffin crossings. Pelican crossings are mid-block crossings controlled by traffic signals and pushbutton pedestrian signals. Toucan crossings are shared crossings for pedestrians and cyclists. Their name is derived from the idea that cyclists 'too can' cross together. The preferred layout includes a tactile warning surface, audible beepers, pushbuttons, infrared lamp monitoring, and vehicle detection on all approaches. Puffin crossings are pedestrian user-friendly intersections. They consist of traffic and pedestrian signals with pushbutton devices or pressure mat detectors. If a pedestrian is present at the end of a vehicle cycle, a walk indicator is given. A separate motion detector extends the green interval, if needed, to ensure that slower pedestrians have time to cross safely (FHWA Study Tour, page 32). These three alternate types of crossings can help tailor crossing designations to particularly high-risk areas.

In addition to making drivers more aware of VRU, making VRU aware of drivers can also increase safety. By placing signs and painting road markings that warn to watch for traffic, accidents can be greatly decreased simply by making VRU more aware of the danger of turning

vehicles. In a study where signs and painted road markings were installed to warn pedestrians to watch for turning vehicles, the percentage of pedestrians not looking for any threats declined from 18% to 3%, and this level was maintained even after the initial period of observation (Retting, et al, page 6).

Vehicles travelling at higher speeds have an increased probability of seriously injuring a VRU if a collision occurs. However, when a vehicle is travelling at 20 mph, there is only a 1 in 20 chance of a fatality (Highway Code, page 48). In order to effectively reduce speeds, traffic-calming methods are often introduced. Traffic-calming methods decrease the speeds at which vehicles travel and control traffic flow. Methods by which speed is controlled are speed humps, raised sidewalks, road narrowing, chicanes, angle parking, pedestrian refuge islands, diagonal diverters, and increased policing to enforce speed limits. It is also possible to distribute traffic along different routes to protect VRU from the dangers of vehicular speed and congestion. Road narrowing and diagonal diverters can also accomplish this objective. Since many of these methods are extensive and inconvenient, traffic can be calmed selectively during peak accident times to reduce cost and inconvenience to vehicular traffic while still protecting VRU. There are many ways to calm traffic and viable solutions exist for almost every type of area.

Controlling and regulating cyclist flow can increase the safety and awareness of cyclists and drivers. Advanced cyclist stop lines can protect cyclists from turning motorists, while implementing a mandatory helmet law can protect cyclists in the case of an accident. It is also important to separate cyclists from pedestrians to prevent collisions between the two groups of VRU. Dedicated cycling lanes, particularly those with differently coloured pavement, will prevent cyclists from fleeing to the sidewalk to avoid traffic and collisions. Creating regulations and provisions for cycling can also increase cycle safety and usage.

### 2.3.2 Encouraging Traffic Flow

Although external discouragements do not hold the same importance as personal safety, they will often prevent current automobile users from adopting non-vehicular forms of transportation. External discouragements are environmental factors, physical concerns, and convenience factors, which have the effect of reducing motivation (Elvik 2000). For example, rain, snow, and cold will often lead many potential cyclists, pedestrians, or transit commuters away from adopting these modes of transportation. Physical concerns include overall health of the commuter, ability to walk/cycle for long distances, and current level of fitness. If a potential cyclist is overweight, a heavy smoker, or even has heart disease, he or she may be quite disinclined to begin exercise at the level of commuting, and should consult a physician before beginning an exercise regime. Also, commuting by non-vehicular modes requires more time, effort, and planning than automobile transportation. Many commuters may prefer the comfort of their own cars over suffering inclement weather, air and noise pollution, and physical exertion.

Reducing costs and increasing convenience can increase cycling. Reducing cycle theft by providing racks, lockers, and other sites for securing cycles will also have the additional benefit of making cycling more generally known in the area (Elvik 2000). If it is known that people commute by cycle and feel comfortable with the racks, more commuters will follow suit. Another way of making cycling more accessible to the public is by providing cycle rentals. If commuters do not need to purchase a cycle before they experiment with cycle commuting, they may be more likely to attempt an alternate form of transportation. Providing showering and locker facilities at places of employment will also encourage cyclists, particularly in the summer months. Financial incentives can also be provided, such as incentives to employees who

commute to work by cycle or transit, and increased parking fees for the remaining auto commuters. Incentives are important to outweigh the external discouragements to increased cycle commuting.

### 2.3.3 Conclusions

After locating areas of concern, we used these methods to provide the Borough of Merton with suggestions for each area of danger. We compared the pedestrian and cyclist recommendations for each site with the methods we researched. Using the combination of these two bodies of information, we provided the Borough with suggestions for each site of perceived risk.

## 2.4 Risk

In our project, a large part of our research involved the perception of risk. In order to better understand the responses that we received from the interviews, we researched into risk definition, perception, and how it affects the decision-making process.

### 2.4.1 Definitions of Risk

The perception of risk involves many different aspects of the human psyche. In fact, human perception depends on many things, including the knowledge, which people either have or do not have, about their safety. For instance, a person might be aware of a certain dangerous intersection, so they stay away or try to avoid it as best as possible. However, they may not know the danger of the street they ride down every day instead. According to Douglas and Wildavsky, people cannot be aware of all the dangers they face during their lifetime. There is no possible way a human can truly know beforehand where they will be in danger, but as soon as

they come face to face with the danger, they become aware. Even if people could know when and where they are at risk, there is 'no guarantee that the very dangers [they] seek to avoid are those that actually will harm them most' (Douglas & Wildavsky 1983, page 3).

There are many definitions of risk. According to Merriam-Webster's Collegiate Dictionary (2001), risk means the possibility of loss or injury to oneself, or it can mean that someone or something creates or suggests a hazard to another human being. 'Since there is no single correct conception of risk, there is no way to get everyone else to accept "it"' (Douglas & Wildavsky 1983, page 4). But, for our project, we will define risk to mean both definitions: the probability of injury and the probability of someone bringing harm to others.

Since risk is a broad term and can be defined in multiple ways, it can be made into four subgroups. Along this line of thought, Douglas & Wildavsky (1983, page 2) wrote,

At the level of public policy the main dangers can be grouped into four kinds:

- 1) foreign affairs; the risk of foreign attack or encroachment; war; loss of influence, prestige, and power
- 2) crime; internal collapse; failure of law and order; violence versus white collar crime
- 3) pollution; abuse of technology; fears for the environment
- 4) economic failure; loss of prosperity

For this project, we focused on the second and third subgroups.

The second subgroup is the risk of violence or failure of law and order. If a driver disobeys the law requiring him to give the right of way to a pedestrian, the pedestrian is at great risk of being injured or even killed. We must take into consideration human error and violations of the laws according to the United Kingdom.

With the same idea in mind, we also focused on the third subgroup, which is pollution or abuse of technology. Once again, if a driver uses his car to get what he wants, he may bring harm to others, including VRU, without even being aware of doing so. In this case, people bring danger to others because they are not aware of their surroundings and, especially, the technology

they use in their everyday lifestyle. 'Some do argue that our new attitudes towards risk are the result of technological advance' (Douglas & Wildavsky 1983, page 32). This argument is somewhat true, but when looking closely, one can see that car transportation, as dangerous as it can be, is not as hazardous as transportation was in the past, such as horses, railroads, and boats. In today's world of fast-growing technology, people have much safer types of transportation. What make today's technology dangerous are the people who do not know how to use it properly.

Every day, people face 'risks that they undertake knowingly and risks that are imposed on them' (Douglas & Wildavsky 1983, page 16). For instance, a pedestrian who walks into the street without looking both ways is creating risk, which they are undertaking knowingly. However, if the pedestrian looks both ways before crossing the street, and all of a sudden a drunken driver comes screeching down the road, the risk is imposed on the pedestrian. This is a good concept to keep in mind while working with the public in the Borough of Merton because perceived risk could be a combination of both types of risk.

Since people are not aware of all the dangers they deal with, how do they select, or realise, the risks, which they actually see or confront?

We choose the risks in the same package as we choose our social institutions. Since an individual cannot look in all directions at once, social life demands organization of bias. People order their universe through social bias... Once the idea is accepted that people select their awareness of certain dangers to conform with a specific way of life, it follows that people who adhere to different forms of social organizations are disposed to take (and avoid) different kinds of risk. To alter risk selection and risk perception, then, would depend on changing the social organization. (Douglas & Wildavsky 1983, page 9)

When attempting to increase or decrease public concern about an action, there is often a noticeable difference between the expert, or researched, opinion and the opinion of the average person in regard to risk. There are several theories as to the source of this discrepancy. The first states that the conflict is about the driving forces behind the action, not the inherent danger of the

action itself (Margolis 1996, page 21). Therefore the conflict is over ideology, not levels of risk. Another theory claims instead that the public does not feel comfortable trusting the expert opinion, and is hesitant to believe the stated risk involved (Margolis 1996, page 21). The final theory, which was most appropriate to our goals, is that the conflict arises over rival rationalities, or perspectives (Margolis 1996, page 22). The concerns of an expert may depend on statistical data and other numerical figures, whereas the concern of the public may deal more with personal experience and common knowledge. This corresponds with the situation involving traffic safety because experts have a body of archival data (accident reports), while the public bases its sense of risk upon experience and hearsay. In this section we will explain the reasons for these feelings and ways to deal with them.

The amount of risk an entity, whether it be a person or community, feels is defined as perceived risk. This sense of visceral risk is based mainly on intuition among most people. Those with training in the field in which the risk lays often base their opinions on knowledge rather than intuition. This is often referred to as the objective risk, because it is considered to be the true measure of risk, as opposed to the amount the public senses. This type of risk is still a subjective measure, but is based upon facts and figures as opposed to feelings and experiences, and is given more credence.

There are many factors that contribute to a public feeling of risk, which is also defined as perceived risk. There are nineteen factors, according to Covello (Kasperson and Stallen 1992), at the heart of expert opinion and public intuition conflicts. The factors are catastrophic potential, familiarity, understanding, certainty, controllability, voluntariness of exposure, effects on children, effects manifestation, effects on future generations, victim identity, dread, trust in institutions, media attention, accident history, equity, benefits, reversibility, personal stake, and



origin. Not all of these factors are applicable to traffic safety, but many are. It is arguable that these factors do not cause perceived risk, but rather are simply part of it. In order to discuss this topic thoroughly, we will first explain each of these factors and the effects, and then the concept of a risk matrix in decision-making.

#### 2.4.2 Risk Factors

The discussion of risk factors influences our goals by determining what affects perceived risk. Knowledge of all factors of risk can enhance our understanding of the responses from our respondents and their reasons and causes for concern.

The following is a discussion of the factors posed by Covello listed above. We will discuss each factor and how it affected our methods for gathering and evaluating information.

Catastrophic potential is whether or not the fatalities are grouped in time and space. If fatalities are grouped, public concern will be high. However, if they are scattered and random, as they are in traffic fatalities, public concern will be lower. This is similar to the concern of victim identity and personal stake. Since victims are randomly distributed, public concern is lower since they are an unidentifiable group in traffic casualties.

Familiarity simply implies that the public is more hesitant about areas with which they are unfamiliar and therefore will consider them of higher risk. Vehicular and non-vehicular forms of transportation are not issues of unfamiliarity, so most respondents' perceived risk were not influenced by this factor.

Understanding of an issue is more complicated. Either the problem or the solution can be more complicated than the average layperson is apt to comprehend initially. If a doctor tells a patient the technical name of their illness, they are more likely to be concerned about their

condition than if the common name is used. This is an example of how terms and concepts that seem unfamiliar and complicated are approached with more concern than common-knowledge items. We were careful to avoid ambiguity and vagueness when posing our questions to avoid causing this factor to be an influence on the answer.

Whether or not experts are clear about the risk is defined as the level of certainty. In the case of accidents, it is clear that accidents do occur. However, the reasons for accidents are not as well agreed upon and understood by the general populace. We intended to determine public opinion for reasons of accidents, making this a major area of concern.

Controllability is the level of personal ability to cause or stop a situation. In our particular situation, the level of controllability is low. There is very little a pedestrian can do beyond being aware of dangerous intersections. This lack of controllability of the situation can greatly increase public insecurity about walking as a form of transportation. We considered this as an area of concentration for interviewing and future improvements.

An example of involuntary level of exposure would be an airborne threat, which would cause great public alarm. Using non-vehicular transportation is considered a voluntary level of exposure. This poses two problems. One, since this is a voluntary level of exposure, VRU will avoid the dangerous areas, thereby making it difficult to locate the high areas of risk through statistics. Second, since people can control their whereabouts, it will be difficult to convince them that they are no longer in danger and to return to these avoided areas. These were two important topics we considered.

The effect on children will arouse public concern even if the risk to the general populace is low. Children are at a much higher risk of being injured in an accident than any other section of the population. Their size reduces visibility to MVO, they often do not have proper road

safety training, may not have the ability to judge distances between cars, and may not have the same knowledge of when it is safe to enter the road as an adult has. This risk factor encouraged us to focus attention toward child safety in our perceived risk research and interviews.

Effect manifestation is the time frame in which the outcomes of an action are seen. This is also tied in with the effect on future generations. This factor was unlikely to be an influence in our respondents' perceptions due to the immediacy of effects of a traffic injury and the lack of permanent environmental damage. However, we still bore it in mind.

Dread is not something one normally associates with traffic accidents. The Merriam-Webster's Collegiate Dictionary (2001) defines dread as a great fear. The responses from our interviews indicated a few specific sites that were dreaded as highly dangerous, but not as an overall factor in risk perception.

Trust in institutions is the amount of trust the public has in information given to them from the institution in charge of the issue. In the case of public transportation, safety measures are easily verifiable. The public believes that traffic lights and specialized crossing designations are effective, and do not need to be convinced to trust in them.

Perceived risk is also based on what is publicly known. If a topic is sensitive, such as nuclear waste transportation, the media will publicize any event that supports the image that it is a risky action, even though it might have a remarkably clean record compared to other actions. Publicity and media phenomenon highly influence public feelings of perceived risk. During our interviews, it was apparent that, while respondents had often heard of accidents through media, it did not affect their feeling of risk unless they knew personally of an accident that had occurred in a nearby area.

Traffic accident history is widely known and varies from minor to major. This knowledge of the current danger causes a higher perceived risk among the public, however it may not correspond to specific sites of danger. During our ranking, we must be were aware of the concept of an overall perception of danger. We realised that this overall feeling of risk, in regard to accidents, may or may not correspond to a specific site of high danger and may alter the perceived severity of the site.

Equity is the distribution of risks and benefits. If both risks and benefits are equally distributed, the public will be less concerned than the converse. How the public views the distribution of risk was an important factor to determine in our research.

When they are clear, benefits and reversibility of effects reduce public concern. This is an important fact, since improvements to public safety must be clearly known in order to decrease perceived risk. Most of the suggestions we made to improve safety are prominently visible and are accepted as effective safety measures, and also can be reversed with no lasting effect on the environment. These two considerations should help the Borough of Merton in implementing our suggestions.

Origin, whether it is a man-made threat or a natural threat, determines a certain level of perceived risk as well. Since both the sources (roads), and the solution (traffic lights, etc), are man-made this did not significantly affect the public concept of perceived risk.

These nineteen factors helped us identify reasons for perceived risk and make suggestions to reduce them as effectively as possible. This discussion of risk is important because no matter what improvements are made, if the feeling of perceived risk does not improve, there will be no affect upon the public to increase non-vehicular transportation use.

As was discussed, certain factors are more important than others. For the risk associated with traffic fatalities and injuries, understanding, certainty, controllability, voluntariness of exposure, dread, accident history, and equity were our major areas of concern. We will address understanding and certainty in the next section, Uncertainty and Risk Communication. The other factors were determined and taken into account in our methods.

### 2.4.3 Uncertainty and Risk Communication

A factor in risk perception, as was discussed in the previous section, is uncertainty, which is related as well to understanding. Before we can discuss uncertainty, both certainty and uncertainty must first be defined. According to Merriam-Webster's Collegiate Dictionary (2001), an event that is certain is sure to occur, free from doubt, definite, or specified, and uncertainty is merely the opposite. This is not a satisfactory definition, since it relates to events, and not thoughts. According to Beyth-Marom, we experience certainty about a specific question when we have a feeling of complete belief or complete confidence in a single answer to the question (Beyth-Marom et al 1985, page 4). Uncertainty, on the other hand, is when we cannot give a single answer to a specific question with complete confidence (Beth-Marom et al 1985, page 5). Either we are unsure that the answer we believe is correct, or we consider two or more answers to be possibilities, though not necessarily equally probable.

As a risk-inducing factor, uncertainty is caused by lack of public consensus. One of our goals was to determine a consensus on areas of perceived risk. In order to effectively analyse responses, we had to be aware of several influences. Since the only agreement is that roads are dangerous, public opinion may respond in two ways, as is seen from the definition of uncertainty. A respondent may be unsure as to the actual danger, and therefore their responses

may be unsure, or if the second definition is true, the responses may be contradictory, since two or more answers to the question may seem likely as true. When we encountered this, we must followed up and delved into their reasons for uncertainty.

Feelings of uncertainty can also be divided into two categories. When a person feels that, in principle, there is now no certain answer to a question, then that person feels general uncertainty. However, when a person feels uncertainty concerning the question but realises that one could feel certainty, believing that someone could know the answer and probably does, that person feels individual uncertainty (Beyth-Marom et al 1985, page 7). These two types of uncertainty affect the way a person answers. If the respondent feels general uncertainty, they will be more likely to indicate their lack of knowledge, since it would no longer be a measure of their intelligence. However, if the respondent feels that the answer is known, and even that they should know the answer, they will be less likely to indicate their ignorance, and we in examining their responses watched carefully for clues of uncertainty while analysing the content of the interview.

Another source of uncertainty is ambiguity. Vague terms cause misunderstanding. It is important that early agreements and definitions of terms are reached. A purposeful conversation can be fruitful if all terms are equally understood, avoiding the type of misunderstanding often referred to as measurement error. However, a conversation based on vague and ambiguous terms is pointless and unproductive (Beyth-Marom et al 1985, page 18).

Risk is a subjective term and feeling. In order to reduce misunderstanding and uncertainty, all terms must be well defined and discussed at the start of any conversation meant to gather information. Risk can mean many different things, and we were aware that this must be discussed thoroughly within each information-gathering session.

The United Nations suggested that risk be defined in one of two ways, pure probability or properties of utility. The definitions are as follows:

1. 'Risk is a statistical concept and has been defined by the preparatory committee of the United Nations Conference on the Human Environments as the expected frequency of undesirable effects arising from exposure' (World Health Organization, 1978, page 19).
2. 'Most literature on this subject begins with the thesis that risk (R) can be estimated as some sort of product of the probability (P) of the event times the severity of the harm (H), or  $R = P \times H$ ' (Campbell, 1980).

Although these are number-based measures of risk, they can help form a framework for responses when combined with the risk definitions covered in the previous section.

Similar sources of uncertainty in communication are verbal expressions, which should be avoided on the part of the interviewer, due to cross-cultural misinterpretations. When a respondent uses a verbal expression in communicating their feeling of risk, we were aware that our interpretation may have been different from the feeling that they were attempting to convey, and always followed up to elicit less subjective wording on the matter.

These sources of uncertainty in both risk perception and communication needed to be understood to avoid misinterpretation during informational gatherings, as well as during the analysis of responses.

#### 2.4.4 Risk Acceptability

In order to determine how far it is necessary to decrease risk, risk acceptability must be examined. Risk exists naturally in nature; it can never be completely eradicated (Beyth-Marom et al 1985). Therefore, the question becomes how low is an acceptable level of risk.

The discussion of acceptability is directed by issues of fairness (Douglas 1983, page 5). This corresponds to several of the risk factors listed by Covello (Kasperson and Stallen, 1992), such as catastrophic potential, effects on children, victim identity, equity, and personal stake. If the public believes that the risks and benefits are equally distributed, no one can be considered taken advantage of. However, the attitude of risks inflicted by others is political (Douglas 1983, page 34). This discussion is highly value based, and requires public agreement upon justice and equality. Unfortunately, objectivity about values is impossible (Douglas 1983, page 12). Most people would prefer equality to err on the side of benefit to themselves, but this leaves a discrepancy for someone else. Consent to risk requires the benefits to be greater than the costs (Douglas 1983, page 15).

In risk perception, attention selectivity is the real issue (Douglas 1983, page 39). Being in control of the situation reduces the feeling of risk. People perceive what they wish to and base their feelings on their observations. Human memory is often selective and erratic, further biasing perceptions. Group perceptions often control overall perception of risk. If a group of individuals ignore some manifest risks, it must be because their social network encourages them to do so (Douglas 1983, page 66).



#### 2.4.5 Risk Matrix

The risk matrix is how an individual weighs costs and benefits to find a solution. There are four modes in the risk matrix: fungibility, 'better safe than sorry', 'waste not, want not', and indifference (Margolis 1996, page 76). When confronted with an issue, the individual is initially in the indifference mode. If the costs are substantially higher than the benefits, they move to the 'better safe than sorry' mode, where caution is considered the best course of action. Conversely, if the benefits are substantially higher than the costs, they take the stance of 'waste not, want not', which is more risk-taking. In either case, the alternate side will usually come more into awareness and they will be moved into the fungibility mode, where they weigh both costs and benefits to decide on the best course of action. The fungibility mode is the most favoured mode in the eyes of an expert attempting to convince the public of something. If the public is entrenched in either 'better safe than sorry' or 'waste not, want not', it is very difficult to convince them otherwise. It is important to cover all sides of the issue in order to keep the public's trust as well as give them information to make an informed decision.

#### 2.4.6 Conclusions

Perceived risk is a very important factor in public opinion. To influence public decisions toward an action, it must not be perceived as risky for those affected by the change, or the costs must not outweigh the benefits. To help fulfil these conditions, we identified reasons for perceived risk and proposed solutions to minimize them.

## **Conclusion**

From our knowledge of current measures in place to protect VRU, the goals and current plan of the Borough of Merton, proven effective methods for increasing safety, and public opinion of perceived risk, we identified dangerous areas and proposed appropriate solutions.

With this knowledge, we determined the best methods for collecting information about perceived risk and analysed the responses we gathered. We were also better able to interpret the information and propose the most feasible and effective solutions for each area.

From knowledge of current measures for protecting VRU, the Borough of Merton's plans for the next year and its long-term goals, safety measures that have been shown to be effective, and methods for determining perceived risk, we were able to form an approach for gathering data from the residents of the Borough on perceived risk and comparing high-risk sites to find suggested relationships and propose solutions for the dangerous areas.

Our goal for the project was to increase the safety of VRU, which in turn would increase the number of cyclists and pedestrians. To accomplish this, we used several different methods of research to gather information. This information was used in conjunction with past statistical data allowing us to offer solutions to help increase VRU and their safety.

To achieve our goal, we divided the task into several categories. First, we determined the perceived risk of VRU in the Borough of Merton by conducting personal interviews and group interviews. Simultaneously, we used past objective data of accident reports and statistics to determine the sites that have had significant accidents. To rank the sites, we used the frequency of responses gathered through the interviews and focus groups, allowing strength of responses to weigh the danger of the site. This allowed us to offer solutions based on VRU interviews and statistical data.

### **3.1 Method Selection Process**

In determining the method that we implemented to solve our problem, several factors had to be weighed. First, we considered the information we needed to collect. Once this was determined, we decided upon the best method to collect this data.

#### **3.1.1 Information Considerations**

In order to decide what type of information to gather, we considered what we needed to accomplish with the data. We needed to provide the Borough of Merton with a ranking for perceived risks for both cyclists and pedestrians, the objective risk for each of these sites, and a way to show relationships between the risks to these two types of VRUs. The Borough also wanted recommendations for improving these areas. The risk sites for the two groups could have been gathered through surveys, but the information as to reasons for perceived risk and improvements VRUs would like to see could only be determined through interviews. The comparison between the types of risk needed to be accomplished through a more in-depth analysis of reasons for risk rather than pure numbers.

#### **3.1.2 Quantitative vs. Qualitative**

After we determined what type of information we needed to collect, we had to consider each type of data collection technique. Our first consideration was quantitative versus qualitative. ‘Quantitative research refers to counts and measures of things’ (Berg 2001, page 3), whereas ‘Qualitative research ... refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and description of things’ (Berg 2001, page 3). Therefore qualitative data was most helpful in determining the how, what, and why of perceived risk. When we

determined the objective risk, we used accident reports and statistics to plot the data on electronic maps, which yielded quantitative data. The data collection strategy we used was triangulation. ‘The use of multiple research-design strategies and theories increases the depth of understanding an investigation can yield’ (Berg 2001, page 6). ‘The important feature of triangulation is not the simple combination of different kinds of data but the attempt to relate them so as to counteract the threats to validity in each’ (Berg 2001, page 115). These threats to validity are the intrinsic biases in each method.

### 3.1.3 Perceived Risk

For perceived risk, the qualitative research methods we chose to gather and triangulate the data were personal interviews and group interviews. In choosing these methods, we had to weigh the pros and cons of each. Once we were knowledgeable of the strengths and weaknesses of possible methods, we were able to choose the most effective methods. This knowledge allowed a plan to be developed implementing the best research tools for this project.

#### 3.1.3.1 Individual Interviews

The pros and cons for personal interviewing are as follows. For personal interviews, there is the significant issue of ‘getting in’. ‘Getting in is typically defined as various techniques and procedures intended to secure access to a setting, its participants and knowledge about phenomena and activities being observed’ (Berg 2001, page 67). An advantage to interviewing is it allows a means to account for the how, what, and why rather than the how much or how many. This was the key reason that guided us toward interviewing to gather data on perceived risk, as opposed to surveys or other methods. After choosing the interview as one of the

strongest methods for gathering data, we had to weigh the strengths and weaknesses of the different types of interviews.

The first type of interviewing we looked at was the standardized interview. ‘The standardized interview uses a formally structured schedule of interview questions’ (Berg 2001, page 69). This would ease in the data collection and analysis because every interviewee would be asked the same questions, but it was limited in two ways. One way is if someone did not understand the question(s), as with language confusion, no data or inaccurate data would be provided. Secondly, if an interviewee had more information, possibly about a particular circumstance over another, this information would not be considered. The next type of interview, the un-standardized interview, posed issues due to the lack of structure. Having only a goal and no set questions, it would be very possible for the interviewee to get off topic and waste time. It did have the advantage of building rapport with the interviewee, but this advantage is also incorporated into the final interview method, which is the one we selected. This method is the semi-standardized interview. ‘This type of interview involves the implementation of a number of predetermined questions and/or special topics’ (Berg 2001, page 70). This method allows the interviewee to stray from the topic in a more conversational type of interview, which develops understanding. It also allows the interviewer to focus on specific topics that one interviewee might be more knowledgeable or vocal on. The questions we asked of each group are included in Appendices D and E.

### 3.1.3.2 Group Interviews

The next research tool that we considered, the group interview, had more positive aspects than negative. ‘The focus group [group interview] may be defined as an interview style designed

for small groups' (Berg 2001, page 111). This group usually consists of no more than seven people (Berg 2001, page 111). The major advantages of group interviews include participant observation, group observation and 'access to fragments of a person's biography and life structure' (Berg 2001, page 115). Due to the structure of group interviews, people are able to expand from each other's comments. 'In many ways it is the very give-and-take interactions characteristic of focus group interviews that lead to spontaneous responses from session participants' (Berg 2001, page 115). Some of the disadvantages include the fact that 'researchers may never learn how subjects might have discussed these issues among themselves' beforehand. Also, dominant personalities form normative responses, which can make the meeker members of the group interview become quieter and un-expressive of their own opinions. To counter this, we observed group dynamics and did follow-up interviews with the quieter members afterwards. The issue of normative response was difficult to deal with, since we were not able to determine when it was occurring. To account for this, we also did individual interviews, isolating the respondents from immediate outside influences.

### 3.1.3.3 Pre-tests

Before we administered either of these methods of interviewing and group interviews, we did pre-tests on the questions with members of the staff of the Merton Council. Pre-testing allowed 'poorly worded questions, questions with offensive or emotional-laden wording, or questions revealing the researchers' own biases, personal values, or blind spots' to be removed or reworded (Berg 2001, page 80). Pre-testing with members of the Merton Council accounted for many of the cultural differences of which we were not aware. It also provided an outside source to confirm that the questions were useful and clear. Finally, we interviewed a VRU to pre-test

the questions. This assisted in assuring the validity of the questions to a person in the frame we targeted. This method reduced many issues with the interview and group interview questions.

### 3.1.4 Analysis of Perceived Risk and Objective Risk

In order to discuss the relationship between perceived and objective risk, we used the literature we researched to provide insights into risk analysis. Using this information, we were able to provide the Borough of Merton with a possible explanation of the discrepancies between perceived and objective risk, and ways to remedy the difference. This, in conjunction with the VRU suggestions for improvement, was provided to the Borough to help increase the safety of VRUs through awareness and safety measures. The implementation of this method will be discussed in the following section.

## 3.2 Our Target

Before implementing our methods, we determined the frames that we would focus on to best achieve our goals within the time limitations. Our global frame was the vulnerable road users in the Borough of Merton. These include power two wheelers, cyclists, and pedestrians. We narrowed this frame down into two groups: cyclists and child pedestrians. The following table summarises the sampling procedure and populations we targeted.

Table 1: Population and Sampling Procedure

<b>Population</b>	<b>Information needed</b>	<b>Sampling procedure</b>
Child Pedestrians (3 - 8)	Risk sites	Individual and Group Interviews with Parents
	Reasons	Individual and Group Interviews with Parents
Child Pedestrians (9-16)	Risk sites	Individual and Group Interviews with Students
	Reasons	Individual and Group Interviews with Students
Cyclists	Risk sites	Individual Interviews with Cyclists
	Reasons	Individual Interviews with Cyclists



### 3.2.1 Pedestrians

We decided on child pedestrians because they represent 20% of the population but 33% of all casualties (ITP, page 128-133). Another reason for researching into this particular frame is the high focus in the Mayor's goals for London. The Mayor's goal for the year 2010 is a 50% reduction of child fatalities and severe injuries (TRSF 2000, page 11). Any benefits we would provide to this group would aid the entire pedestrian community. It also allowed us to focus on a smaller population, given the limited time frame.

To gather our data about the perceived risks for children, we approached schools and shopping centres for permission to contact respondents. First, we contacted first schools in order to access parents of children. Since younger children do not always have the ability to accurately assess personal risk, we did not believe accurate data would be gathered from them. Instead, by contacting school districts, we interviewed parents in both individual and group interviews for children ages 3-8. We interviewed parents and nannies walking into the school to meet the children, guaranteeing our sample as those who walk to school. These are the individuals who have legal responsibility for the children we were targeting. By interviewing parents, we gathered information from people who can articulate many of the perceived risks concerning children's safety, which young children may not be able to explain. To gather our data we used semi-standardized interviews. These interviews helped us understand the parents' viewpoints by allowing them to more freely discuss their feelings and opinions. We were also able to elicit deeper responses through follow-up questions.

Next, to gain an understanding of the opinions of older children, both in middle school and high school, we once again asked permission of schools and also that of the Wimbledon

Shopping Centre. We interviewed children during the school day in groups to ascertain the areas where they perceive they are at danger, and their reasons for specifying these areas as dangerous. We also approached children as both individuals and groups outside of the Wimbledon Shopping Centre. We chose the shopping centre as an additional focus to determine to what areas children walk other than to school, and the dangers they are exposed to in these areas.

### 3.2.2 Cyclists

The Borough of Merton contains many groups for cyclists that promote the goals and ideals of avid cyclists. In order to determine the opinions of less vocal cyclists, particularly those who cycle on a regular basis, but are not avid cycling promoters, we used three methods to provide triangulation. First, we used reference sampling from names given to us by our liaison. After performing the interview, we then asked each person if they could give us the names of one or two friends who also cycle regularly. This provided us with more cyclists at the same level as our initial interviewees. Second, we sent out a global e-mail to members of the Merton Cycling Campaign requesting interviews with any interested cyclists. We chose this group because it was a cycling community that is based upon commuters, not directly affiliated with the Merton Council. Finally, we gathered on-site interviews at busy cycling locations, specifically Wimbledon Centre tube stop and Wimbledon Park.

### **3.3 Implementation of Each Method**

The process by which each research method was conducted was crucial in gaining entry to the frames and gaining the data that we sought. Individual and group interviews each required different methods to accomplish our goal.

### 3.3.1 Social Exchange Theory

The first method that we used to access our frames was the social exchange theory (Blau 1964). In any interview or group interview, results will be very difficult to reach, and even setting up schedules will be nearly impossible if the interviewee gains no or low benefit for themselves. The social exchange theory proposes that an interviewer or group interview facilitator must raise the benefits of the session(s) to be greater than the costs for the interviewee(s). In order for a person's costs, such as to travel to the site where the interview is to be conducted, give up their own time, and be honest, they must somehow gain from the interview or group interview. This gain does not have to be material in the sense that the interview may simply benefit a cause they agree with, help out a friend, or even gain for them some form of acknowledgement. When the case is not that simple, rewards can be offered, usually ones that apply to the interview, for the interviewee. For example, if one were conducting an interview for public transportation, free tickets to use some method of public transportation might be used in order to get the interview.

When conducting an interview many conditions must be taken into account. First, the social exchange between interviewer and interviewee must be weighed. This was achieved by informing the vulnerable road users we interviewed that we were doing research to increase VRU safety. This is a significant benefit for the VRU. We were greatly aided in gaining credibility through the support of the Safety Planning Department. This credibility increased participation through convincing the schools that aiding us would have an effect on the community.

### 3.3.2 Researchers' Roles

The next step we took when conducting group interviews and interviews was to develop rapport with the subjects. This involved considerations such as role and clothing.

We needed to decide on what role the interviewer would take when conducting interviews. These roles consist of unsympathetic unsophisticated, unsympathetic sophisticated, sympathetic unsophisticated and sympathetic sophisticated (Mitchell 1990). For our research, it was best to play sympathetic sophisticated, conveying that despite our being experts in the field, we care about the interviewees' opinions and ideas. We came to this decision by weighing the other three roles against the data we researched.

The role of sympathetic unsophisticated is not helpful when interviewing about perceived risk because if we are doing interviews and group interviews with the attitude that we are not experts involving locations of high risk, we take the chance of losing credibility and confidence. When interacting with the subjects outside of interviews and group interviews we filled the role of sympathetic sophisticated as well. This demonstrated that we were knowledgeable in the field and built rapport with our subjects. The other two roles were logically ruled out. Both unsympathetic sophisticated and unsympathetic unsophisticated would have provided unnecessary challenges and complications when conducting our research. The subjects would be offended if we had taken a role that did not sympathize with their views. This would generate untruthful responses from the subjects, if we were able to get as far as interviewing them, and would add inaccuracy to our data. Therefore, both unsympathetic roles would not have been beneficial to us in our research.

### 3.3.3 Appearance

Next, when conducting interviews and group interviews, attention was paid to the interviewer/facilitator's manner of dress. 'Basic to the communication of the interview meaning is the problem of appearance and mood. Clothes often tell more about the person than his conversation' (Berg 2001, page 36). Therefore we always dressed in a professional manner, using the zero plus one rule of thumb. This meant that we always dressed at the level of our audience (zero), or one level above the audience (plus one). In addition, we wore nametags labelling us as affiliated with the Borough of Merton as researchers. This also built credibility with our subjects.

### 3.3.4 Interviewing

When we were conducting interviews, we used the following procedure to have an organized, successful interview (Berg 2001, page 99). We prepared for each interview with a significant amount of practice. Once we engaged the interviewee for our interview, we began by asking questions intended to engage interest and establish ourselves as sympathetic listeners. This developed rapport with the interviewee by allowing small talk before the actual interview began. To keep us focused and on track, we outlined each interview with a loose schedule and had the questions we wish to ask pre-determined. Having the questions pre-determined allowed us to have a natural flow to the interview. As mentioned previously, we were sympathetic to our interviewee. If they said something funny, sad, or interesting, we prompted them with the appropriate smile, frown, or acknowledgement. While conducting interview questions that could be answered with a simple yes or no, we asked further questions into the matter when possible.

### 3.3.5 Group Interviews

The method we used to facilitate our group interviews was similar to the methods for interviewing, but some differences were incorporated. After we secured our participants, who will be discussed in the following section, we designated our meeting place. Beforehand, as with the interviews, we practiced so that we presented a natural front to the focus group. Since the key to successful group interviews is practice, our facilitator and research assistant were well prepared. Once we were comfortable with the mechanics of running the group interview, we prepared the meeting place. The first goal in preparing the meeting place was to provide an amiable or neutral environment where the members of the group interview would be comfortable discussing the topic at hand. We did this by going into a familiar environment, specifically, part of their own school. We also developed rapport between the facilitator and the members of the group by being open and conversational initially with the different group members. Finally, before even beginning the session, the facilitator ensured that everything was well-prepared and organized so that the group interview ran smoothly. At the start of the group interview, we were specific in laying the objective of the session. This provided a clear purpose for all the members and helped keep the topic in focus.

### 3.3.6 Measurement of Objective Risk

We used two methods to compare perceived and objective risk. First, we used the TraffMap® software to generate a list of the highest accident clusters. These were found by giving the program area and accident frequency criteria. For cyclists, a cluster was five or more accidents within 100 metres (concentric circles of 100 metre diameter), and for pedestrians, the

cluster radius was reduced to 50 metres. The radii were different since the distances and speeds travelled by each group are quite different.

The second method used to compare objective risk with perceived risk was accidents per length of road. We generated three sets of data in this way, including accidents from the past 3 years, the past 6 years, and the past 9 years. This was used to see trends in the accident rates over the past years to see whether pedestrian and cyclist accidents have undergone any substantial change. Where we observed trends, we determined whether the problem had been remedied, or if traffic was simply avoiding the area.

### 3.3.7 Ranking of Sites

The final method we employed was ranking the sites. By examining the interview data from both cyclists and pedestrians, we categorized each response as high, medium, or low in severity of site, based on our analysis of latent meaning from each interview. We specifically focused on adjectives, tone of voice, and body language of each respondent. We assigned a numerical value to each level of response (3, 2, and 1, respectively). We used strength of language and overall feeling portrayed by the interviewee to infer their vehemence about a particular area. When categorizing a response as low, we were aware of shrugs, words such as ‘kind of’, ‘sometimes’, ‘occasionally’, and similar adjectives, as well as a casual tone of voice. A rating of medium was given when a person stated that the road was generally busy and that they often had trouble crossing, had a concerned expression, and used a more confident tone of voice when stating the road as dangerous. Finally, a high rating was reserved for roads that were ‘always’ or ‘very’ busy, took a long time to cross, were stated first as a dangerous place, caused the respondents to feel upset when speaking about the area, or were repeated frequently.

Summing the strengths of the responses in this way, we were able to give a listing of the sites based on the perceived danger. We compared this listing to the objective risk data to determine relationships and provide solutions to the Borough of Merton.

### **3.4 Conclusions**

To increase the safety of vulnerable road users there were several steps to accomplish our goals. To begin with, we reviewed literature pertaining to VRU. This included traffic laws, the plans of action already taken in Merton, how to deal with perceived risk, and traffic-calming methods that are being used in other cities. Next, we divided our methodology into several sections so that we could clearly state our intentions. This was perceived risk, objective risk, and finally site ranking.

We determined perceived risk by interviewing and focus grouping pedestrian parents of pedestrians ages 3 – 8 and older children up to the high school level. For cyclists, we used reference sampling and on-site interviews to gather the opinions of regular cyclists.

For objective risk, we used accident reports and statistics through the Traffmap software used by the Borough. We then formed a list of the highest risk sites for cyclists and pedestrians.

All of this data allowed us to draw conclusions based on current and past methods of traffic calming to increase VRU safety and, it is hoped, increase the number of VRU.



Using the literature we reviewed in Chapter 2, the results from our interviews, and objective risk information, we examined the data for patterns and overall meanings. The data we gathered was able to show us areas of perceived risk and the relationship they have to objective risk, which was identified by the accident reports. We were also able to locate areas that need to be remedied. In the final chapter, we will discuss the conclusions we made from the data.

We first analysed the latent values to provide a ranking of perceived risk. The latent values are a ranking of the strength and frequency of the responses for a particular road. We then compared the perceived and objective rankings, comments from interviews and reasons for accidents, and clusters of accidents generated by the software. This information was used to see trends and relationships between perceived and objective risk.

#### **4.1 Perceived Risk Pedestrians**

In order to assess the public's level of perceived risk, we performed individual and group interviews. After we collected the data, we were able to rank the sites that were cited as dangerous through content analysis and latent meaning. Table 1 shows each latent ranking, the frequency for each road, and the total 'score' each road received. We determined the rankings by using the low, medium, or high value designation described in Section 3.3.7 on each reference to the road during our interviews.

Table 2: Perceived Risk for Pedestrians

Road	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Frequency	Total
West Barnes Lane	3	3	3	3	3	3	2				7	20
Kingston Road	2	1.5	1	1.5	2	2	2.5	2.5	1.5	1.5	10	18
Beverly Roundabout	2.5	2	2.5	2.5	3						5	12.5
Grand Drive	2	2.5	1.5	2	2						5	10
Merton Hall Road	2	2	2	1.5	1.5						5	9
Aragon Road	2	2	2	2							4	8
Manor Road	2	2	2	2							4	8
London Rd (Mitcham)	2	2	1	2							4	7
Acacia Road	2.5	2	2								3	6.5
Merton Road	1.5	1	2	2							4	6.5
Wide Way Roundabout	2	2	2								3	6
Grove Road	2	2									2	4
Streatham Road	2	2									2	4
Church Road (Mitcham)	3										1	3
Church Road (W. Park)	3										1	3
Henfield Road	3										1	3
Hillcross Avenue	1	2									2	3
Christchurch Road	2										1	2
Haydon's Road	2										1	2
Morden Road	2										1	2
Mostyn Road	2										1	2
Stratton Road	2										1	2
Tamworth Lane	2										1	2
Western Road	2										1	2
Bond Road	1										1	1
Dorset Road	1										1	1
Liberty Avenue	1										1	1
Three Kings' Pond	1										1	1
Wide Way	1										1	1

Table 2 shows that the road with the highest pedestrian perceived risk was West Barnes Lane, followed by Kingston Road. In order to determine if a relationship existed between perceived and objective risk, we used the Traffmap® software to determine the number of accidents per 500 metres for the past three years, from 1/1/98 to 31/12/00, on each of the roads listed above.

We then listed the two rankings side by side in Table 3 so that we could determine whether a relationship existed. A map of each road can be seen in Appendix L.

Table 3: Perceived and Objective Rankings

	Perceived Ranking	Latent Total		Objective Ranking	Number of Accidents	Length of Road (m)	Accidents/500m
1.	West Barnes Lane	20	1.	Streatham Road	6	1340	2.24
2.	Kingston Road	18	2.	London Rd (Mitcham)	6	1580	1.9
3.	Beverly Roundabout	12.5	3.	Manor Road	3	840	1.79
4.	Grand Drive	10	4.	Grove Road	3	852.8	1.76
5.	Merton Hall Road	9	5.	Church Rd (Mitcham)	5	1490	1.68
6.	Aragon Road	8	6.	Western Road	3	1130	1.33
7.	Manor Road	8	7.	Morden Road	3	1370	1.09
8.	London Rd (Mitcham)	7	8.	Wide Way	1	489.7	1.02
9.	Acacia Road	6.5	9.	Acacia Road	1	551.5	0.91
10.	Merton Road	6.5	10.	Christchurch Road	1	920	0.86
11.	Wide Way Roundabout	6	11.	Kingston Road	4	2710	0.74
12.	Grove Road	4	12.	Mostyn Road	1	1110	0.45
13.	Streatham Road	4	13.	Tamworth Lane	1	1220	0.41
14.	Church Road (Mitcham)	3	14.	West Barnes Lane	1	1230	0.41
15.	Church Road (W. Park)	3	15.	Haydon's Road	1	1370	0.36
16.	Henfield Road	3	16.	Grand Drive	1	2110	0.24
17.	Hillcross Avenue	3	17.	Aragon Road	0	1056	0
18.	Christchurch Road	2	18.	Beverly Roundabout	0	187.6	0
19.	Haydon's Road	2	19.	Bond Road	0	570.9	0
20.	Morden Road	2	20.	Church Road (W. Park)	0	1560	0
21.	Mostyn Road	2	21.	Dorset Road	0	1060	0
22.	Stratton Road	2	22.	Henfield Road	0	332.3	0
23.	Tamworth Lane	2	23.	Hillcross Avenue	0	1790	0
24.	Western Road	2	24.	Liberty Avenue	0	458.6	0
25.	Bond Road	1	25.	Merton Road	0	920	0
26.	Dorset Road	1	26.	Merton Hall Road	0	647.5	0
27.	Liberty Avenue	1	27.	Stratton Road	0	187.6	0
28.	Three Kings' Pond	1	28.	Three Kings' Pond	0	516.1	0
29.	Wide Way	1	29.	Wide Way Roundabout	0	76.8	0

Table 4 is an abbreviated version of Table 3, comparing directly the road and the objective ranking.

Table 4: Comparison of Pedestrian Rankings

	Road	Objective Ranking
1.	West Barnes Lane	14
2.	Kingston Road	11
3.	Beverly Roundabout	18
4.	Grand Drive	16
5.	Merton Hall Road	26
6.	Aragon Road	17
7.	Manor Road	3
8.	London Rd (Mitcham)	2
9.	Acacia Road	9
10.	Merton Road	25
11.	Grove Road	4
12.	Streatham Road	1
13.	Wide Way Roundabout	29
14.	Church Road (Mitcham)	5
15.	Church Road (W. Park)	20
16.	Henfield Road	22
17.	Hillcross Avenue	23
18.	Christchurch Road	10
19.	Haydon's Road	15
20.	Morden Road	7
21.	Mostyn Road	12
22.	Stratton Road	27
23.	Tamworth Lane	13
24.	Western Road	6
25.	Bond Road	19
26.	Dorset Road	21
27.	Liberty Avenue	24
28.	Three Kings' Pond	28
29.	Wide Way	8

From Tables 3 and 4, it is apparent that few of the perceived and objective sites have a similar ranking. Of the 29 roads listed, only two are within one or two places of the objective ranking. These three roads are Acacia Road and Three King's Pond. However, Three King's Pond is the second lowest perceived risk site, and has no accidents recorded. Therefore, the only road with accidents that corresponds to the ranking given by the pedestrians is Acacia Road. The percentage of 'correct' rankings given by pedestrians is 7%.

This discrepancy between perceived and objective risk is very high. In order to propose

reasons for these differences, we compared the reasons for the accidents on the roads with the comments made during the interviews. We also examined the objective data from three to six years ago (01/01/1995 to 31/12/1997), and again from six to nine (01/01/1992 to 31/12/1994) to determine if any trends existed. Furthermore, we researched into the past actions taken in these areas to see if any improvements had been made. The software was then used to generate clusters of 5 accidents or more in a 250-metre radius, which we compared to the roads that were listed by pedestrians as dangerous.

Table 5 compares the comments from the interviews in which a road was mentioned, and the accident reports from the road. The numbers in parentheses in column two are the frequency of similar responses. In column three, the number in parentheses is the number of accidents that occurred on this road. Each star at the beginning of a comment denotes a new response. An extended version of the comments can be seen in the content analysis, Appendix G, and the full accident reports are included in Appendix I.

Table 5: Comments from Interviews and Reasons for Pedestrian Accidents

Road	Comments from Interviews	Accident Types (Number)
Acacia Road	*Acacia Road outside of school needs crossing. (3)	Peds stepped or crossed in front of vehicle. (1)
Aragon Road	*Dangerous because of traffic. (4)	(0)
Beverly Roundabout	*Beverly roundabout is a very hard place to walk and to cross the road. (5)	(0)
Bond Road	*Bond Road has traffic.	(0)
Christchurch Road	*Savacentre roundabout has a gap in crossings near Christchurch Road.	Peds stepped or crossed in front of vehicle. (1)
Church Road (Mitcham)	*On Church Road, we have to cross at a traffic island. They are not wide enough because the street is so narrow and you can't fit a pushchair without it hanging out into the traffic. *One time, my wife was walking our daughter to school and she was up at Church Street at the Haslemere Avenue zebra crossing and the motorist didn't stop and my wife got her foot run over. They don't stop at the crossing. It is very unsafe.	Peds stepped or crossed in front of vehicle. (5)
Church Road (WP)	*Not enough crossings.	(0)
Dorset Road	*Has traffic.	(0)
Grand Drive	*Grand Drive, it is impossible to get in and	Peds stepped or crossed in front of vehicle. (1)

	out of the car with children because people drive so fast down this road. (2) *Main roads go through to Grand Drive through London without crossings, like at Hackfield School where there is only one Zebra crossing, needs more. (3)	
Grove Road (Mitcham)	*Grove Road near school – no crossing, only a pedestrian refuge, which isn't wide enough to fit a bicycle. Would like to see a Zebra crossing. (2)	Peds stepped or crossed in front of vehicle. (3)
Haydon's Road	*Haydon's Road has traffic.	Peds stepped or crossed in front of vehicle. (1)
Henfield Road	*I live by an alleyway, on Henfield Road, and the cars drive through it really fast, so I am not allowed to go and play there. I think that they should put up some signs that say 'children at play' because on the other side of the alleyway there are flats and the alleyway is like their garden and so the children want to play there, but because the cars speed down the alleyway, they cannot.	(0)
Hillcross Avenue	*Hard to cross. (2)	(0)
Kingston Road	*Crossing over Kingston Road is hard sometimes, because of traffic. (6) *Near the train station, road is busy. (3) *Also near the Liquor Bottle [Pub, on the corner of Merton Hill Rd and Kingston Rd], cars do not stop for the lights. I was waiting to cross one day and the light was red for the cars but two of them just went through it. It makes it really hard to cross the road when they do that.	Peds stepped or crossed in front of vehicle. (4)
Liberty Avenue	*Split speed bumps aren't effective. Cars line up their wheels and they go right through. A couple more zebra crossings.	(0)
London Road (Mitcham)	*Near Figges Marsh – Two crossings are too far apart, makes it difficult if not near either one. (2) *All the lorries on the side of the road, the smell and noise and you can't see or get through. It's particularly bad in the morning *Between Cricket Green to Morden Road there should be more crossings.	Peds stepped or crossed in front of vehicle. (6)
Manor Road	*Traffic. *Crossing men don't work. *Four roads meet, very busy and fast traffic. *At the corner (Rowan Rd, Wide Way) because all 4 roads come together and the pedestrian lights don't work all the time and when they do, they don't stay green long enough for you to cross safely.	Peds stepped or crossed in front of vehicle. (3)
Merton Hall Road	*Very busy. (5)	(0)
Merton Road	*Merton Road is very busy. (2) *Merton Road has lots of traffic. *Down Merton Road, it's tough sometimes.	(0)
Morden Road	*Morden Road is hard to cross.	Peds stepped or crossed in front of vehicle. (3)
Mostyn Road	*Mostyn Road is very busy.	Peds stepped or crossed in front of vehicle. (1)

Stratton Road	*Stratton Road – no crossings, however, adding crossings would increase traffic by slowing cars down.	(0)
Streatham Road	*Streatham Road – not enough crossings. (2)	Peds stepped or crossed in front of vehicle. (6)
Tamworth Lane	*It is hard to cross.	Peds stepped or crossed in front of vehicle. (1)
Three Kings' Pond	*Very busy and no crossings.	(0)
West Barnes Lane	*Doesn't have a crossing. *You have to just try to cross the road when you can. *Everyone crosses all over the road. *It isn't safe at all. *We have to run across the road sometimes. *Needs a crossing. (2)	Peds stepped or crossed in front of vehicle. (1)
Western Road	*Western Road – no crossings.	Peds stepped or crossed in front of vehicle. (3)
Wide Way	*Very busy.	Peds stepped or crossed in front of vehicle. (1)
Wide Way Roundabout	*Hard to cross at times. (3)	(0)

As we can determine from Table 5, although pedestrians perceive many roads as having too few crossings and being too busy, the accident reports indicate the danger is from pedestrians not waiting for an appropriate time to cross and placing themselves in danger. At this time, we have no way of determining the factors influencing the pedestrians' judgement, causing them to take this risk. Many possibilities exist, such as being unable to cross the road promptly due to traffic volumes, causing the pedestrian to try to cross without an adequate gap between vehicles. Another explanation could be impatience and lack of education. It was also brought to our attention that pedestrians do not often walk out of their way to reach a crosswalk and will place themselves in danger to avoid the inconvenience.

Next, we examined the trends in child pedestrian accidents from the past three years, from three to six years ago, and six to nine years ago. We also researched the changes that have been made on these roads to attempt to locate reasons for these trends and the perceived risk. A map of each road for the three time periods is included in Appendix L.

Table 6: Accident Trends and Improvements for Pedestrians

Road	Accidents/ 500m	Changes	Accidents/ 500m	Changes	Accidents/ 500m	Changes
	1/1/98– 31/12/00	1/1/98–31/12/00	1/1/95– 31/12/97	1/1/95–31/12/97	1/1/92– 31/12/94	1/1/92–31/12/94
Streatham Road	2.24	99 – Parking bay w/ partial footpath parking, extended double yellow lines from bridge, new signal crossing facilities at London Rd, parking restrictions, road narrowing	0		0	
London Road (Mitcham)	1.9	99 – Red light cameras to prevent drivers from running red lights	2.22		1.27	
Manor Road	1.79		2.99		1.19	
Grove Road	1.76		0.59		0.59	
Church Road (Mitcham)	1.68	99 – Conversion of Zebra to Pelican near Haslemere, removed pedestrian refuges to provide parking spaces, junction entry treatment, waiting restrictions	2.68	95 - Waiting restrictions	0.67	
Western Road	1.33		0.88		1.33	
Morden Road	1.09		0		0.73	94 – Pedestrian refuges, road markings
Wide Way	1.02		5.11		2.04	
Acacia Road	0.91		0.91		2.72	
Christchurch Road	0.86		0		2.57	
Kingston Road	0.74	98 – Antiskid surfacing 98 – Pedestrian crossing at Hartfield Road 99 – Slow, give way markings	0.18		0.92	
Mostyn Road	0.45		0		0	93 – Traffic calming
Tamworth Lane	0.41		1.23		0.82	94 – Traffic calming
West Barnes Lane	0.41	00 – Waiting restrictions increased 00 – Mini roundabout approved	0.41		0	
Haydon's Road	0.36		0.36	95 – Extended waiting restrictions	0.73	
Grand Drive	0.24	00 – Banned U turn at Bushey Road	0.24		0.71	93 – Pedestrian refuges 94 – Waiting



						restriction
Aragon Road	0		0		0	
Beverly Roundabout	0		2.68		0	94 – Waiting restriction, Grand Drive
Bond Rd	0		0		1.75	
Church Road (W. Park)	0		0.32		0.64	94 – Traffic calming and parking restrictions
Dorset Road	0		0		0	92 – Lorry ban 93 – Traffic calming
Henfield Road	0		0		0	
Hillcross Ave	0		0.56		0	
Merton Road	0		0		0	
Merton Hall Road	0		0		0	
Stratton Road	0		0		0	
Liberty Avenue	0		1.09	95 – No right turn	0	
Three Kings' Pond	0		0.97		0.97	
Wide Way Roundabout	0		0		6.51	

From Table 6, we were able to isolate trends in the accident data. The first pattern that was apparent is the oscillatory nature of the accident levels for each road. The tendency on the majority of the roads is to fluctuate over time. This can be due to several factors including changes in traffic demographics, the avoidance of an area that was formerly dangerous and thereby reducing the traffic density, and being more careful in a high risk intersection or road. Once a road is viewed as dangerous, both pedestrians and drivers will compensate for the risk by being more cautious at the area.

On several roads, after waiting restrictions or parking restrictions were introduced, the accident levels increased. The effect of introducing parking restrictions can make a road appear more wide, increasing the 85<sup>th</sup> percentile speed of drivers on the road, that is, the speed that 85% of motorists drive at or under. While restrictions to vehicles beside a road can improve visibility

and reduce accidents caused by pedestrians crossing in between parked cars, the negative effect of a speed increase may be to cause more casualties.

Finally, as the last method, we located clusters through the Traffmap® software to determine where the highest accident sites were, if they corresponded to roads listed by pedestrians, and the reasons for the accidents on these roads. The software was given the criteria of finding five or more accidents in a 250-metre radius. A map of each cluster is included in Appendix N. The first column of Tables 7 through 11 is the police code, followed by the date the accident happened and where it occurred. The age of the pedestrian involved and the contributory factor code is included as well. The description of each code can be found in Appendix K.

Table 7: Pedestrian Cluster Data 1

<b>CLUSTER 1</b>					
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age/Gender :</b>	<b>Code:</b>
0198VW00407	7/5/98	36 Beeleigh Road 130M S J/W Bardney Road	Ped ran into path of V1 from between parked vehicles.	2/M	402
0100VW00219	3/14/00	Central Road J/W Bruton Road	Ped walked into path of V1.	5/F	404
0198VW00363	6/15/98	Central Road 20M N J/W Hazelwood Avenue	Ped ran into path of V1 from between parked vehicles.	9/M	402
0199VW00604	9/14/99	NFL flagged at Central Road J/W Bristol Road	Ped stepped onto crossing into starting V1.	13/M	403
0199ZN00400	6/4/99	Bristol Road NFL 20M W J/W Canterbury Road Croydon	Ped crossed road across path of V1 masked by parked vehicles.	10/F	402

Table 8: Pedestrian Cluster Data 2

<b>CLUSTER 2</b>					
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age/Gender :</b>	<b>Code:</b>
0100VW00059	1/26/00	Rowan Road J/W Stanford Way	Ped stepped into path of V1.	10/M	404
0198VW00304	5/18/98	141 Manor Way 170M E J/W Manor Place	Ped ran into path of V1 from between parked vehicles.	5/F	402
0198VW00103	2/25/98	195 Manor Way 80M W J/W Rowan Road	Ped ran into path of V1 from behind parked vehicles.	9/M	402
0199VW00444	7/20/99	<b>Manor Road</b> 50M W J/W <b>Wide Way</b>	Ped ran into path of V1.	12/F	402
0198VW00758	12/9/98	Rowan Road J/W Northborough Road	Ped on crossing struck by V1 overtaking on near side. V1 FTS.	14/F	206

Table 9: Pedestrian Cluster Data 3

<b>CLUSTER 3</b>					
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age/Gender :</b>	<b>Code:</b>
0199VW00669	10/31/99	NFL flagged at Hassocks Road 50M E J/W Rowan Road	Ped walked into path of V1.	4/M	402
0199VW00407	7/1/99	79 Rowan Road 30M N J/W Windermere Road	Ped stepped into path of V1.	15/F	404
0198VW00337	6/3/98	Rowan Road 20M N J/W Windermere Road	Ped ran into path of V1.	9/F	404
0100VW00089	2/11/00	71 Rowan Road J/W Windermere Road	Ped ran into path of V1.	11/F	402
0198VW00055	2/3/98	Rowan Road J/W Windermere Road	Ped crossing struck by V1.	11/F	404

Table 10: Pedestrian Cluster Data 4

<b>CLUSTER 4</b>					
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age/Gender :</b>	<b>Code:</b>
0199VW00135	3/3/1999	Steers Mead J/W Turner Avenue	Ped ran into path of V1 from behind parked vehicles.	5/M	402
0100VW00104	2/14/2000	<b>London Road</b> 50M N J/W Lavender Avenue	Ped ran into path of V1.	11/F	402
0198VW00242	4/18/1998	26 Lavender Avenue 30M E J/W Rose Avenue	Ped ran into path of V1 from behind parked vehicles.	6/F	402
0100VW00286	5/13/2000	<b>London Road</b> J/W <b>Streatham Road</b>	Ped ran into path of V1.	10/M	404
0100VW00386	7/1/2000	<b>London Road</b> J/W <b>Streatham Road</b>	V1 disobeyed ATS & struck ped crossing road.	9/M	204
0198VW00159	3/21/1998	<b>London Road</b> J/W Locks Lane	Ped ran onto crossing into path of V1.	13/M	403

Table 11: Pedestrian Cluster Data 5

<b>CLUSTER 5</b>					
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age/Gender :</b>	<b>Code:</b>
0100VW00237	4/19/00	<b>London Road</b> J/W Lower Green West	Ped stepped into path of V1.	14/F	404
0198VW00516	8/26/98	<b>London Road</b> J/W Elmwood Road	Ped stepped into path of V1 from between stationary vehicles.	9/F	402
0199VW00285	5/10/99	Upper Green West 30M E J/W <b>London Road</b>	Ped ran into path of V1.	12/M	404
0198VW00517	8/27/98	Upper Green West J/W <b>London Road</b>	Ped ran onto crossing against red light into path of V1.	6/M	403
0199VW00520	8/23/99	NFL flagged at Upper Green West J/W <b>London Road</b>	Ped stepped onto crossing into path of V1.	2/M	224
0100VW00283	5/10/00	Upper Green West 45M W J/W <b>London Road</b>	Ped ran into path of V1.	13/M	404
0199VW00761	12/23/99	15 Upper Green West 50M E J/W Holborn Way	Ped stepped into path of V1, which FTS.	9/M	402
0100VW00555	8/20/00	Upper Green West 30M E J/W <b>London Road</b>	Ped ran into path of V1.	8/F	402
0199VW00734	12/9/99	Upper Green West J/W <b>Western Road</b>	Ped crossed into path of V1.	14/F	402
0199VW00313	5/23/99	Holborn Way J/W <b>Western Road</b>	Ped ran into path of V1.	13/M	404

The road names that have been written in bold font are those mentioned in pedestrian interviews as dangerous. It is apparent from Tables 7 through 11 that the highest risk sites once again do not correspond with the pedestrian rankings we determined. The accidents were, once again, predominantly the fault of the pedestrian in the eyes of the reporting officer. Whether impatience or a lack of inadequate crossing time and facilities was a factor depends greatly on the area and time of day.

#### 4.2 Perceived Risk Cyclists

To determine the perceived risk for cyclists, we performed individual interviews both at workplaces of referred cyclists and on-site at high traffic locations for cyclists. In Table 13, the

latent value given to each response and the frequency and totals are listed. A description of how each of these values was determined can be read in Section 3.3.7. The full comments from each interview can be read in Appendix H.

Table 12: Perceived Risk for Cyclists

Road	Latent Value	Latent Value	Latent Value	Latent Value	Latent Value	Frequency	Total
Kingston Road	3	3	3	3		4	12
Wimbledon Centre Area	2	2	2	2	2	5	10
Martin Way	3	2.5	2.5			3	8
Worple Road	2	2	3			3	7
Grand Drive	1	1.5	3			3	5.5
Morden Station Area	2	2				2	4
West Barnes Lane	2	2				2	4
Colliers Wood Station Area	2	2				2	4
Raynes Park	2	2				2	4
Savacentre Roundabout	2	1.5				2	3.5
The Broadway	3					1	3
North Road	2.5					1	2.5
Black Shaw Road	2					1	2
Garret Lane	2					1	2
Hartfield Crescent	2					1	2
Hillcross Avenue	2					1	2
Bushey Road	1					1	1
Goldcliff Area	1					1	1
Mitcham Area	1					1	1

From Table 12, we can see that the highest perceived risk for cyclists is on Kingston Road, with the Wimbledon Centre area highly mentioned as well. In order to determine whether a relationship between perceived and objective risk exists for these sites, we listed the accidents per 500 metres for these roads and compared the two lists in Table 13. The maps for the objective data are included in Appendix M.

Table 13: Perceived and Objective Ranking

	Perceived Ranking	Latent Total		Objective ranking	Number of Accidents	Length of Road (m)	Accidents/500m
1.	Kingston Road	12	1.	Savacentre Roundabout	4	165	12.12
2.	Wimbledon Centre	10	2.	Wimbledon Centre	20	980	10.2
3.	Martin Way	8	3.	Broadway	8	880	4.55
4.	Worple Road	7	4.	Colliers Wood Station area	2	277.6	3.6
5.	Grand Drive	5.5	5.	Kingston Rd	10	2770	1.81
6.	Morden Station Area	4	6.	Morden Station area	2	602	1.66
7.	West Barnes Lane	4	7.	Worple Road	5	2000	1.25
8.	Colliers Wood Station Area	4	8.	Martin Way	3	1630	0.92
9.	Savacentre Roundabout	3.5	9.	West Barnes Lane	4	2290	0.87
10.	Broadway	3	10.	Bushey Road	2	2179	0.46
11.	North Road	2.5	11.	Hillcross Avenue	1	1780	0.28
12.	Blackshaw Road	2	12.	Grand Drive	5	2070	0.24
13.	Hartfield Crescent	2	13.	Blackshaw Road	0	1220	0
14.	Hillcross Avenue	2	14.	Hartfield Crescent	0	240	0
15.	Bushey Road	1	15.	North Road	0	650	0

Table 14 is an annotated version of Table 13, comparing only the rankings.

Table 14: Comparison of Cyclist Rankings

	Road	Objective Ranking
1.	Kingston Road	5
2.	Wimbledon Centre	2
3.	Martin Way	8
4.	Worple Road	7
5.	Grand Drive	12
6.	Morden Station Area	6
7.	West Barnes Lane	9
8.	Colliers Wood Station Area	4
9.	Savacentre Roundabout	1
10.	Broadway	3
11.	North Road	15
12.	Blackshaw Road	13
13.	Hartfield Crescent	14
14.	Hillcross Avenue	11
15.	Bushey Road	10

From Tables 13 and 14, there are five locations which are within a deviation of two places from the objective ranking. These five sites are Wimbledon Centre, the Morden Station Area, West Barnes Lane, Blackshaw Road, and Hartfield Crescent. Of these areas, Blackshaw Road and

Hartfield Crescent are ranked as low risk for both rankings. This leaves us with Wimbledon Centre, the Morden Station Area, and West Barnes Lane. The percentage of ‘correct’ rankings is 20%.

To explain why this difference exists between public opinion and the statistics from accidents, we analysed the objective data to learn the reasons for the accidents. We then compared the reasons for each accident with the comments made during interviews to see if there was a relationship between the cause of the accident and the reasons cyclists feel endangered. Next, we compiled the data from the present to three years past, three to six years ago, and six to nine years ago to attempt to isolate trends. We located changes that had been made to each road in the time period to help explain the changes. We also located clusters of accidents and examined the reasons and areas in which they were occurring.

In Table 15, the comments from the interviews are compared to accident types occurring on each of the listed roads. The full accident reports can be read in Appendix J.

Table 15: Comments from Interviews and Reasons for Cyclist Accidents

Road	Comments from Interviews	Accident Types
Black Shaw Road	*The bollards cause cyclists to weave in and out of the traffic and it's horrible, I can hear the traffic revving up behind me.	(0)
Broadway	*If you have to get across traffic, in order to go into the one way system and there is no marking for it there is no safe way of doing it (in front of Woolworth's).	*Cyclist collided with vehicle. *Vehicle turned across cyclist's path. *Vehicle changed lanes into cyclist's path. *Vehicle struck from behind by cyclist. (2) *Cyclist struck by passing vehicle. (2)
Bushey Road	*Poor road condition, not clearly marked as cycle route, and it only runs 1/2 way along the road.	(0)
Collier's Wood Station Area	*The minute you do this your in two or three lanes and you never know which lane to be in: There are no cycle lanes, and it is not well lit at night (2)	*Cyclist fell into path of vehicle. *Vehicle failed to give way.
Grand Drive	*Need route along Grand drive; gets so congested. Lots of cars went too fast, over 30 mph. (3)	*Vehicle turned across cyclist's path. *Pedestrian struck by cyclist. (2) *Vehicle opened door into cyclist's path. *Cyclist cycled into vehicle.

Hartfield Crescent	*Residents park on either side of the street, and road humps. There are two things about that road, one is traffic moving freely, and traffic cannot get past you so they ride up behind you. If traffic isn't moving freely, it gets really backed up and it is difficult for a cyclist to get through there because of the traffic and cars parked on either side.	(0)
Hillcross Ave	*It's one of the few roads in the Borough that has had absolutely nothing done to it. Speed reduction systems (cameras) were installed on other roads so no traffic uses this one as a principal route: You can do it at sixty and never encounter a police officer, and the council has done nothing about it.	*Pedestrian on footpath struck by cyclist.
Kingston Road	*Traffic just does not care about cyclists, you're an impediment to the road. *Cars parking in cycle lanes is bad and nothing seems to ever happen to them. *I don't really cycle on Kingston anymore. *I feel unsafe riding on Kingston Rd, cars travel way too fast, and they are main carriage ways. Cars travelling too fast, to much traffic	*Vehicle turned across cyclist's path. (3) *Vehicle crossed give way/lane line into cyclist's path. (4) *Cyclist collided with emerging vehicle. (2)*Cyclist forced into kerb. *Cyclist struck from behind.
Martin Way	*Traffic just does not care about cyclists, you're an impediment to the road. *There are certain points on the road where the pavement seems to jut out and there is an island. On more than one occasion vehicles choose to share that narrow bit of road with me. *It is principally because heavy goods vehicles have found it a very convenient cut through or direct route; there is nothing more terrifying than an eighteen wheeler when you're on a bike. Why does the cycle track run out when you need it?	*Vehicle crossed give way line and struck cyclist in junction. (3)
Morden Station Area	*The minute you do this you're in two or three lanes and you never know which lane to be in. (2)	(0)
North Road	*There are no cycle lanes and it is not well lit at night	(0)
Savacentre roundabout	*Traffic travels very fast from Mitcham and it is difficult for motorists to see the cyclists. (2)	*Cyclist fell into vehicle. (2) *Vehicle failed to give way. *Vehicle and cyclist collided in junction.
West Barnes Lane	*You are expected to dismount to cross pavement. *Very poor surfaces.	*Cyclist on footpath collided with vehicle. *Cyclist changed lanes into path of vehicle. *Vehicle opened door into path of cyclist. *Cyclist changed lane into vehicle.
Wimbledon Centre	*Busy area, dangerous area. (5)	*Vehicle turned across cyclist's path. (2)*Cyclist cycled into path of vehicle. (2)*Cyclist struck by passing vehicle. (3) *Stationary vehicle struck by cyclist. (4)*Vehicle changed lanes into cyclist. (6) *Cyclist fell over. (3)
Worple Rd	*Bad surface, and very heavy traffic, and it is a bit on the narrow side. *Because there are so many road works and terribly bad surfaces, to avoid the bad surfaces you veer out. *Too hilly and difficult to zigzag to avoid lots of buses.	*Cyclist struck in junction by vehicle. *Cyclist fell into path of oncoming vehicle. *Passenger opened door into path of cyclist. (2) *Cyclist struck from behind by vehicle.



From Table 15, we can see that the reasons for accidents as well as the dangers perceived by cyclists are widely varied. Accidents can be caused by anything from opening car doors to inattention to the automatic traffic signals. Accidents are caused by many more reasons for cyclists than for pedestrians. Pedestrians only interact with vehicles when attempting to cross the carriageway, however cyclists must interact with vehicles almost constantly. This also explains the higher level of accidents per 500 metres than for pedestrians.

Next, we compared the accidents per 500 metres of road for the three time spans and the improvements and changes made to these roads over the same time periods. The maps for all three periods of accident data can be seen in Appendix M.

Table 16: Accident Trends and Improvements for Cyclists

	Accidents/500m	Changes	Accidents/500m	Changes	Accidents/500m	Changes
1/1/98–31/12/00	1/1/98–31/12/00	1/1/95–31/12/97	1/1/95–31/12/97	1/1/92–31/12/94	1/1/92–31/12/94	1/1/98–31/12/00
Savacentre Roundabout	12.12		12.12		12.12	
Wimbledon Centre	10.2	99 – Banned right turn 98 – Speed cushions	3.06	97/98 bicycle route (4/97)	6.12	
Broadway	4.55		0.57		4.55	
Colliers Wood Station area	3.6		7.2		1.8	
Kingston Rd	1.66	98 – Antiskid surfacing 00 – Toucan crossings	2.17		2.71	
Morden Station area	1.25		0		0	
Worple Road	0.92		0.5		1.5	
Martin Way	0.87		1.84	96 – Footway parking, waiting restrictions revoked	1.23	
West Barnes Lane	0.46		0.44		0.66	
Bushey Road	0.28	00 – Banned U turn at Grand Drive	0.23		0.92	94 – Waiting restrictions 94 – 40mph speed limit
Hillcross Avenue	0.24		0.28		0.56	
Grand Drive	0	00 – Banned U turn at Bushey Road	1.93		0.72	
Blackshaw Road	0		0		0	
Hartfield Crescent	0		2.08		2.08	
North Road			0.77		0.77	

From Table 16, several trends are apparent. First, the accidents also oscillate over the years, further supporting the assumption that accidents oscillate naturally through traffic demographics and risk compensation. Because the accident trends oscillate naturally, it is difficult to form conclusions, but we were able to conclude one major finding. Specifically, waiting restrictions

appear to improve accident rates. This can be stated from the accident trends on Bushey Road and Martin Way. Several explanations for this exist. First, removal of parking vehicles would remove the hazard of car doors in the path of cyclists. Second, without parked vehicles, the road is wider, providing more room for a cyclist to ride without having to swerve around vehicles at the side of the road. Despite the possible increase in vehicular speed, waiting restrictions appear to increase cyclist safety.

Finally, we used the Traffmap® software to locate the top five accident clusters in a 250-metre radius, as shown in Tables 17 through 21. The number in column one is the police code through Traffmap®. The following columns give the date of the accident, where it occurred, the type of accident, and the contributory factor code. The list of these codes is in Appendix K. Also, pictures of these clusters are in Appendix O. The roads that were cited by cyclists as dangerous are written in bold text.

Table 17: Cyclist Cluster Data 1

<b>CLUSTER 1</b>				
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0100VW00529	9/2/00	<b>Wimbledon Hill Road</b> J/W Woodside	C1 stationary at junction struck from behind by V1.	218
0199VW00364	6/14/99	<b>Wimbledon Hill Road</b> J/W Woodside	V1 crossed give way line into path of C1.	207
0199VW00348	6/8/99	<b>Wimbledon Hill Road</b> J/W Woodside	V1 dazzled by sun crossed into path of C1.	233
0199VW00490	8/3/99	<b>Wimbledon Hill Road</b> J/W Compton Road	V1 stopped at junction struck from behind by C1.	216
0199VW00525	8/25/99	<b>Wimbledon Hill Road</b> J/W <b>Worple Road</b>	C1 fell into path of oncoming V1 which FTS.	239
0198VW00263	4/26/98	NFL flagged at 20 Alexandra Road 160M N J/W <b>Wimbledon Hill Road</b>	V1 turned left across path of C1 on near side.	210
0198VW00434	7/20/98	<b>Worple Road</b> J/W Francis Grove	V1 crossed give way line and struck C1 in junction.	207
0199VW00183	3/26/99	<b>Wimbledon Hill</b> J/W Alexander Road	V1 changed lanes into path of C1 changed lanes into path of V1.	221
0100VW00471	8/4/00	NFL flagged at <b>Wimbledon Bridge</b> 50M E J/W Alexandra Road	C1 forced to brake sharply fell from machine.	238
0100VW00029	1/13/00	<b>Wimbledon Bridge</b> J/W Hartfield Road	V1 change lanes across path of C1 and FTS.	221
0100VW00565	9/28/00	<b>Wimbledon Bridge</b> J/W Hartfield Road	V1 changed lanes across path of C1.	221
0198VW00102	2/25/98	<b>Wimbledon Bridge</b> J/W Hartfield Road	C1 collided with V1 on off side.	217
0198VW00181	3/28/98	<b>Wimbledon Broadway</b> 25M W J/W Queens Road	C1 struck by passing V1 which FTS.	217
0199VW00713	11/30/99	<b>Wimbledon Broadway</b> J/W Queens Road	C1 travelling on wrong side of road struck by V1.	231

Table 18: Cyclist Cluster Data 2

<b>CLUSTER 2</b>				
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0199VW00355	6/11/99	Merton Road J/W Pelham Road	C1 struck from behind by V1 which FTS.	216
0100VW00221	4/12/00	Merton Road 70M N J/W Balfour Road	V2 turned right across path of C1.	209
0199VW00155	3/17/99	<b>Kingston Road</b> J/W Brisbane Avenue	V2 crossed give way line into path of C1.	207
0100VW00451	7/26/00	Merton High Street J/W Merton Road	C1 turned right across V1 on offside.	209
0100VW00697	11/22/00	Merton High Street J/W Merton Road	V1 turned right across path of C1 which FTS	209
0199VW00182	3/27/99	Morden Road J/W Merton High Street	C1 cycled onto crossing against red light into path of V1.	230
0199VW00738	12/10/99	Morden Road J/W <b>Kingston Road</b>	Passenger in V1 opened door into path of C1.	305
0198VW00717	11/21/98	Morden Road J/W High Path	V1 stopped at ATS struck by C1 on near side.	216
0198VW00616	10/8/98	Morden Road J/W High Path	C1 cycling off footpath struck by V1 overtaking on near side. V1 FTS.	229
0198VW00276	5/1/98	NFL flagged at Morden Road J/W The Path	C1 forced to swerve by passing vehicle left carriageway.	238

Table 19: Cyclist Cluster Data 3

<b>CLUSTER 3</b>				
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0100VW00293	5/17/00	Priory Road J/W Christchurch Road	Passenger in V1 opened door into path of C1.	305
0199VW00457	7/26/99	Christchurch Road J/W Christchurch Close	C1 on crossing struck by V1.	204
0199VW00531	8/26/99	<b>Christchurch Road</b> J/W Tandem Way	V1 and C1 collided in junction.	217
0100VW00198	4/1/00	Merantun Way/ <b>Christchurch Road</b>	V1 failed to G/W to C1	207
0100VW00557	9/2/00	<b>Christchurch Road</b> J/W Merantun Way	Starting C1 fell against V1.	239
0198VW00057	2/2/98	<b>Christchurch Road</b> J/W Merantun Way	Rider of C1 lost control and fell into path of V1.	239
0199VW00719	12/1/99	Tandem Way 170M E J/W <b>Christchurch Road</b>	C1 cycled off footpath into turning V1.	229
0100VW00632	10/25/00	Christchurch Road 25M S J/W Liberty Avenue	C1 cycled off footpath into turning V1.	229
0199VW00496	8/6/99	Western Road 35M E J/W Church Road	V1 turned right across path of C1.	207
0100VW00036	1/16/00	<b>Christchurch Road</b> J/W Church Road	C1 cycled onto ped crossing into path of starting V1.	230

Table 20: Cyclist Cluster Data 4

<b>CLUSTER 4</b>				
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0198VW00305	5/18/98	8 Colliers Wood High Street 50M N J/W Waterfall Road	V1 turned left across path of C1 on near side	210
0100VW00482	7/25/00	Colliers Wood High Street J/W Robinson Road	V2 turned right across path of C1	209
0199VW00504	7/24/99	Colliers Wood High Street J/W Briscoe Road	V1 turned left across path of C1 on near side	210
0100VW00483	8/12/00	Colliers Wood High Street J/W Walpole Road	V1 opened door into path of V2. V2 into C1	223
0199VW00253	4/26/99	<b>Colliers Wood</b> High Street J/W Marlborough Road	V1 turned right into path of C1	207
0100VW00343	6/10/00	<b>Colliers Wood</b> High Street J/W Marlborough Road	V1 turned right across path of C1	209
0198VW00067	2/6/98	High Street <b>Colliers Wood</b> J/W Byegrove Road	C1 cycling off pavement collided with turning V1	229
0198VW00463	7/31/98	<b>Colliers Wood</b> High Street J/W Cavendish Road	V1 turned right across path of C1	209

Table 21: Cyclist Cluster Data 5

<b>CLUSTER 5</b>				
<b>Police Code:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0100VW00224	4/7/00	Camborne Road/Queen Mary Avenue	C1 rode off in path of V1	214
0100VW00306	5/11/00	<b>Grand Drive</b> 50M S J/W Queen Mary Avenue	V1 opened door into path of C1	223
0100VW00291	5/16/00	402 <b>Hillcross Avenue</b> 110M E J/W Tudor Drive	Ped on footpath struck by C1	228
0199VW00132	3/1/99	<b>Grand Drive</b> J/W <b>Hillcross Avenue</b>	C1 struck from behind by V1 which FTS	216
0199VW00369	6/15/99	Tudor Drive J/W Lower Morden Lane	V1 stopping in traffic struck from behind by C1	216
0199VW00206	4/1/99	Lower Morden Lane 50M E J/W <b>Hillcross Avenue</b>	V1 emerged into path of C1	207
0199VW00123	3/2/99	Tudor Drive J/W Lynmouth Avenue	V1 crossed give way line into path of C1	207
0198VW00312	5/20/98	NFL flagged at Tudor Drive 30M E J/W Lynmouth Avenue	C1 cycled onto ped crossing into path of V1	230

Several of these clusters correspond with areas of danger identified by cyclists. These are the Wimbledon Centre, the Savacentre Roundabout, and the Colliers Wood Station. They also identified several dangerous roads, such as Hillcross Avenue, Grand Drive, and Kingston Road.

Since these clusters correspond, objective risk can be used as a measure of perceived risk for cyclists when making improvements to accident cluster areas.

### **4.3 Conclusions**

The data we gathered exhibited patterns and trends that we were able to use to make suggestions and propose reasons for the information we found. In Chapter 5, we will discuss the implications of these findings and propose solutions to the Borough of Merton.

After researching the literature pertaining to VRU safety and improvements, current plans, and perceived risk, we were able to formulate suggestions from the implications of our data that fit as a cohesive part of the overall plan of the Borough of Merton.

### **5.1 Child Pedestrian Concerns**

From the data we collected, we cannot show that any relationship exists between perceived and objective risk. The roads that child pedestrians and their carers were most concerned about only in one instance actually appeared as dangerous according to the statistical data. This may not be a startling conclusion, since upon inspection of the accidents occurring in the Borough, one or more roads of particularly high risk could not be selected, unlike the patterns for cyclists. An overall map of the Borough with child pedestrian accidents marked can be seen in Appendix L. The accidents appeared scattered around the Borough, which would explain why only roads the children crossed on a regular basis seemed dangerous. Since their exposure was higher, the perceived risk increased. We also noticed that children did not travel very far or very often throughout the Borough, so would have no knowledge of roads outside of their area, making it difficult for there to be one road with an overall feeling of perceived risk.

We examined the roads that were described as unsafe, and were able to make some general conclusions. First, poor line of site when crossing affects the feeling of risk. This is a problem most often found at or near roundabouts, particularly at larger intersections. Second, traffic speed was the reason most often listed for a feeling of risk. Finally, pedestrian refuges are not perceived as effective.



Several suggestions can be made from these observations. In order to remove the need for advanced line of sight, Pelican or Toucan crossings can be installed, which allows pedestrians to cross without having to make a decision based solely on gaps in traffic; they can instead observe merely when cars have stopped. Another difficulty with roundabouts is limited driver visibility, which makes it difficult for the motorist to see a traffic light, pedestrian, or crossings. Both pedestrians and motorists must be especially vigilant around crossings, and in order to assist children in being aware of approaching motorists, school crossing patrols could be utilized to help children judge gaps in traffic.

Since the data suggested that waiting restrictions increase casualties, possibly through increased vehicle speed, a solution could be to include road narrowing measures with waiting restrictions, avoiding the compensation of drivers to the increased width of the carriageway. Using build-outs as a road narrowing measure would also increase the visibility of both pedestrians and motorists, and would allow parking in some areas as well.

In addition, traffic calming procedures are supported throughout the pedestrian community, and further improvements and expansions are viewed as necessary. However, when traffic-calming measures are mentioned, road humps are the only example respondents mention. This implies that the public views road humps as the major traffic calming measure, and may not even be aware of road narrowing as an improvement. Build-outs, chicanes, and pedestrian refuges were never mentioned as traffic calming measures that would be desired. In order to increase awareness of the many measures the Borough of Merton uses to decrease vehicular speeds, more publicity needs to be given to alternative traffic calming procedures.

Although pedestrian refuges are an effective road narrowing measure, it is the opinion of child pedestrians and parents that they are not effective. The main concern is the lack of depth,

causing difficulties with cycles, pushchairs, and wheelchairs. The narrowness of the refuges makes it difficult or even impossible for these groups to use the pedestrian refuges. Respondents indicated that a Zebra crossing would be the most favourable change in these areas.

As a final conclusion, in order to determine where pedestrians feel at risk, the only method we can recommend at this time is to consider the input of the pedestrians. Since the reasons appear predominantly the same for all roads, it would not be necessary in the future to do interviews, and surveys would suffice.

**Pedestrian Recommendations:**

1. Institute school crossing patrols at roundabouts near schools.
2. Reduce number of vehicles parking by installing build-outs instead of waiting restrictions.
3. Replace pedestrian refuges with Zebra crossings.
4. Expand current publicity schemes to include education on alternative traffic calming measures.

## **5.2 Cyclist Concerns**

As opposed to child pedestrians, we feel that it may be possible to determine perceived risk through objective risk for cyclists. In our analysis of the highest risk sites for cyclists, every cluster in the top five had a road that was described as dangerous, and three out of five were actual sites listed by cyclists. Also, in an overall visual inspection of accident trends, four roads were noticeably more dangerous. These were Rowan Road, Dunsford to Haydon's Road, High Street Colliers Wood, and Wimbledon Hill to Wimbledon Bridge and the Broadway, and may be examined in Appendix P. Haydon's Road, the Colliers Wood area, and the Wimbledon area were all listed as dangerous areas, further supporting the conclusion that objective risk can be an indicator of perceived risk for cyclists. However, the dangers to cyclists seem more difficult to treat, since accidents seem to be caused by many more reasons.

In order to propose solutions to these dangers, we reviewed the comments and suggestions made by cyclists during our interviews. A predominant concern among cyclists was the overall attitude of drivers towards cyclists. The respondents mentioned a lack of respect, awareness, and willingness to share the road with cyclists. This attitude was cited as the cause of accidents involving motorists passing too closely or not leaving an appropriate gap for the cyclist out of impatience and the feeling that cyclists do not have a right to the road. The solution cyclists proposed to this concern was driver education. If an impression could be made upon motorists that cyclists too have a right to the road, cyclists believe accidents of this type would decrease.

A reason similar to that of pedestrians for stating a road as dangerous was speed. However, cyclists prefer speeds of vehicles in the centres to be 20 miles per hour, rather than 30. Cyclists, on the other hand, recognize traffic calming measures apart from road humps, and support the alternative measures more than road humps. Complaints were made during interviews about the speeding up and slowing down of vehicles in response to these humps, which causes difficulty for the cyclists.

Another frequent reason for accidents was the opening of car doors into cyclists' paths. This could also be remedied through education, since rarely do we open our doors into the path of a vehicle, since it would cause great damage to our cars. However, since cyclists are injured much more than the vehicle is damaged, awareness is not as high as would be desired. Another solution is waiting restrictions. Reducing the number of cars parked along a road reduces the number of car doors opening. Since this can have the effect of increasing vehicle speed, we recommend once again road narrowing procedures to be implemented as well.

Most cyclists were in favour of cycling lanes, however there was a discrepancy between the opinion of an activist cyclist and that of an average cyclist. Most average cyclists approved of current cycling lanes, but would like to see more. The activist cyclist, however, seemed quite vehement about completely separate cycling lanes, and believed that painted cycling lanes placed cyclists in more danger by placing them in the same area as motorists.

The second method we used to propose solutions was observation of dangerous areas, specifically the clusters which corresponded to high perceived risk sites. These three areas were the Wimbledon Centre, the Colliers Wood Station area, and the Savacentre roundabout.

The Wimbledon Centre is composed of several intersections along a very short section of road. It is an extremely high traffic area due to the large number of businesses, the shopping centre, and the rail station located there. Buses, cycles, pedestrians, and motorists are all in high quantities in this area. In an ideal situation, vehicle traffic would be diverted around the Centre, decreasing the traffic and congestion in the immediate vicinity. However, since this is not feasible at this time, we recommend addressing the matter of cycling lanes not being present near the Centre.

The second cluster is the Colliers Wood Station area. As we can see from Appendix O, the intersection of Christchurch and High Street Colliers Wood is at an unusual angle. An improvement that could be made is to modify the angle of merge with High Street or using Priory Street as the main route instead, since most accidents in the area are caused by vehicles not yielding the right of way to cyclists.

Finally, the Savacentre roundabout, which consists of Christchurch, Tandem Way and Merantun Way, which is also near the merge of Western and Church Roads, which can be seen in Appendix O as well. The area has poor line of site with many stoplights and high volume,

#### Cyclist Recommendations

1. Traffic calming measures in town centres.
2. Opt for alternate traffic calming measures instead of road humps.
3. Decrease number of parked cars through waiting restrictions.
4. Build cycling lanes near the Wimbledon Centre.
5. Modify angle of Christchurch/High Street Collier's Wood intersection.
6. Traffic calming at Savacentre roundabout.
7. Increase driver education focus on right of cyclists to road and danger of opening car doors into a cyclist's path.

### 5.3 Joint Recommendations

Many of the recommendations for pedestrians and cyclists can be made to improve the same areas for the other VRU group. Below is a list of combined recommendations that take into account the needs of both cyclists and pedestrians.

#### Joint Recommendations

1. School crossing patrols at roundabouts near schools.  
Benefit – School crossing patrols help children judge gaps in traffic when crossing, and have the benefit of increasing the awareness of motorists, which will in turn aid cyclists.
2. Replace existing waiting restrictions with build-outs.  
Benefit – Build-outs increase the ability of pedestrians to see motorists, and vice versa. They also decrease the number of parked cars and reduce the need for cyclists to swerve around vehicles and opening doors. See Appendix Q.
3. Replace pedestrian refuges with Zebra or split Toucan crossings.  
Benefit – Allows pushchairs, cycles, and wheelchairs to cross safely.
4. Utilize alternate traffic calming measures instead of road humps, particularly in the town centres and the Savacentre roundabout.  
Benefit – Traffic calming measures such as build-outs and crossings assist pedestrians as well as slow traffic, and do not cause difficulties to cyclists.
5. Increase number of cycle lanes, focusing first on the Wimbledon Centre.  
Benefit – Increases the safety of cyclists, and reduces the number of cyclists using footpaths meant for pedestrians.
6. Modify angle of Christchurch/High Street Collier's Wood intersection.  
Benefit – Increased line of sight reduces errors in giving way to both cyclists and pedestrians.
7. Expand current educational programs to include alternate traffic calming measures, cyclists' right to the road, and the dangers of opening doors into a cyclists' path.  
Benefit – Including alternate traffic calming measures increases public awareness of the many ways the Borough increases safety. Increasing acceptance of cyclists on the road will help decrease accidents from impatience and unawareness.

Due to the time restrictions we were under and the limitations of the project, there are many avenues of research still open to provide a more complete picture of the perceived risk of VRU. These limitations include the sample size we were able to obtain, the distance between the areas in which we located respondents and the coverage error associated with this, and the biases intrinsic in our sampling methods. For example, choosing to only interview parents at public schools creates a bias, since many private schools exist in the Borough. Second, since we interviewed cyclists who worked within the Borough, we are unaware of the opinion of cyclists who live in the Borough, but cycle to work elsewhere. From these and other limitations we did not have time or resources to incorporate, we have listed a few possible projects that could expand the scope of our research.

Since we narrowed our focus to child pedestrians and cyclists, there are many frames in the VRU population that could be concentrated on instead. Elderly members of the community, powered two-wheeler riders, walking commuters, and many others are possible frames of research.

It was also not within the scope of our project to determine which VRU safety measures are perceived as most effective, and which in fact are the most effective. We would propose to do on-site interviews and analyse objective data to find a relationship.

Another area we would have liked to pursue is observation of high risk sites and interviewing both VRU and motorists at these sites to determine the opinions of actual users of these areas, who would be able to further explain why accidents are occurring.

A project that would focus more on increasing the number of VRU, specifically cyclists, in the Borough would be a feasibility study of placing cycle rental facilities placed around the Borough, near stations and other high traffic areas.

In order to determine other areas that need improvement, observations could be made of cycling and walking routes set up throughout the Borough to analyse whether they are effective and being used, and if improvements need to be made.

A suggestion which specifically stems from our project would be a determination of the effectiveness of painted cycle lanes versus separated cycle lanes, and the public opinion of each.

Finally, to provide a ranking of all the roads and the perceived risk of each in the entire Borough, we would propose a mail or household survey. The data from a project of this scope would be able to show more clearly the disparity between perceived and objective risk, or perhaps even an unknown relationship.

## **5.5 Conclusions**

The Borough of Merton requested our assistance in increasing VRU safety. We achieved this by providing them with a ranked list of sites perceived as dangerous by child pedestrians and cyclists, comparing this ranking with the objective risk, determining the relationships between the types of risk, and finally by proposing solutions to the dangers perceived by both groups.

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# **GLOSSARY OF TERMS**

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**EXTERNAL DISCOURAGEMENT:** Outside influences other than danger that affect a decision

**GENERAL UNCERTAINTY:** Uncertainty felt by all members of the community

**GTP:** Green Travel Plan

**IQP:** Interactive Qualifying Project

**KERB:** British equivalent to the US curb

**MVO:** Motor Vehicle Operator

**OBJECTIVE RISK:** The actual risk that the community has

**PELICAN CROSSINGS:** Mid-block crossings controlled by traffic signals and pushbutton pedestrian signals

**PERCEIVED RISK:** The danger that people believe exists at a section or site

**PERSONAL UNCERTAINTY:** Uncertainty felt by an individual

**PUFFIN CROSSINGS:** Pedestrian user-friendly intersections, which consist of traffic and pedestrian signals with pushbutton devices or a pressure mat detector

**TRANSIT:** Public transportation

**TOUCAN CROSSINGS:** Shared crossings for pedestrians and cyclists

**VRU:** Vulnerable Road Users

**ZEBRA CROSSINGS:** White diagonal lines painted on the road, which may or may not have signals

## APPENDIX A:

### CHILD PEDESTRIAN FATALITY RATE

Child pedestrian fatality rate per 100,000: 1997\*

Country	Children 0-14 Pedestrians
Great Britain	1.21
Austria	0.79
Belgium	0.94
Denmark	0.85
Finland	0.94
France	0.91
Greece	0.64
Ireland	1.31
Italy	0.49
Netherlands	0.66
Norway	0.81
Spain	0.94
Sweden	0.54
Switzerland	0.96

\*Facts from Tomorrow's Roads - Safer for Everyone, 2000

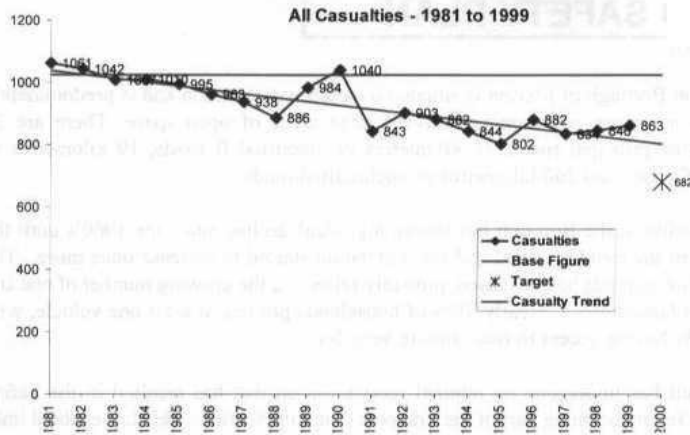
## APPENDIX B:

### RISK MATRIX

		Opportunity	
		Yes	No
D a n g e r	Y e s	Fungibility	"Better Safe Than Sorry"
	N o	"Waste Not, Want Not"	Indifference

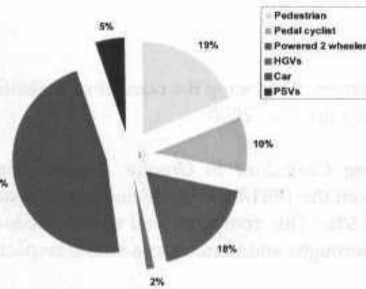
# APPENDIX C:

## STATISTICS OF UK CASUALTIES

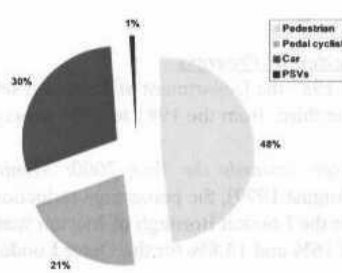


The pie charts below illustrate how the casualties recorded in 1999 are divided between road user type for all ages and for children only.

Casualties by Road User Type All Ages 1999



Child Casualties by Road User Type 1999



There is a marked difference between the two charts with adults more likely to be injured as a car occupant while children are more at risk as pedestrians. It is therefore from these two groups that casualty savings will need to be made if the new targets are to be met.

### The New Targets

In March 2000 the Government published 'Tomorrow's Roads - Safer for Everyone' in which new targets for casualty reduction were set out. The new targets are that using the 1994-98 average as the base figure by 2010:

- There will be a reduction of 40% in the number of people killed or seriously injured in crashes
- There will be a 50% reduction in the number of children killed or seriously injured in crashes
- There will be a 10% reduction in the slight casualty rate, expressed as the number of people slightly injured per 100 million vehicle kilometres

# APPENDIX C:

(continued)

In Merton this means a reduction from an average of 130 killed or seriously injured per year to 52 per year for all age groups, and for children a reduction from 21 killed or seriously injured per year to 11 per year. The base figure for slight casualties is 712.

**Targets:** a reduction in the number of casualties from the 1994 -1998 base figure to -

78 Killed or seriously injured for all ages by 2010

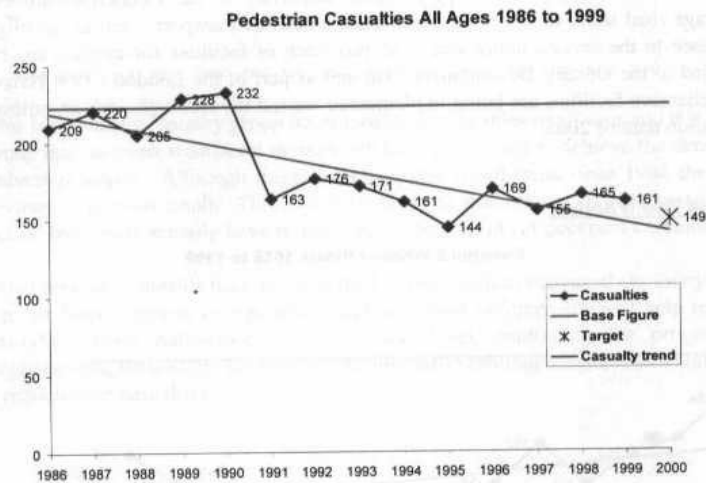
11 Children killed or seriously injured by 2010

These targets are challenging and are going to be difficult to achieve especially without increasing the number of slight casualties. Engineering measures can be used to reduce the number of crashes occurring at locations where there is an identifiable pattern or clusters of crashes. However, many of the fatal and serious casualties occur at locations that have no history of crashes and so an appropriate engineering solution can be difficult to identify. In the long term any sustainable reduction in road casualties has to be from changes in the attitudes and behaviour of all road users, particularly drivers.

ROAD SAFETY PLAN 2001/2002

### Casualty Trends

#### Pedestrians

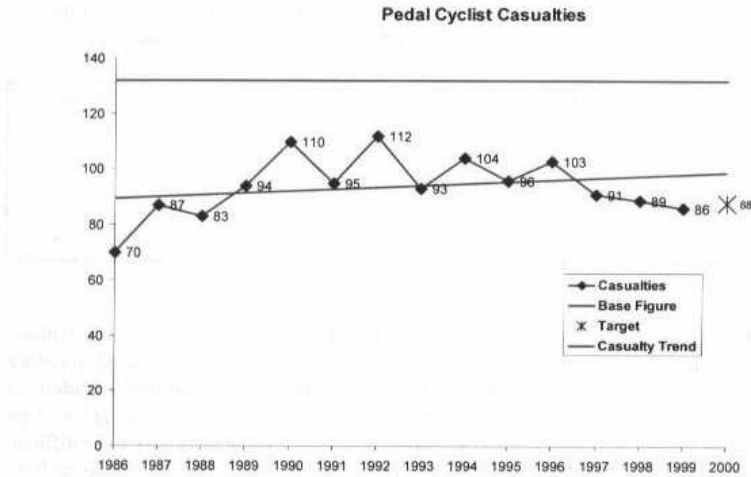


There has been good overall progress in reducing the number of pedestrian casualties, although there has been a slight increase since the lowest point in 1995. As the second largest casualty group, and a vulnerable road user group with 45 fatalities since 1986 out of a total of 94. The needs of pedestrians are already a high priority when the design of traffic schemes is being considered and they will continue to be a priority for casualty reduction.

# APPENDIX C:

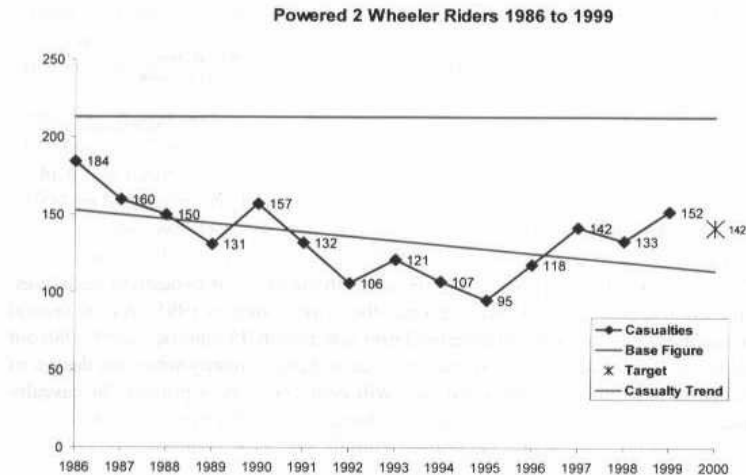
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## Pedal Cyclists



The one-third-target reduction for pedal cyclist casualties has been met. However, there is an overall upward trend in the casualty data since 1986. It is, therefore, important that providing facilities for cyclists, such as cycle routes, together with practical training schemes are continued. This will be more important as the Council continues to encourage road users to use more sustainable modes of transport, such as cycling, in preference to the private motor car. The provision of facilities for cyclists has been identified in the Unitary Development Plan and as part of the London Cycle Network comprehensive facilities are being implemented around the Borough with an estimated completion date of 2005.

## Powered Two Wheelers

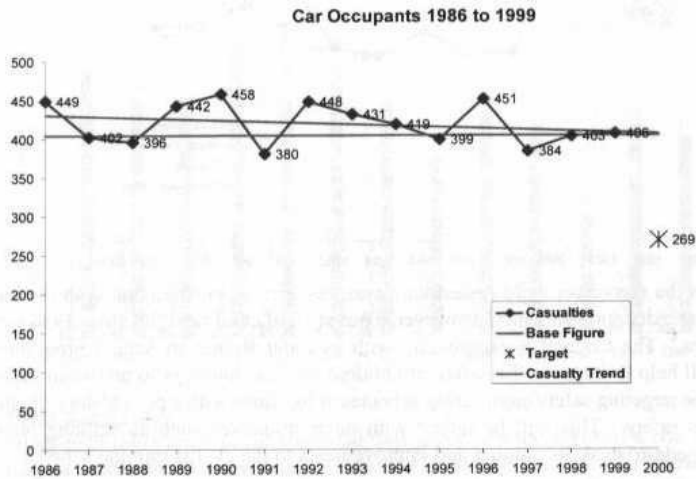


# APPENDIX C:

(continued)

There is an encouraging general downward trend in the number of people being injured as moped or motorcycle riders. However, over recent years the number of casualties has increased from the low point of 95 in 1995. This may be the result of more people using powered two wheelers as an alternate to the car for commuter journeys. As a vulnerable road user, consideration is given to powered two wheelers in the design of traffic schemes.

## Car Occupants



ROAD SAFETY PLAN 2001/2002

This is the largest casualty group when looking at casualties of all ages and it is from this group that the most significant savings will have to be made to achieve the new casualty reduction targets. Although there is a slight downward trend since 1986 the casualty savings have been small. This is a success given that car use has increased over the period that could actually have resulted in an increase in car occupant casualties.

Other measures, outside the control of the Council, such as improved car safety features, e.g. air bags, changes in legislation, and increased enforcement will help reduce the casualty figures nation-wide. On a local level, continuing the programme of implementing local safety schemes, including traffic calming measures will contribute to a reduction in casualties.



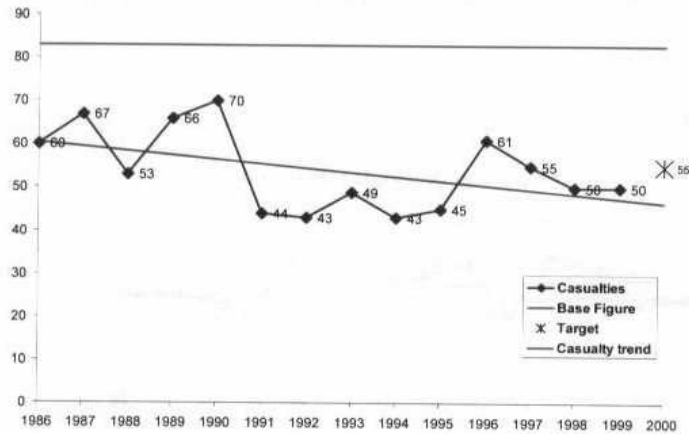
# APPENDIX C:

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## Children (All Road User Groups)

Britain as a whole has a poor record of child casualties, particularly pedestrians.

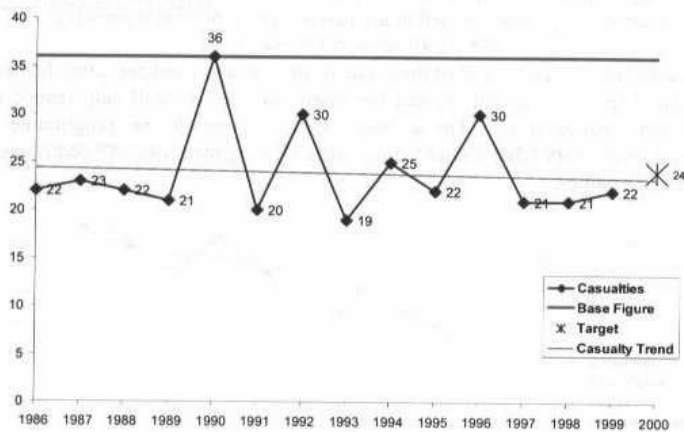
Child Pedestrian Casualties 1986 to 1999



In Merton the record for child pedestrian casualties is more encouraging with the one-third-target reduction being met. However, 6 out of 10 of child fatalities since 1986 were pedestrians. The Council is progressing with its Safer Routes to School programme which will help to improve the safety of children on their journeys to and from school and will be targeting safety engineering schemes at locations with a poor history of child pedestrian safety. This will be linked with other initiatives such as walking buses, practical pedestrian skills training and improvements to the cyclist training scheme.

The one-third target for child pedal cyclists has been met despite the overall casualty trend remaining fairly constant since 1986.

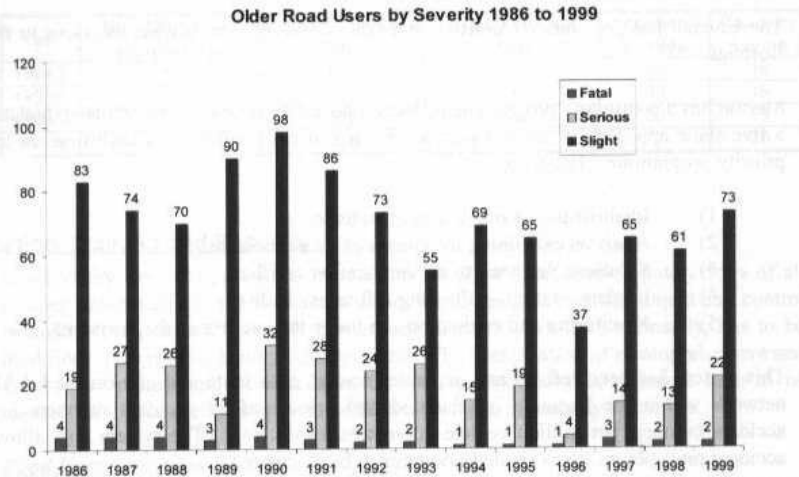
Child Pedal Cyclist Casualties 1986 to 1999



# APPENDIX C:

(continued)

Changes to cyclist training to include an on-road course introduced during 2000 should improve the safety of child cyclists. Research has shown that children do not easily transfer skills learnt off-road to an on-road situation. While the change will mean that fewer cyclists will be trained the training they receive should better equip them for on-road cycling.



ROAD SAFETY PLAN 2001/2002

### Older Road Users

Older road users are a vulnerable road user group. In the event of a crash or collision they are more likely to be fatally or seriously hurt because of their increasing frailty. Nearly 50% of fatalities in the Borough between 1986 and 1999 (44 out of 115) were road users aged 60 or over, therefore, fatalities in this age group has to be addressed if the target of a 40% reduction in fatalities and serious injuries is to be achieved. While engineering measures will help, education will also be required to raise awareness among this group of the risks they face and the ways in which this risk can be minimised.

### Road Users with Special Needs

While casualty data for those with special needs are not available, it is recognised that people with a visual or hearing impairment or other disability need special consideration. The provision of audible signals on pelican crossings, tactile paving and dropped kerbs will continue and the needs of disabled road users will be considered during the design and implementation of local safety schemes.

## **APPENDIX D:**

### **INTERVIEW QUESTIONS FOR CHILD PEDESTRIANS**

- Do you regularly walk to school, how far, how often, why?
- How long have you been regularly walking to school?
  - How long without parent or other supervision?
- Other than walking to and from school, discuss some other locations that you walk to.
  - Can you explain the reasons you choose to walk?
  - Why do you choose this instead of cycling or public transportation or a ride?
- Will you take me through your walk to and from school on a typical day?
- Where are you most uncomfortable when walking...
  - to school? Why?
  - outside of school? Why?
  - when crossing? Why?
- Are there areas that you avoid?
- Do you ever go to an area because you know it is dangerous?
- What type of crossing do you feel most secure at? (Pelican, Puffin, Toucan, Zebra, Crossing guards)
- What type of locations do you feel least secure (comfortable, safe?)
- Do you have any experience, personal or unrelated with pedestrians getting injured? Explain
- Is there anything you wish was in place to make you safer?

## **APPENDIX E:**

### **INTERVIEW QUESTIONS FOR PARENTS**

- Do you always accompany your young children to school?
  - Why or why not?
- Does an older child accompany your child?
  - Why or why not?
- If not, what is the farthest you let them walk on their own without supervision?
  - How often do they walk without supervision?
- Can you describe for me your child's walk to school?
- Do you feel uncomfortable in any areas while walking with your child?
  - Why and how?
- Are there areas you do not allow your children to go? Why? Where?
- At what age would you let your children travel by themselves?
  - Why? Is this affected by where they might travel?
- What is your opinion of crossing guards and automated crossings? (Lollipops, Pelican, Puffin, Zebra, Toucan)
- Are there any improvements that you would like to see?
- Do you have any experience (personal or otherwise) with accidents?
  - Can you please describe the situation?
  - Could something have prevented it?
- Are there any other suggestions or comments you would like to make?

## APPENDIX F:

### INTERVIEW QUESTIONS FOR CYCLISTS

- How often do you cycle? (number of times a week, month, year)
  - When you don't cycle, what are your reasons?
  
- How long have you been cycling?
  - What persuaded you to become an active cyclist?
  - Is cycling a regular form of transportation for you? Can you tell me your reasons for choosing or not choosing to cycle for regular transportation?
  
- How far do you cycle on average? (For a given day, week, month, year)
  
- When you are cycling, where do you ride the most often? (In cycle lanes, in road, on pavements, designated paths)
  - What are some of the reasons for where you choose 'your' location of riding?
  - Will you tell me some of the factors that influence your decision on what route to travel on?
  
- Have you ever been in an accident as a cyclist?
  - If yes, what were the circumstances?
    - What could have helped prevent the accident?
  - If not, have you had any near misses?
    - If anything what could be done to help improve on these near misses?
  
- Where and what type of locations do you feel the safest?
  - What do you feel can be done to improve other locations to be "safer"?
  
- Where and what type of locations do you feel at greater than normal risk?
  - What do you feel can be done to improve these/this location of greater risk?
  
- What methods do you currently use to make yourself safer when you cycle? (Practices in cycling methods to type of equipment used and safety checks.)
  
- Do you have any other comments, experiences, or input?
  
- Please describe your average cycling experience?

## APPENDIX G:

### Content Analysis for Child Pedestrians

Child Pedestrian Individual Interviews of Parents

Themes	1 <sup>st</sup> Interview	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
Age	5	5	3	4&6	8	3,5,7
Accompaniment	Always	Always	Always	Always	Always	Always
Locations of play time	Park	Parks	Outside/Parks	Fenced area in yard, parks, outside front door	Parks	Parks
Level of supervision	Eye sight	Always	Eye sight	Eye sight except outside front door alone	None	High
Distance to school	1 Block	1 mile	5/10 min	10 min	Far	Unknown
Dangerous areas	Parks at night	Main roads, train tracks	None	Church Rd	Main roads and crossings	Roundabout near school
Age for independence for walking	10	10	10	10	14	14
Explain:	People	Guess	Guess	People/Knowledge	People (Father of child)	Father of child (paedophiles)
Areas at that age	School/Park	All areas excluding #6	No opinion	Anywhere, except for people	Parks, Savacentre	No opinion
Opinions of crossings	Great	All good	Do not use	Good	Good	Good when available
Explain:	Knowledge of use		Uses side streets	Need more	Safe	Need more
Specific problem located in Merton	Haydon's Rd	Merton Rd	None	Church Rd	Church St & Haslemere Ave Zebra crossing	See #6
Specific improvements	No opinion	No opinion	No opinion	Traffic island needs to be Zebra crossings, not wide enough	Signal	Need lollipop at #6
General suggestions	No opinion	No opinion	No opinion	Not enough crossings on Western Rd between Liberty & Church	None	More policemen
More suggestions				Liberty St has split speed bumps, not effective		
Pedestrian Training	No	Yes	Yes	Yes	Yes	Yes
Explain:	Already knows	Learned herself		Earlier the better		
Knowledge of accidents	Boy hit in crossing, no injury	None	None	None	At #10, wife had foot run over at crossing while walking daughter to school	None



## Parent Group Interview

	1	2	3	4	5
<b>Age of Children</b>	4 & 8	8	7 & 10	5	3 & 6
<b>Mode of Transportation</b>	Drive	Walk	Walk	Drive	Walk & Cycle
<b>Anyone else walk w/ child</b>	no	yes, older siblings	yes, older siblings	yes, older siblings	no
<b>Distance of walk</b>	10 min drive	mile	mile	to far to walk	mile
<b>Dangerous areas</b>	Grand Dr, Aragon Rd	Lower Morden Ln	Beverly Roundabout	Tudor Rd	Hillcrest
<b>Parks</b>		Morden Park	King George's Field		Cannon Fields, Blossom Gardens
<b>Like or Dislike</b>		Dislike	Dislike		Dislike
<b>Why?</b>		Full of graffiti	Full of graffiti		Not maintained
<b>Places child can walk alone</b>	Park	no where	no where		
<b>Age to play alone</b>	Don't know	Don't know	Don't know	Don't know	Don't know
<b>Crossings</b>		The ones that are there are fine	Where are they?		
<b>Zebra or Pelican</b>	Zebra	Zebra	Zebra	Zebra	Zebra
<b>Support Safety Training in the Schools</b>	Yes	Yes	Yes	Yes	Yes



## Interviews with Child Pedestrians

Age	Sex	Distance	Mode of Travel	Opinion of Area	Busy Roads	School	Age Walk Alone
15	M	15 min	Walk	Safe	Kingston Road	Private	11 or 12
12	F	5 -10 min	Walk	Safe	None	St. Catherines MS	9 or 10
12	F	Raynes Park	Bus	Safe	None	Bushey MS	10 or 11
12	F	Raynes Park	Bus	Safe	None	Bushey MS	10 or 11
12	M	Wimbledon Park	Train	Safe	None	St. Catherines MS	9 or 10
12	M	Wimbledon Park	Train	Safe	None	St. Catherines MS	10
14	F	Wimbledon Park	Tube	Busy but safe	Merton Road	Wimbledon High	unknown
15	F	Raynes Park	Train	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
15	F	Raynes Park	Train	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
15	F	Raynes Park	Train	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
15	F	Up the street	Walk	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
15	F	Raynes Park	Train	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
14	F	Raynes Park	Train	Busy but safe, needs crossing	West Barnes Lane	Raynes Park	unknown
14	F	10 min	Bus	Safe	None	Ursuline High	12 or 13
14	F	10 min	Bus	Safe	None	Ursuline High	11 or 12
9	M	unknown	Walk	Safe	None	Wimbledon (MS?)	recently
13	M	unknown	Bus	Safe	None	Raynes Park	12
17	F	Wimbledon Park	Bus	Safe	None	Wimbledon High	unknown
15	F	10 min	Walk	Safe	None	Ricards Lodge	10 or 11
15	F	10 min	Walk	Safe, busy occasionally	None	Ricards Lodge	10 or 11
11	M	Morden	Bus	Safe	None	Malmesbury MS	unknown
14	F	Raynes Park	Bus	Safe, needs Zebra	West Barnes Lane	Raynes Park	unknown
12	M	10 min	Walk	Busy but safe	Merton Road	St. Catherines MS	unknown
14	F	15 min	Train	Safe	None	Wimbledon High	unknown
14	F	15 min	Train	Busy but safe	None	Wimbledon High	unknown
11	M	10 min	Walk	Safe	None	St. Catherines MS	unknown
12	F	15 - 20 min	Bus	Safe	None	Ursuline High	unknown
12	F	15 - 20 min	Bus	Safe	None	Ursuline High	unknown
15	M	10 min	Walk	Safe	None	Private	unknown
13	F	Wimbledon Park	Walk or Bus	Safe	None	Wimbledon High	unknown
10	F	5 min	Walk	Safe	See J	Wimbledon Chase	6
11	M	15 min	Walk	Safe	Kingston Road	Wimbledon Chase	7
11	M	20 min	Walk	Safe	Mostyn Road	Wimbledon Chase	5
10	M	20 min	Walk	Safe	None	Wimbledon Chase	8
11	F	30 min	Walk	Safe	Kingston Road	Wimbledon Chase	7
10	F	3 min	Walk	Safe	Kingston Road	Wimbledon Chase	7

## APPENDIX H:

### CONTENT ANALYSIS FOR CYCLISTS

Themes	1st interview	2nd interview	3rd	4th
Reason for not cycling	It's not practical to bring my cycle with me. To wet	Hurt back from unrelated accident	Large Scare from before (Brush with Lorry)	Not always professional (clergyman), rain
Cycle year round	Yes.	Yes	Yes	Yes
Reason for being cyclist	Not wanting to drive in London, Stay in shape, good form of transportation, enjoyment	Health, Cheap, Had traffic, Love outdoors	Transportation, Enjoyment	Fitness, dislikes underground, likes cycles (has 5)
Distance cycled to work	Two and a half - three miles	Fifteen miles each way	Couple of miles	Couple of miles
Distance cycled on weekend	Fifty eight miles	Unknown	Just to shops	On the common
Place on road one cycles	Stay to the left (away from parked cars)	Directly on road	Cycle lanes then roads	Mainly in the road
Accidents	Yes.	Yes	No	No
Explain:	Pedestrian stepped into cyclist's path without looking. Car turned left into cyclist since the driver couldn't see cyclist or did not check	Driver turning left into cyclist- happens every couple of months	N/A	N/A
Are current safety markings (advanced stop lines etc) helpful?	Yes, advanced stop lines are very good.		Helpful, need more marked cycle lanes	
Have you had any near misses?	Yes, quite a few		Yes	Yes
Explain:	Roundabouts, have to stay in middle lane, traffic can get annoyed at slower pace of cyclist. Push their limit		Where Bollards and build outs used to narrow road, car and lorries still squeeze by when I cyclist is in the narrow area	Riding on inside, lorries cut cyclists off, particularly roundabouts
Type of problem site	Roundabouts, heavy traffic, build outs, parked cars, bollards, densely parked cars	Busy streets, heavy traffic	Narrow roads, no marked bike paths, heavy traffic, fast travelling cars	Roundabouts
Specific locations in Merton that are a problem	Back of saver centre (see site list), Blackshaw road, Morden around the civic centre	NO specific Merton locations. Centre of London, South London	Martin Way, Kingston Road, all major roads	Everywhere cyclists must ride in the road

<b>Themes</b>	<b>1st interview</b>	<b>2nd interview</b>	<b>3rd</b>	<b>4th</b>
Type of location that is safer	Residential back roads	Less busy road, less lanes, less traffic	Separate bicycle areas	Separate cycling lanes
Safety methods used	Helmet, visibility - flashing light on back, brownie belt, cycling trousers	Helmet, Cycling jacket (has reflective strip) admitted to not being that safe	Wears a helmet	Rear lights, helmet, reflective clothing
Cycling accommodations	Space to store wet clothes and change while at work. No real need for a shower	Works at Bike shop, doesn't need any real accommodation	More places to lock up bicycles	
Extraneous information	Danger to arms when signalling since cars sometimes drive directly into them. Feels that campaigns are necessary to raise awareness of cyclists to motorists and a message to cyclists to respect the road and it's use.	Like to see the centre of London Pedestrianized, Cycles, pedestrians, trams, no cars!	Would like to see more separate bike lanes, raise traffic awareness of cyclists and make it so safe children can ride their bicycles	Speed limit of 20 mph would be better in town centres instead of 30 mph

## APPENDIX H: (continued)

Themes	5th	6th	7th	8th
Reason for not cycling	None	None	Wet weather	None
Cycle year round	Yes	Yes	Yes	yes
Reason for being cyclist	Cheap, exercise	Faster than the train, healthier, cheaper	Convenience (time), environmental concerns	
Distance cycled to work	10 miles each way	7 miles each way	2 miles	10 - 15 minutes
Distance cycled on weekend	60 miles	Only shopping	Cycle to parks, family cycle ride (14 miles)	20 - 30 miles
Place on road one cycles	Directly on road	On the road with the cars	On the road	In the carriage lane
Accidents	Yes	Yes	Yes	Yes
Explain:	Knocked off bike by buses	Hit by a lorry, went through a windscreen of a car; car jumped a red light	While cycling in a designated cycle route, on the wrong side of the road, went under a car	Minor accidents
Are current safety markings (advanced stop lines etc) helpful?	Yes, cycling lanes not as effective		Waste of time, cycling lanes too	
Have you had any near misses?	Yes	Yes	Yes	yes
Explain:	Riding next to a Mercedes	Motorists in a hurry, think they own the road - pay taxes, etc	Everyday occurrence, cyclists resented by drivers	Car opened driver door and knocked cyclist off bike
Type of problem site	Intersections		Roads that people use as alternate routes to avoid speed cameras	Traffic humps without gaps
Specific locations in Merton that are a problem	Kingston road, wants green arrow for cyclists		Martin Way, Hillcross Ave.	
Type of location that is safer		Separate cycling lanes (Camden St)		20 mph speed limit
Safety methods used	Helmet, lights	Lights, reflective clothing	Lights, high visibility clothing, helmet	Lights, reflective strips when dark
Cycling accommodations		Separate traffic lights	Driver education	
Extraneous information	Density of traffic (low) increases feeling of safety	Making cycling lanes that don't have parking restrictions wastes money - lanes are useless when used as parking spaces for motorists	Wants shared use and driver education to make cyclists accepted and not 'second class citizens'	Night lighting insufficient, bike paths on side routes not well maintained, no provisions made for cyclists when construction is occurring

## APPENDIX H: (continued)

Themes	9th	10th	11th	12th
Reason for not cycling	Long way in rain with no changing points			
Cycle year round	Yes		Yes	Yes
Reason for being cyclist	Exercise, cheap, convenience	Exercise, easier by cycle	Hates train	Exercise
Distance cycled to work	3 miles each way	20 minutes		
Distance cycled on weekend	To family, around area, 10 or 20 miles			
Place on road one cycles	Cycle lanes, then road			
Accidents	Yes			
Explain:	Overtaking car turned left in front of cyclist			
Are current safety markings (advanced stop lines etc) helpful?				
Have you had any near misses?	Yes			
Explain:	Cars overtaking, roundabouts			
Type of problem site		Congestion of traffic, narrow roads		Main roads due to congestion
Specific locations in Merton that are a problem	A3 from Rayne's Park towards Putney; Martin Way cycle path ends at parked cars	Wimbledon Centre, Haydon's Road		Wimbledon Centre, roundabouts
Type of location that is safer	Additional cycle tracks			
Safety methods used	Reflective bands, helmet, gloves			
Cycling accommodations	Barrier between cyclists and motorists			
Extraneous information	Cyclists should have to keep getting on and off to be legal at crossings	People need to be more understanding of cycles on trains	Need more cycle racks	More cycle routes

## APPENDIX H: (continued)

Themes	13th	14th	15th	16th
Reason for not cycling			Hurt hands	Very long trip
Cycle year round	Yes	Yes	Yes	Yes
Reason for being cyclist	Fitness	Greener	Environmental, faster, cheaper, healthier	Environmental, Hate driving, enjoyment go places cars cannot
Distance cycled to work			Couple of miles	10-15 miles per week
Distance cycled on weekend			only shopping	17 miles
Place on road one cycles			Cycle lanes then roads	cycle lanes, then road
Accidents			No	No
Explain:			N/A	N/A
Are current safety markings (advanced stop lines etc) helpful?			Very good need more	Advanced stop lines, separate cycle paths
Have you had any near misses?			Yes	No
Explain:			Cars opening door, cars turning when cyclist in the inside lane	N/A
Type of problem site	Speed of traffic	No cycle lanes, not well lit	Busy roads	Narrow road, bad surfaces
Specific locations in Merton that are a problem	Kingston Rd to Morden Rd, roundabouts	Colliers Wood, Haydon's and North Rd	Worple Road, Goldcliff	Worple Rd, Kingston Rd, The whole Mitcham area
Type of location that is safer			Separate Cycle lanes	Separate cycle lanes
Safety methods used			Rear view mirrors, bicycle lamps, in rain bright yellow rain coat	Rear view mirror, bicycle lamps, NO HELMET
Cycling accommodations				
Extraneous information	more cycle paths, better indicated, separate cycle paths	more cycle racks	More designated cycle paths with a possibility for slower speeds	Need to educate drivers, place advanced stop line laws in affect and connect cycle paths

## APPENDIX I:

### ACCIDENT REPORTS FOR CHILD PEDESTRIANS

<b>Number:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Age:</b>	<b>Code:</b>
0198VW00361	6/15/98	<i>London Road J/W Tramway Path</i>	Ped ran into path of starting V1	10 M	404
0198VW00091	2/15/98	<i>London Road J/W Morden Road (Mitcham)</i>	Ped ran onto crossing against red light into path of V1	14 M	403
0198VW00516	8/26/98	<i>London Road J/W Elmwood Road</i>	Ped stepped into path of V1 from between stationary vehicles	9 F	402
0100VW00237	4/19/00	<i>London Road J/W Lower Green West</i>	Ped stepped into path of V1	14 F	404
0198VW00517	8/27/98	Upper Green West J/W London Road	Ped ran onto crossing against red light into path of V1	6 M	403
0199VW00520	8/23/99	NFL Flagged at Upper Green West J/W London Road	Ped stepped onto crossing into path of V1	2 M	224
0199VW00092	1/26/99	Bushey Road J/W Grand Drive	Ped on footpath struck by passing V1 which FTS	13 M	218
0100VW00260	5/5/00	<i>Church Road (Mitcham) 20 M N J/W Mount Road</i>	Ped crossed into path of V1	10 M	404
0198VW00674	11/3/98	<i>Church Road (Mitcham) J/W Batsworth Road</i>	Ped crossed into path of V1	10 M	404
0100VW00560	9/27/00	<i>Church Road (Mitcham) J/W Miles Road</i>	Ped on footpath struck by passing V1	14 M	218
0198VW00038	1/19/98	<i>Church Road (Mitcham) J/W CHURCH PLACE</i>	Ped ran into path of V1 from between parked vehicles	9 F	402
0198VW00371	6/18/98	<i>Church Road (Mitcham) J/W Mount Road</i>	Ped ran into path of V1	13 F	404
0199VW00019	1/8/99	157 Western Road J/W Mortlake Drive	Ped ran into path of V1	12 M	404
0199VW00082	1/28/99	<i>Western Road 300M E J/W Church Road</i>	Ped ran into path of V1	14 F	404
0199VW00313	5/23/99	Holborn Way J/W Western Road	Ped ran into path of V1	13 M	404
0199VW00284	5/10/99	<i>Haydon's Road J/W Caxton Road</i>	Ped ran into path of V1	9 F	404
0199VW00383	6/23/99	<i>Kingston Road J/W Sydney Road</i>	Ped ran into path of V1 from behind parked vehicle	13 F	402
0198VW00767	12/14/98	<i>Kingston Road 25M W J/W Rothesay Avenue</i>	Ped stepped onto crossing against red light into path of V1	14 M	403
0198VW00802	12/31/98	<i>Kingston Road J/W Quintin Avenue</i>	Ped ran into path of V1	15 F	404
0199VW00426	7/10/99	<i>Kingston Road J/W Hartfield Road</i>	Ped stepped into path of V1	15 F	404
0199VW00460	7/28/99	Merton High Street J/W Morden Road	Ped ran into path of V1	8 F	404
0100VW00048	1/19/00	<i>Morden Road J/W The Path</i>	Ped stepped into path of V1	10 F, 27 F	403

0199VW00459	7/27/99	<b>Morden Road J/W High Path</b>	Ped stepped onto crossing against red light into path of V1	15 F	403
0198VW00270	5/4/98	350 West Barnes Lane J/W Station Road	Ped ran into path of V1	13 M	404
0100VW00302	5/20/00	23 Mostyn Road 75M S J/W Church Path	Ped ran into path of V1	5 M	404
0100VW00386	7/1/00	London Road J/W Streatham Road	V1 Disobeyed ATS & struck ped crossing road	9 M	204
0100VW00286	5/13/00	London Road J/W Streatham Road	Ped ran into path of V1	10 M	404
0198VW00177	3/24/98	<b>Streatham Road J/W Manship Road</b>	Ped stepped into path of V1	14 F	404
0100VW00153	3/15/00	173 Streatham Road J/W Garden Avenue	Ped ran into path of V1	11 M	404
0100VW00598	10/17/00	234 Streatham Road J/W The Bungalows	Ped crossing road struck by V1	14 F	225
0198VW00458	7/26/98	<b>Streatham Road J/W Vectis Road</b>	Ped ran into path of V1	14 F	402
0199VW00342	6/7/99	<b>Tamworth Lane J/W Acacia Road</b>	Ped on crossing struck by V1	15 M	0
0199VW00342	6/7/99	Tamworth Lane J/W Acacia Road	Ped on crossing struck by V1	15 M	0
0100VW00381	6/28/00	108 ChristChurch Road J/W Runnymede	Ped crossing road struck by V1 which FTS	10 M	224
0199VW00509	8/11/99	NFL Flagged at Grove Road 30M W J/W Woodstock Way	Ped ran into path of V1	9 M	404
0198VW00769	12/14/98	<b>Grove Road J/W Woodstock Way</b>	V1 overtaking on wrong side of road caused ped to fall over	7 M	231
0198VW00611	10/6/98	181 Grove Road 25M S J/W Woodside Way	Ped ran into path of V1	10 M	404
0100VW00229	4/14/00	NFL Flagged at Wide Way 35M S J/W Ivy Gardens	Ped crossed into path of V1	13 F	404
0199VW00444	7/20/99	<b>Manor Road 50M W J/W Wide Way</b>	Ped ran into path of V1	12 F	402
0198VW00695	11/10/98	<b>Manor Road J/W Sherwood Park Road</b>	Ped ran onto crossing against red light into path of V1	13 F	403
0198VW00758	12/9/98	<b>Rowan Road J/W Northborough Road</b>	Ped on crossing struck by V1 overtaking on nearside. V1 FTS	14 F	206



## APPENDIX J:

### ACCIDENT REPORTS FOR CYCLISTS

<b>Number:</b>	<b>Date:</b>	<b>Occurred On:</b>	<b>Accident Type:</b>	<b>Code:</b>
0198VW00102	2/25/98	<i>Wimbledon Bridge J/W Hartfield Road</i>	C1 collided with V1 on offside	217
0198VW00099	2/24/98	<i>Wimbledon Broadway J/W Trinity Road</i>	V1 turned left across path of C1 on nearside	210
0198VW00386	6/29/98	61 The Broadway 30M E J/W Queens Road	C1 cycled off footpath into path of V1	229
0198VW00406	7/4/98	90 Wimbledon Hill Road 120M E J/W Draxmont	C1 cycling on footpath collided with stationary V1	228
0198VW00716	11/20/98	NFL flagged at Wimbledon Hill Road 50M N J/W Mansell Road	C1 struck by passing V1 which FTS	217
0198VW00263	4/26/98	NFL flagged at 20 Alexandra Road 160M N J/W Wimbledon Hill Road	V1 turned left across path of C1 on nearside	210
0198VW00181	3/28/98	<i>Wimbledon Broadway 25M W J/W Queens Road</i>	C1 struck by passing V1 which FTS	217
0198VW00151	3/14/98	110 Wimbledon Broadway 20M W J/W Palmerston Way	V1 stationary in traffic struck from behind by C1	225
0199VW00490	8/3/99	<i>Wimbledon Hill Road J/W Compton Road</i>	V1 stopping at junction struck from behind by C1	216
0199VW00525	8/25/99	<i>Wimbledon Hill Road J/W Worple Road</i>	C1 fell into path of oncoming V1 which FTS	239
0199VW00183	3/26/99	<i>Wimbledon Hill Road J/W Alexandra Road</i>	V1 changed lanes into path of C1	221
0199VW00713	11/30/99	<i>Wimbledon Broadway J/W Queens Road</i>	C1 traveling on wrong side of road struck by V1	231
0199VW00348	6/8/99	<i>Wimbledon Hill Road J/W Woodside</i>	V1 dazzled by sun crossed into path of C1	233
0199VW00364	6/14/99	<i>Wimbledon Hill Road J/W Woodside</i>	V1 crossed give way line into path of C1	207
0199VW00418	7/4/99	NFL flagged at Wimbledon Broadway 70M E J/W Queens Road	V1 changed lanes across path of C1	221
0199VW00347	6/3/99	<i>Wimbledon Broadway 20M E J/W Stanley Road</i>	Ped stepped onto crossing into path of C1	403
0100VW00029	1/13/00	<i>Wimbledon Bridge J/W Hartfield Road</i>	V1 changed lanes across path of C1 and FTS	221
0100VW00565	9/28/00	<i>Wimbledon Bridge J/W Hartfield Road</i>	V1 changed lanes across path of C1	221
0100VW00529	9/2/00	<i>Wimbledon Hill Road J/W Woodside</i>	V1 stationary at junction struck from behind by C1	218
0100VW00471	8/4/00	NFL flagged at Wimbledon Bridge Road 50M E J/W Alexandra Road	C1 forced to brake sharply fell from machine	238
0198VW00660	10/26/98	<i>Kingston Road J/W Bronson Road</i>	V1 turned right across path of C1	207
0198VW00735	12/1/98	<i>Kingston Road 20M W J/W Quintin Avenue</i>	C1 cycling on footpath collided with emerging V1 which FTS	229
0198VW00317	5/24/98	<i>Kingston Road J/W Church Lane</i>	C2 cycled onto ped crossing against red light into path of V1	230

0198VW00385	6/28/98	<b>Kingston Road J/W Kirkley Road</b>	C1 forced by passing V1 to swerve into kerb. V1 FTS	217
0199VW00088	2/5/99	<b>Kingston Road J/W Palmerston Road</b>	V1 crossed give way line into path of C1	207
0100VW00276	5/11/00	<b>Kingston Road J/W Palmerston Road</b>	C1 crossed give way line into V1	207
0199VW00155	3/17/99	<b>Kingston Road J/W Brisbane Avenue</b>	V1 crossed give way line into path of C1	207
0199VW00631	10/19/99	Cannon Hill lane J/W Kingston Road	C1 struck from behind by V1	0
0199VW00648	10/28/99	<b>Kingston Road J/W Russell Road</b>	V1 turned right across path of C1	209
0100VW00276	5/11/00	<b>Kingston Road J/W Palmerston Road</b>	V1 crossed give way line into C1	207
0100VW00274	5/9/00	<b>Kingston Road J/W Rutlish Road</b>	V1 turned right across path of C1	209
0198VW00288	5/9/98	<b>Martin Way J/W Cannon Hill Lane</b>	V1 crossed give way line and struck C1 in junction	207
0199VW00358	6/13/99	<b>Martin Way J/W Cannon Hill Lane</b>	V1 crossed give way line and struck C1	207
0100VW00710	12/6/00	Cannon Hill Lane J/W Martin Way	V1 crossed give way line into C1	207
0198VW00434	7/20/98	<b>Worple Road J/W Francis Grove</b>	V1 crossed give way line and struck C1 in junction	207
0199VW00525	8/25/99	Wimbledon Hill Road J/W Worple Road	C1 fell into path of oncoming V1 which FTS	239
0199VW00481	7/31/99	NFL flagged at Worple Road 30M E J/W Lampton Road	Passenger in V1 opened door into path of C1	302
0199VW00067	1/27/99	NFL flagged at Worple Road J/W Worple Avenue	Passenger in V1 opened door into path of C1	305
0100VW00258	5/4/00	<b>Worple Road J/W Lower Downs Road</b>	Turning C1 struck from behind by V1 which FTS	216
0199VW00095	2/11/99	<b>Grand Drive J/W Bushey Road</b>	V1 turned left across path of C1 on nearside. V1 FTS	210
0199VW00612	10/7/99	<b>Grand Drive 100M S J/W Southway</b>	Ped on crossing by struck by C1 cycling on wrong side of road which FTS	205
0199VW00156	3/18/99	152 Grand Drive 35M N J/W Westway	C1 cycled off footpath into V1	229
0100VW00589	10/9/00	Bushey Road J/W Grand Drive	C1 disobeyed ATS and struck ped on crossing	206
0100VW00306	5/11/00	<b>Grand Drive 50M S J/W Queen Mary Avenue</b>	V1 opened door into path of C1	223
0198VW00162	3/18/98	<b>West Barnes Lane 40M S J/W Camberley Avenue</b>	C1 cycling on footpath collided with emerging V1	228
0198VW00499	8/19/98	37/38 West Barnes Lane 40M S J/W Taunton Avenue	C1 changed lanes across path of V1	221
0198VW00143	3/13/98	<b>West Barnes Lane J/W Linkway</b>	C1 cycled off footpath into path of V1	229
0100VW00265	5/7/00	<b>West Barnes Lane J/W Marina Avenue</b>	V1 opened door into path of C1	223
0198VW00444	7/24/98	<b>Haydon's Road J/W Cromwell Road</b>	V1 turned left across path of C1 travelling on nearside	210
0199VW00231	4/17/99	Merton High Street J/W Haydon's Road	V1 turned right across path of C1	209
0199VW00618	10/12/99	<b>Haydon's Road J/W All Saints Road</b>	V1 turned left across C1 on nearside and FTS	210
0199VW00543	9/3/99	<b>Haydon's Road J/W Haccombe</b>	C1 cycled onto crossing into path of	230

		<b>Road</b>	V1	
0100VW00223	4/17/00	<b>Haydon's Road/Caxton Road</b>	V1 overtook & hit C1	217
0100VW00171	3/27/00	<b>Haydon's Road J/W Cowdrey Road</b>	V1 turned into oncoming C1 and FTS. Following V2 struck C1	207
0100VW00466	7/20/00	<b>Haydon's Road J/W Cardigan Road</b>	V1 turned right across C1 overtaking on nearside	209
Savacenter				
0198VW00057	2/2/98	<b>Christchurch Road J/W Merantun Way</b>	Rider of C1 lost control and fell into path of V1	239
0199VW00531	8/26/99	<b>Christchurch Road J/W Tandem Way</b>	V1 AND C1 collide in junction	217
0100VW00198	4/1/00	Merantun Way/Christchurch Road	V1 Failed to G/W TO C1	207
0100VW00557	9/2/00	<b>Christchurch Road J/W MERANTUN WAY</b>	Starting C1 fell against V1	239
The Broadway				
0198VW00099	2/24/98	<b>Wimbledon Brodaway J/W Trinity Road</b>	V1 turned left across path of C1 on nearside	210
0198VW00386	6/29/98	61 The Broadway 30M E J/W Queens Road	C1 cycled off footpath into path of V1	229
0198VW00181	3/28/98	<b>Wimbledon Broadway 25M W J/W Queens Road</b>	C1 struck by passing V1 which FTS	217
0198VW00151	3/14/98	110 Wimbledon Broadway 20M W J/W Palmerston Way	V1 stationary in traffic struck from behind by C1	225
0199VW00713	11/30/99	<b>Wimbledon Broadway J/W Queens Road</b>	C1 traveling on wrong side of road struck by V1	231
0199VW00418	7/4/99	NFL flagged at Wimbledon Broadway 70M E J/W Queens Road	V1 changed lanes across path of C1	221
0199VW00347	6/3/99	<b>Wimbledon Broadway 20M E J/W Stanley Road</b>	Ped stepped onto crossing into path of C1	403
0100VW00291	5/16/00	402 Hillcross Avenue 110M E J/W Tudor Drive	Ped on footpath struck by C1	228

## APPENDIX K:

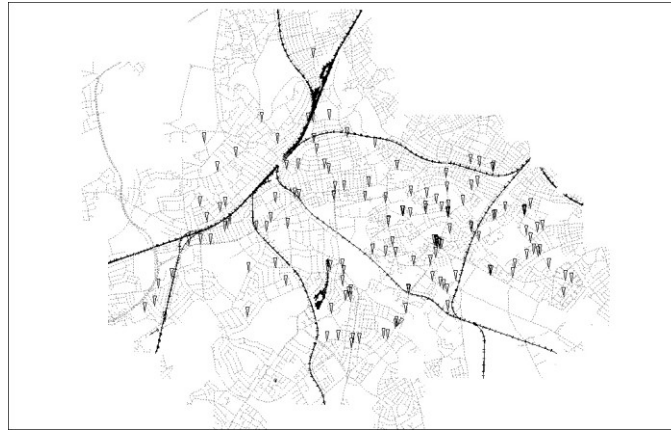
### CONTRIBUTORY FACTOR CODES

Code	Description
204	Disobeyed ATS
206	Failure to give precedence to pedestrian at Zebra crossing
207	Disobeyed Stop or Give Way sign or marking
209	Turning right injudiciously
210	Turning left
214	Starting
216	Driving too close to vehicle in front
217	Driving too close to vehicle alongside
218	Driving too close to kerb
221	Changing lane injudiciously
223	Negligently opening or closing door
224	Going to fast having regard to road environment
225	Going to fast having regard to other road users
228	Riding on pavement
229	Riding off pavement
230	Riding across pedestrian crossing
231	Driving/riding on wrong side of road
233	Dazzled by sun
238	Swerved/braked to avoid having an accident
239	Lost control - no apparent reason
305	Negligently opening or closing door
402	Crossing road masked by parked vehicles
403	Crossing road heedless of traffic and pedestrian crossing
404	Crossing road heedless of traffic elsewhere
0	Factor unknown

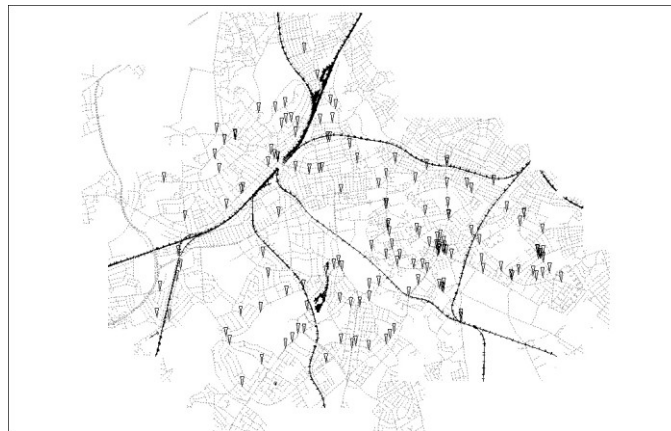
# APPENDIX L:

## PEDESTRIAN CASUALTIES MAPS

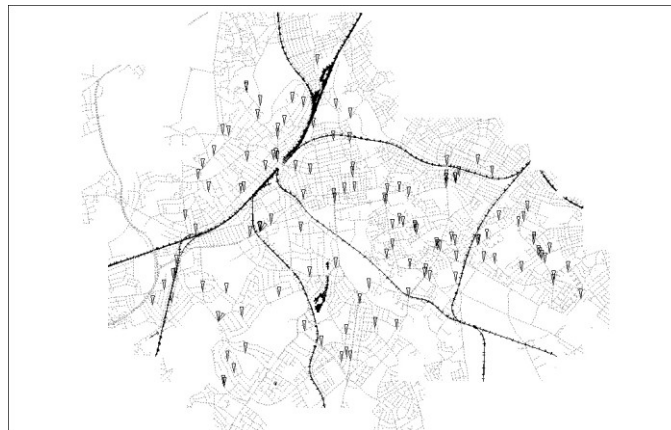
### BOROUGH OF MERTON



0 – 3 years



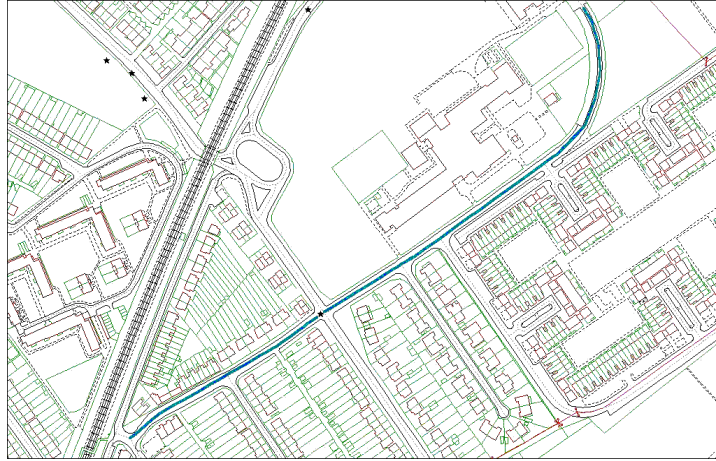
3 – 6 years



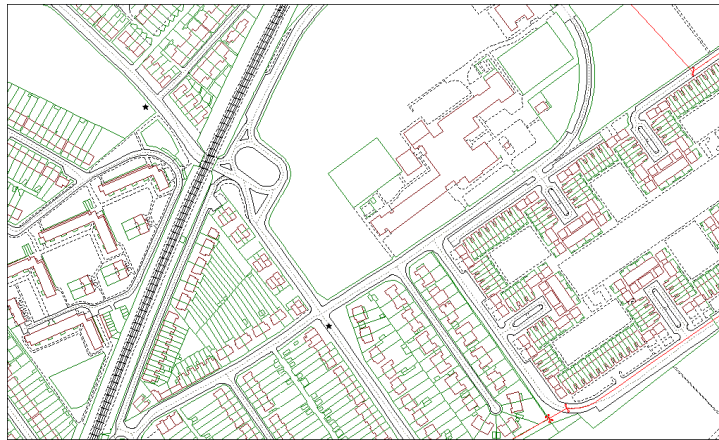
6 – 9 years

**APPENDIX L:**  
(continued)

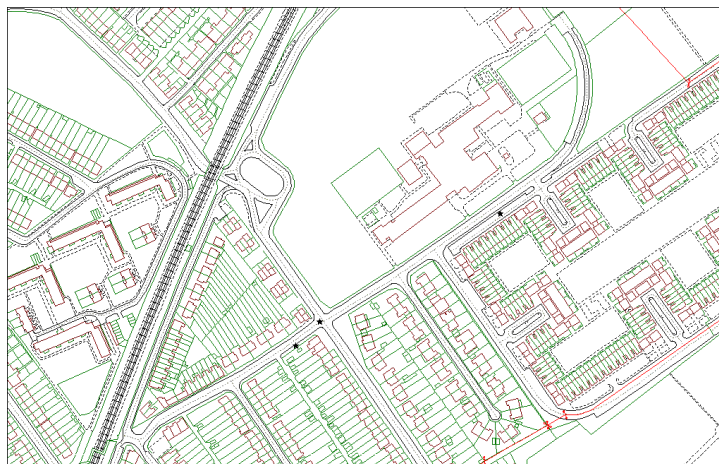
**ACACIA ROAD**



0 – 3 years



3 – 6 years

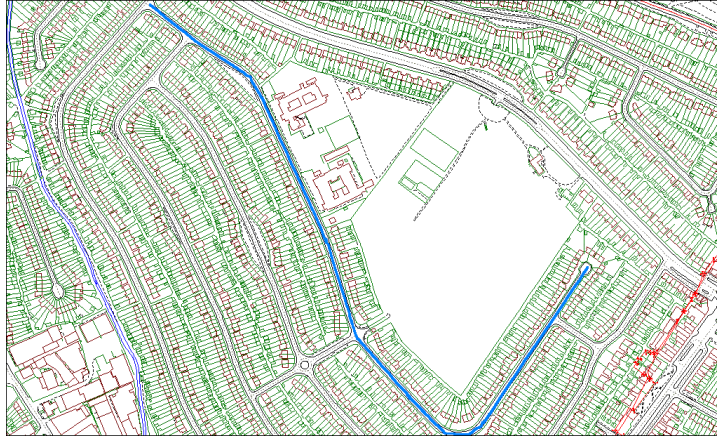


6 – 9 years

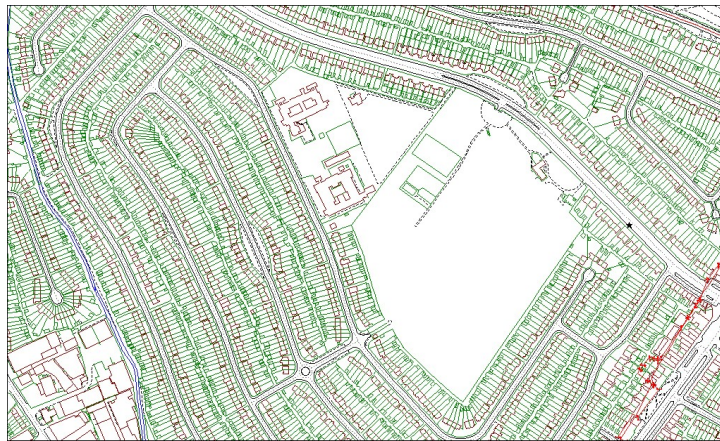
# APPENDIX L:

(continued)

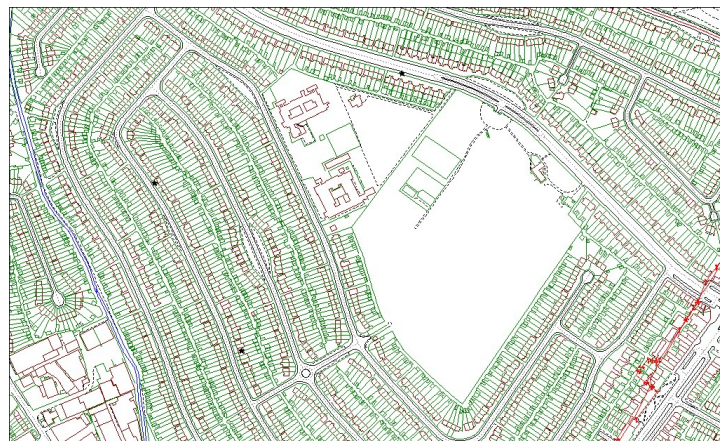
## ARAGON ROAD



0 – 3 years



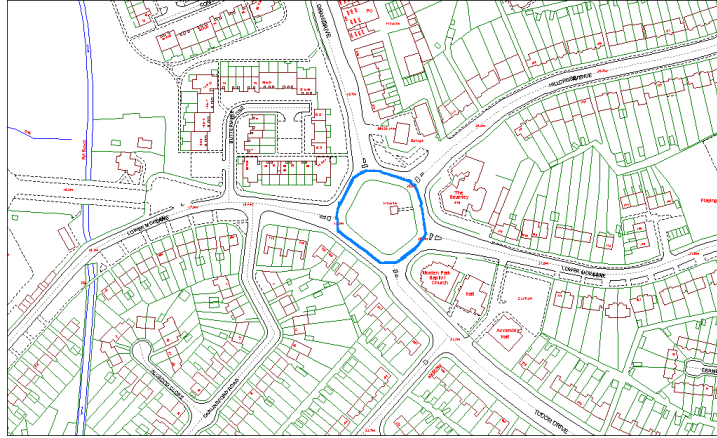
3 – 6 years



6 – 9 years

# APPENDIX L: (continued)

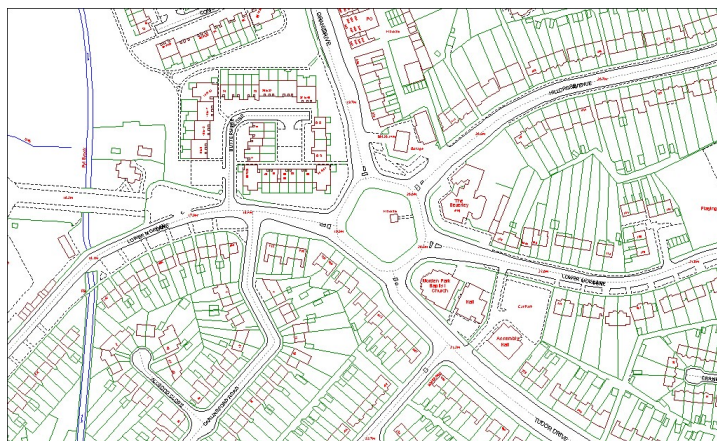
## BEVERLY ROUNDABOUT



0 – 3 years



3 – 6 years

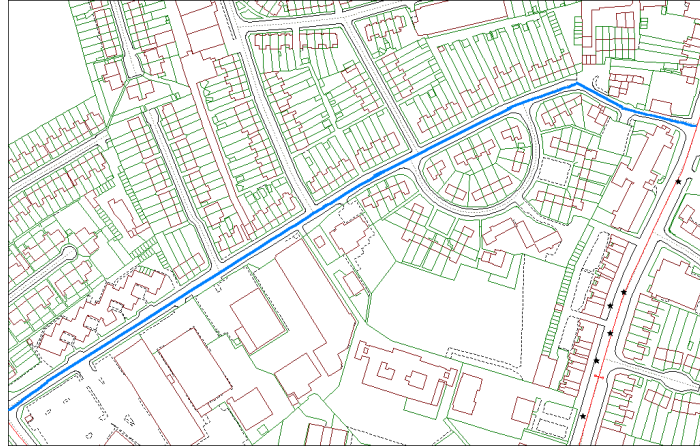


6 – 9 years



**APPENDIX L:**  
(continued)

**BOND ROAD**



0 – 3 years



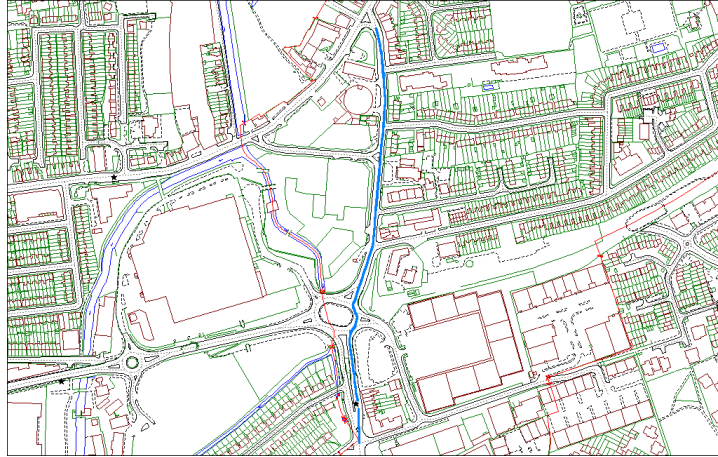
3 – 6 years



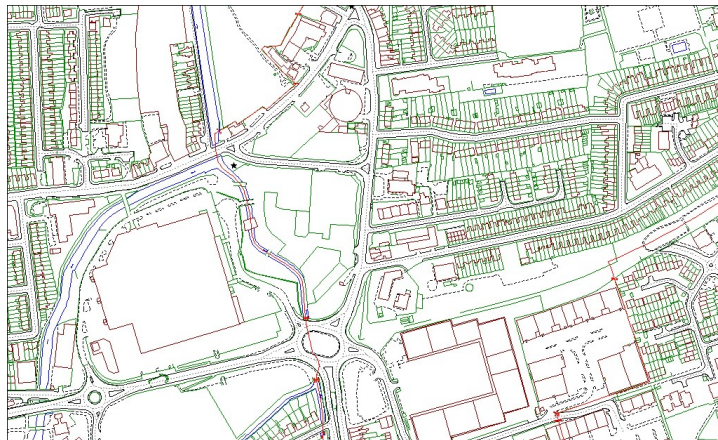
6- 9 years

**APPENDIX L:**  
(continued)

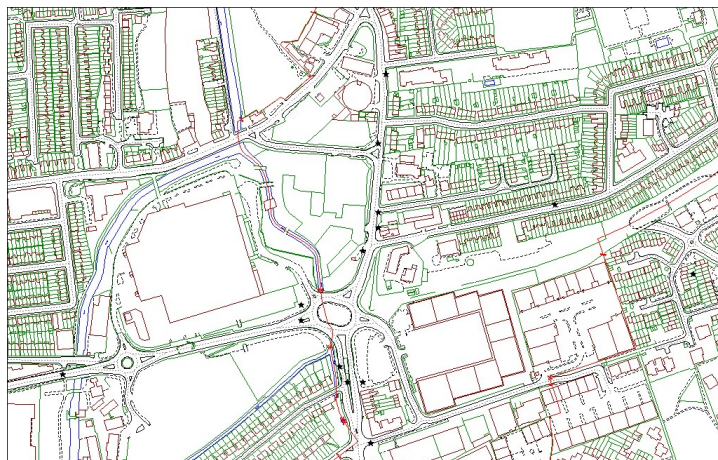
**CHRISTCHURCH ROAD**



0 – 3 years



3 – 6 years



6 – 9 years

# APPENDIX L:

(continued)

## CHURCH ROAD (MITCHAM)



0 – 3 years



3 – 6 years

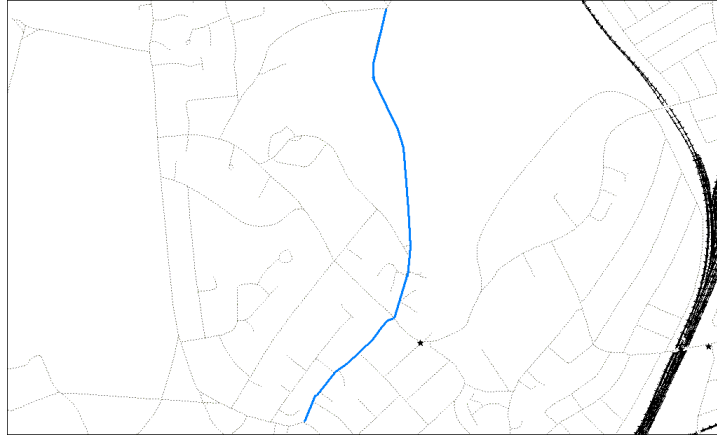


6 – 9 years

# APPENDIX L:

(continued)

## CHURCH ROAD (WIMBLEDON PARK)



0 – 3 years



3 – 6 years



6 – 9 years

**APPENDIX L:**  
(continued)

**DORSET ROAD**



0 – 3 years



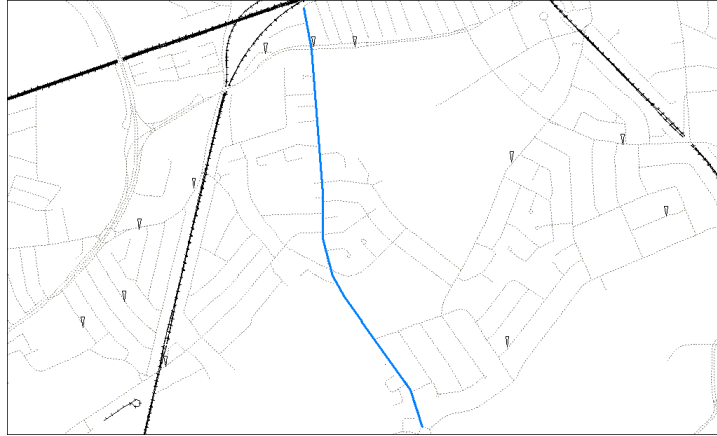
3 – 6 years



6 – 9 years

**APPENDIX L:**  
(continued)

**GRAND DRIVE**



0 – 3 years



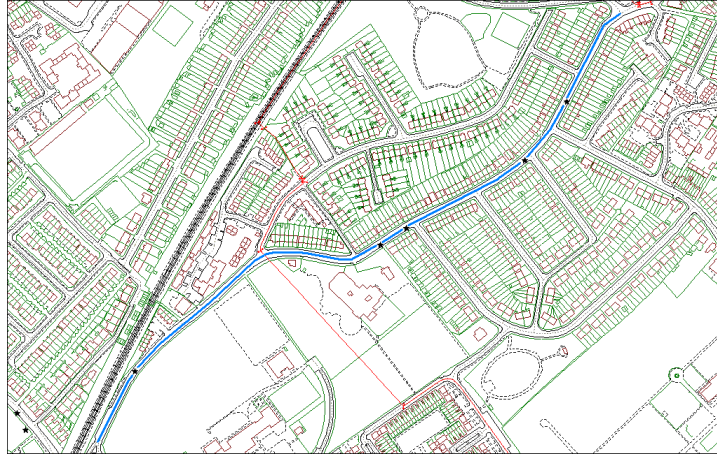
3 – 6 years



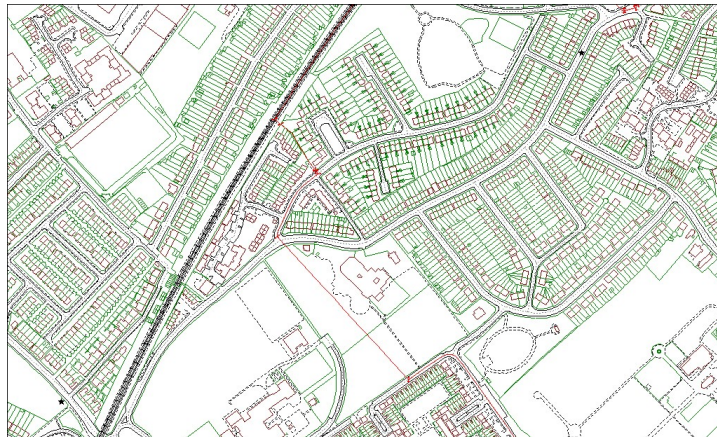
6 – 9 years

**APPENDIX L:**  
(continued)

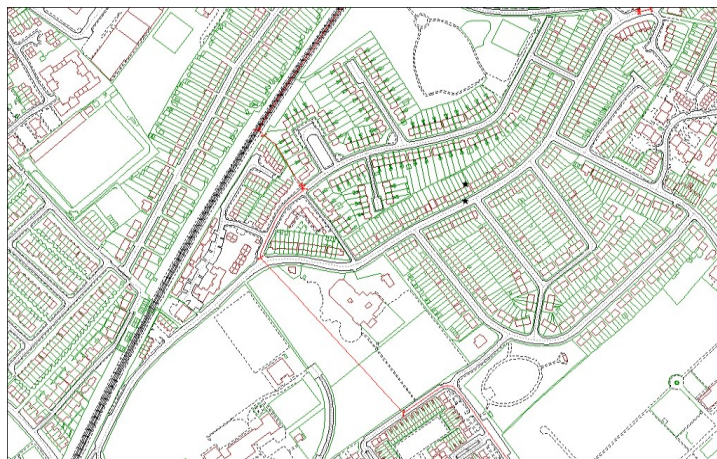
**GROVE ROAD**



0 – 3 years



3 – 6 years



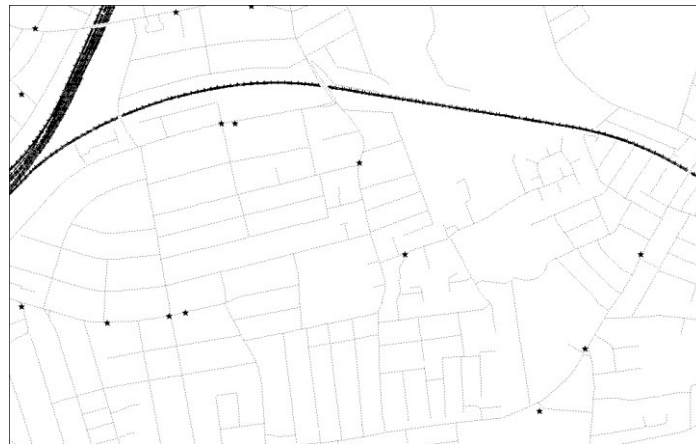
6 – 9 years

**APPENDIX L:**  
(continued)

**HAYDON'S ROAD**



0 – 3 years



3 – 6 years



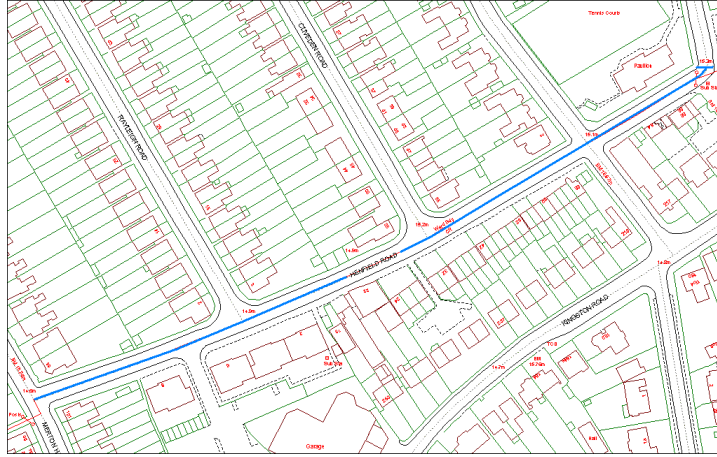
6 – 9 years



# APPENDIX L:

(continued)

## HENFIELD ROAD



0 – 3 years



3 – 6 years



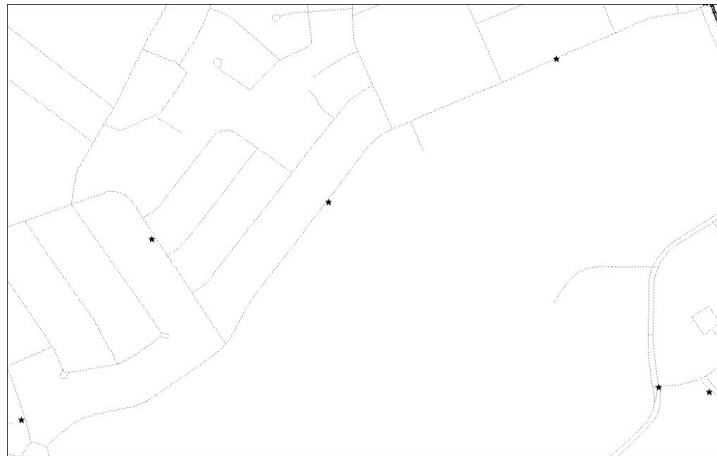
6 – 9 years

**APPENDIX L:**  
(continued)

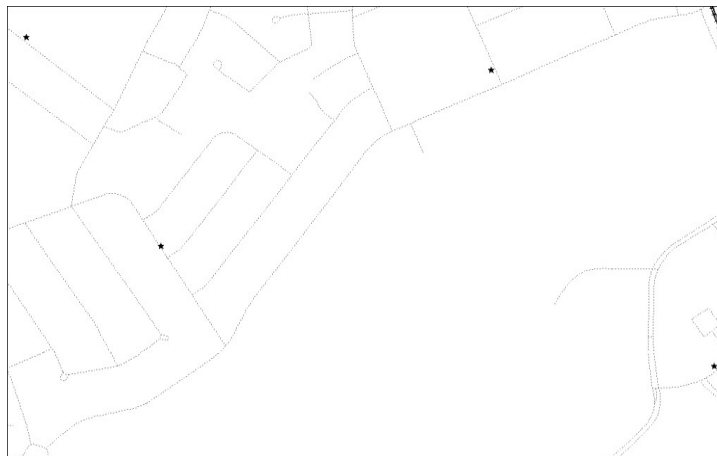
**HILLCROSS AVENUE**



0 – 3 years



3 – 6 years

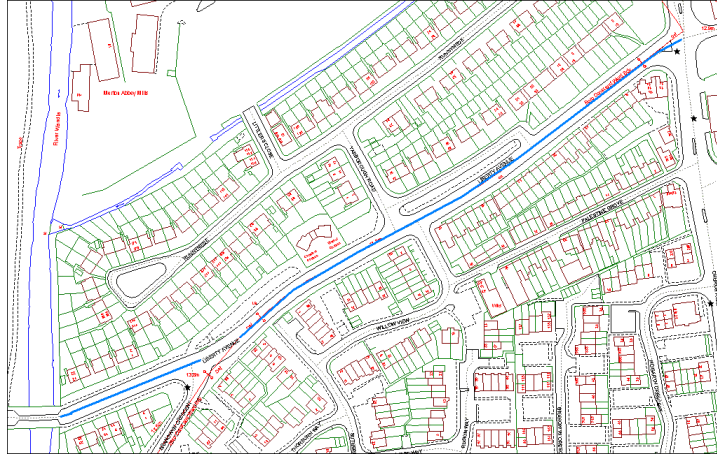


6 – 9 years



# APPENDIX L: (continued)

## LIBERTY AVENUE



0 – 3 years



3 – 6 years



6 – 9 years

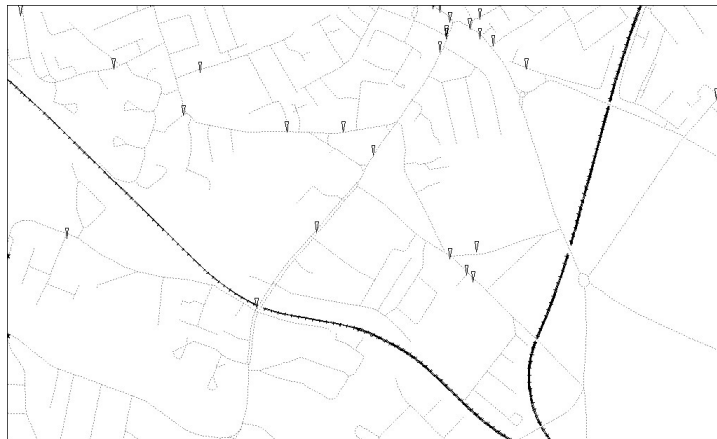
# APPENDIX L:

(continued)

## LONDON ROAD



0 – 3 years



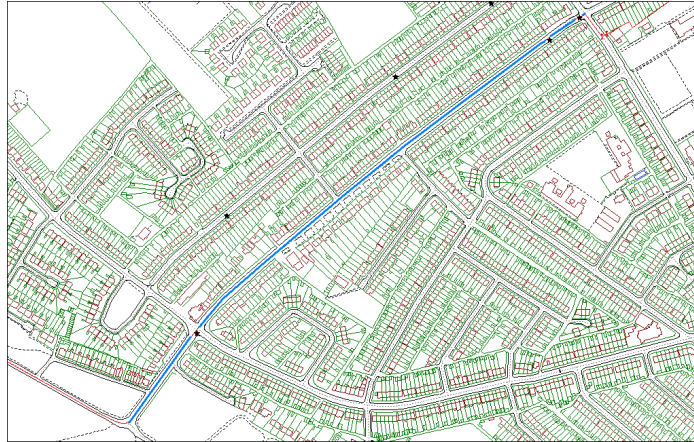
3 – 6 years



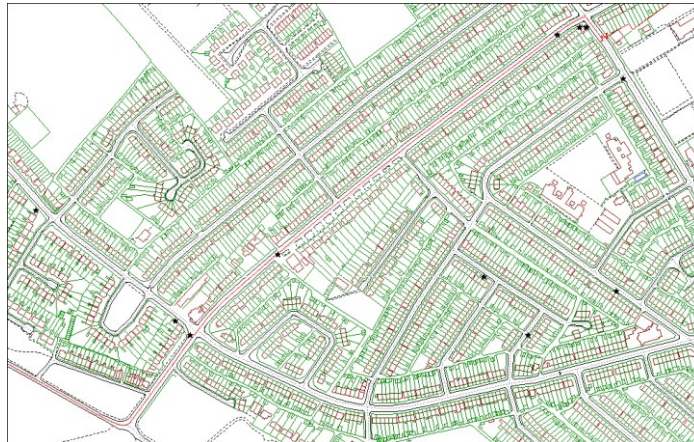
6 – 9 years

**APPENDIX L:**  
(continued)

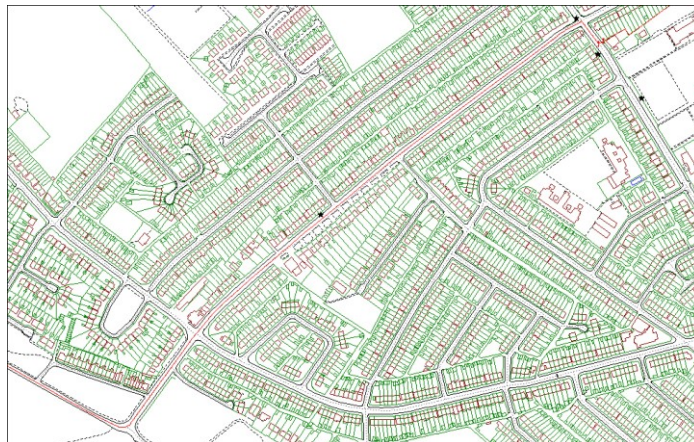
**MANOR ROAD**



0 – 3 years



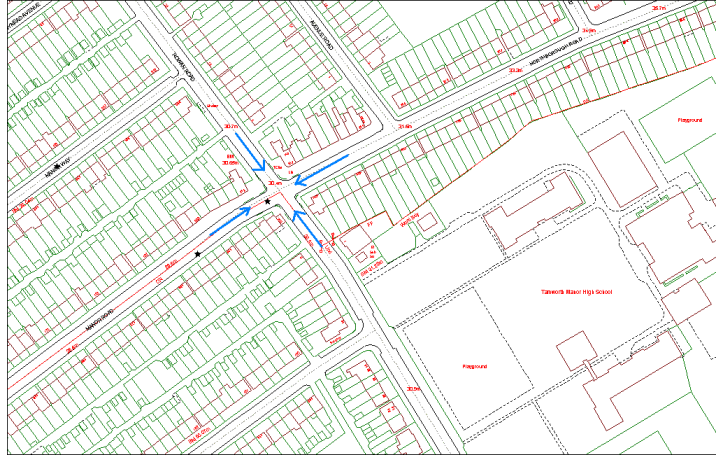
3 – 6 years



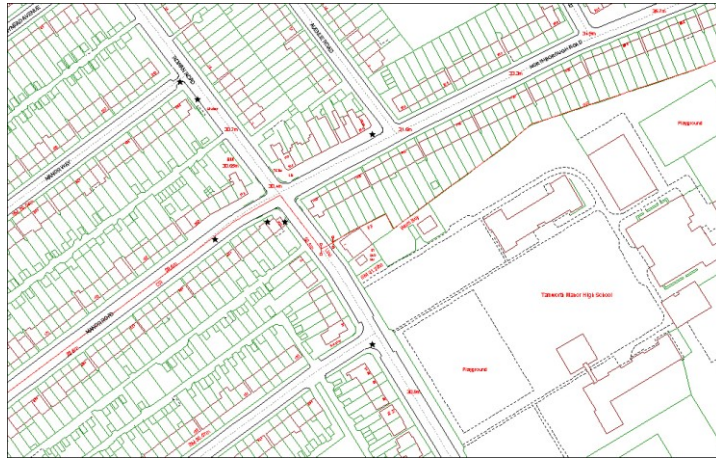
6 – 9 years

# APPENDIX L: (continued)

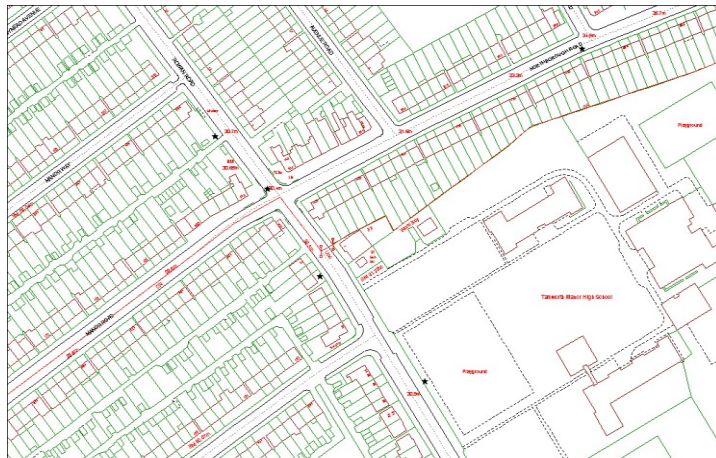
## MANOR ROAD, ROWAN ROAD, & WIDE WAY CORNER



0 – 3 years



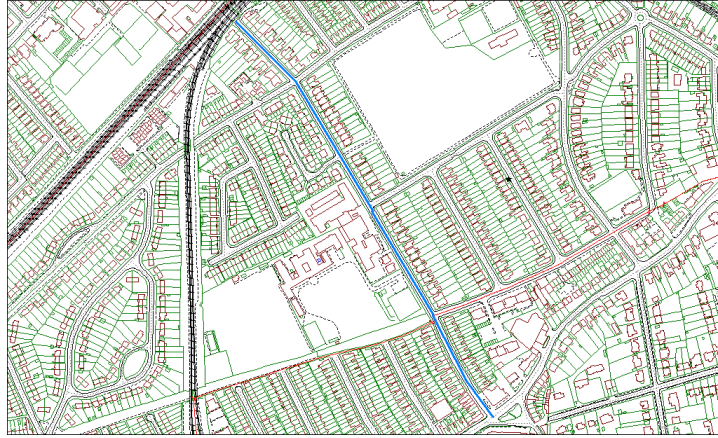
3 – 6 years



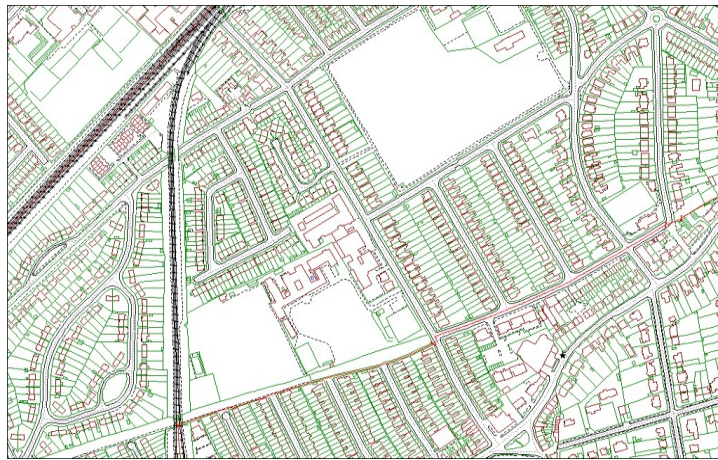
6 – 9 years

**APPENDIX L:**  
(continued)

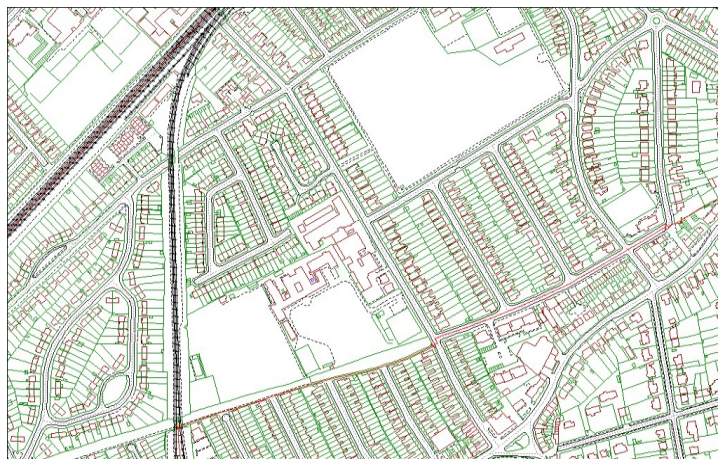
**MERTON HALL ROAD**



0 – 3 years



3 – 6 years



6 – 9 years



**APPENDIX L:**  
(continued)

**MERTON ROAD**



0 – 3 years



3 – 6 years



6 – 9 years

**APPENDIX L:**  
(continued)

**MOSTYN ROAD**



0 – 3 years



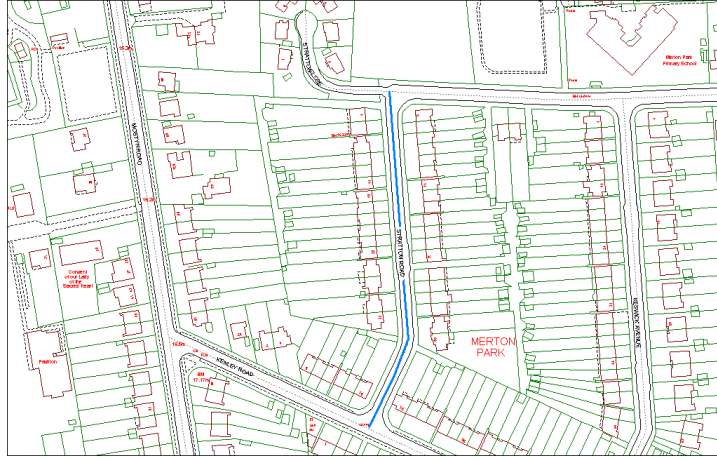
3 – 6 years



6 – 9 years

# APPENDIX L: (continued)

## STRATTON ROAD



0 – 3 years



3 – 6 years



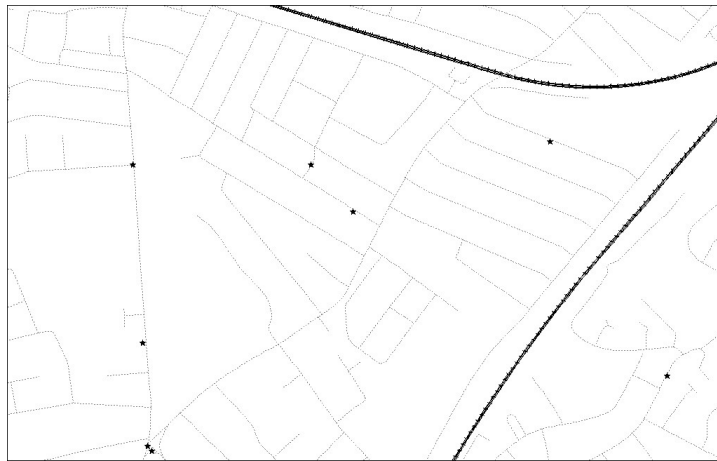
6 – 9 years

**APPENDIX L:**  
(continued)

**STREATHAM ROAD**



0 – 3 years



3 – 6 years

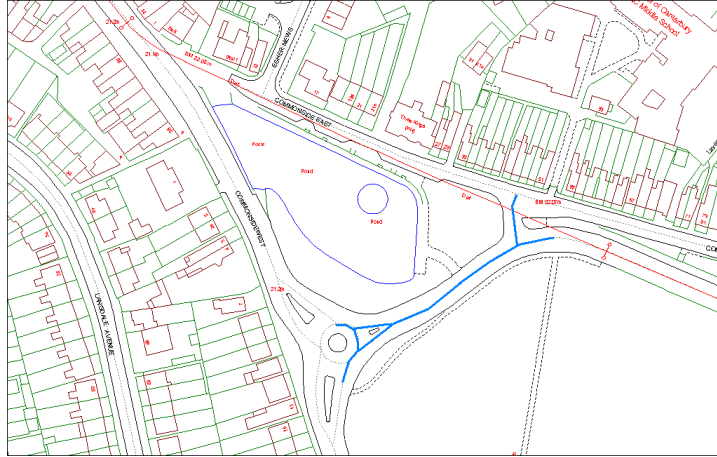


6 – 9 years



# APPENDIX L: (continued)

## THREE KINGS ROAD



0 – 3 years



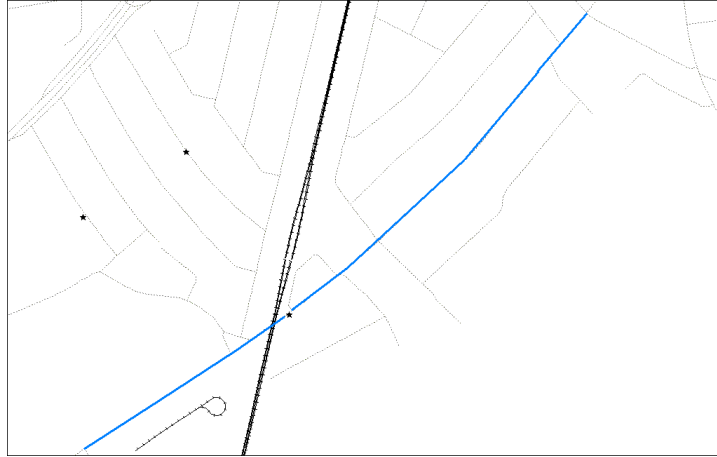
3 – 6 years



6 – 9 years

**APPENDIX L:**  
(continued)

**WEST BARNES LANE**



0 – 3 years



3 – 6 years



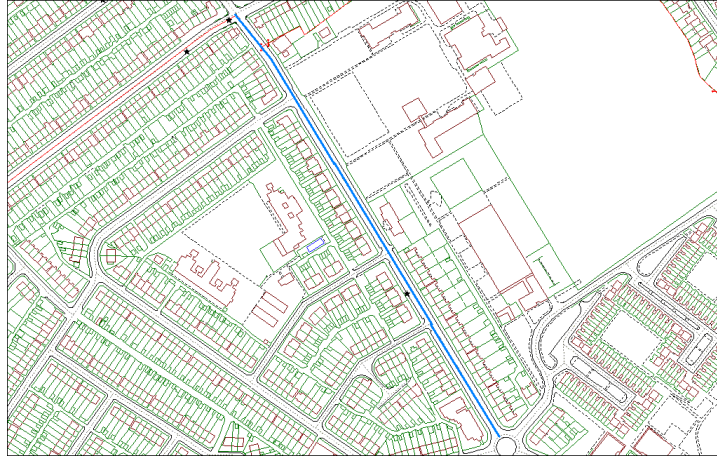
6 – 9 years



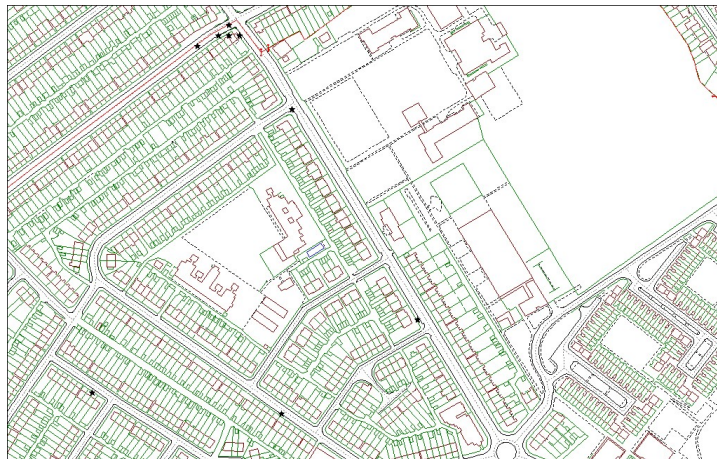


# APPENDIX L: (continued)

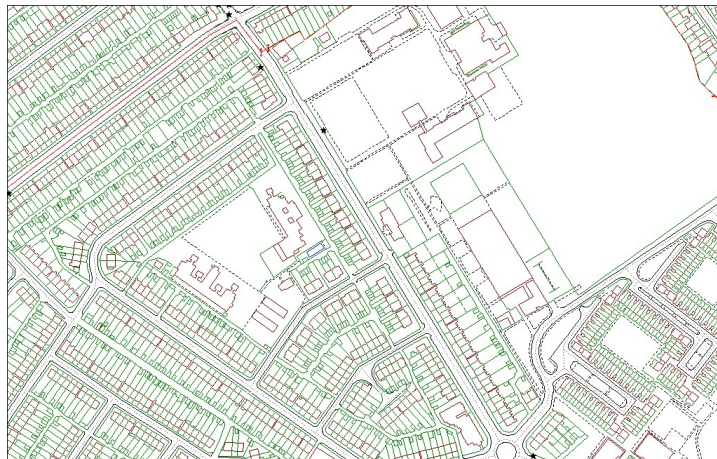
## WIDE WAY



0 – 3 years



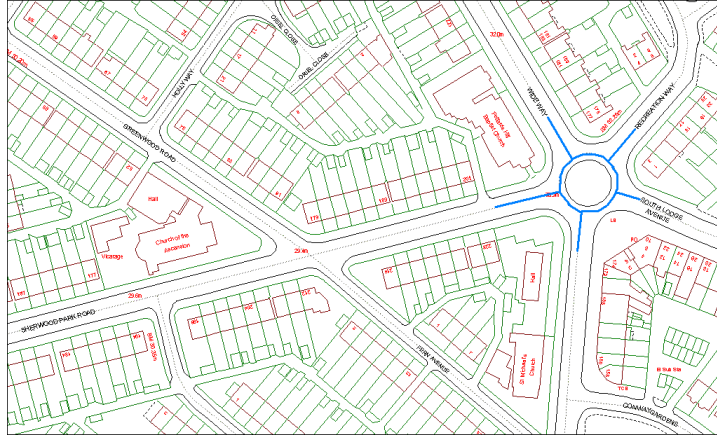
3 – 6 years



6 – 9 years

# APPENDIX L: (continued)

## WIDE WAY ROUNDABOUT



0 – 3 years



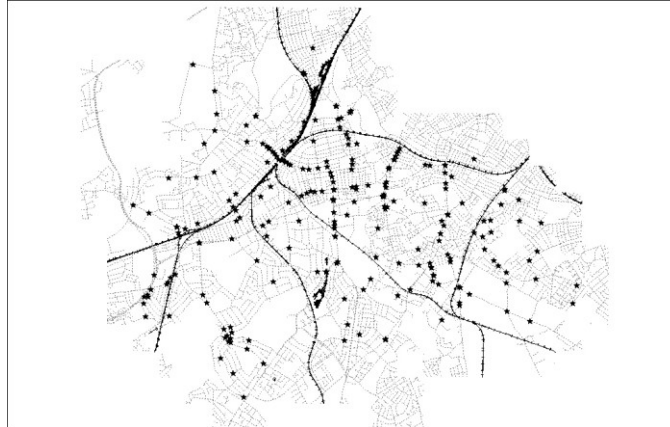
3 – 6 years



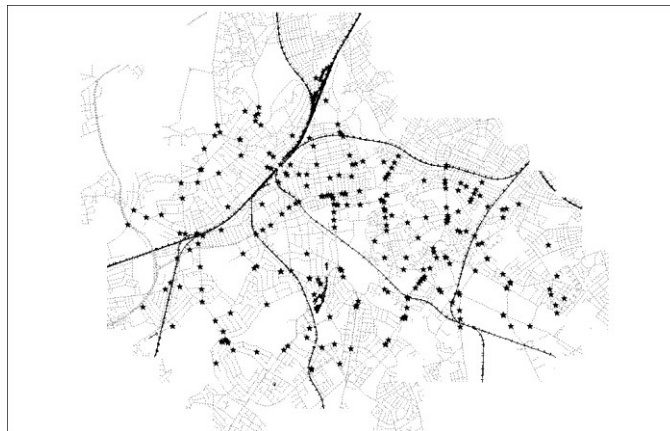
6 – 9 years

**APPENDIX M:**  
**ACCIDENT MAPS FOR PEDESTRIANS**

**BOROUGH OF MERTON**



0 – 3 years



3 – 6 years



6 – 9 years

# APPENDIX M:

(continued)

## BLACKSHAW ROAD



0 - 3 years



3 - 6 years



6 - 9 years

**APPENDIX M:**  
(continue)

**BUSHEY ROAD**



0 – 3 years



3 – 6 years



6 – 9 years

# APPENDIX M:

(continue)

## GRAND DRIVE



0 – 3 years



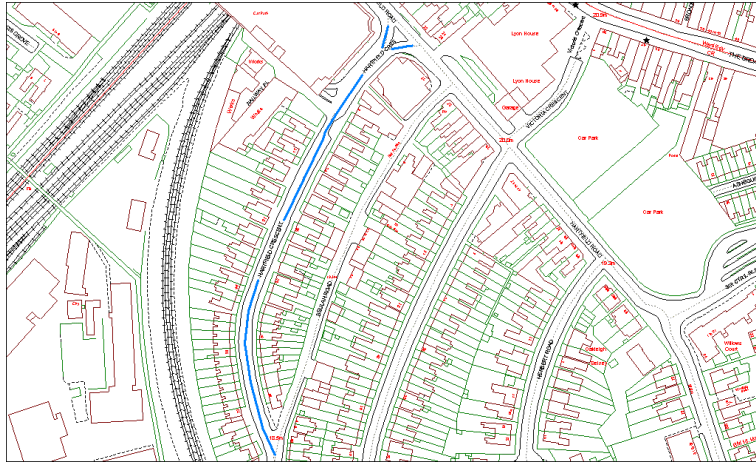
3 – 6 years



6 – 9 years

# APPENDIX M: (continue)

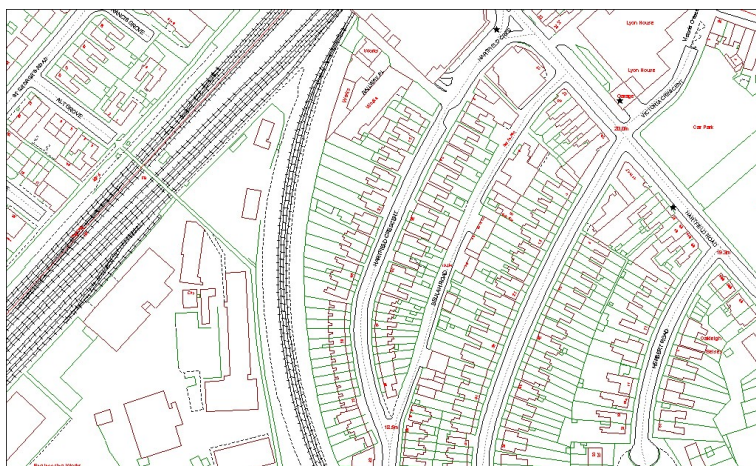
## HARTFIELD CRESCENT



0 – 3 years



3 – 6 years



6 – 9 years

**APPENDIX M:**  
(continue)

**HAYDON'S ROAD**



0 – 3 years



3 – 6 years



6 – 9 years



# APPENDIX M:

(continue)

## HILLCROSS AVENUE



0 – 3 years



3 – 6 years



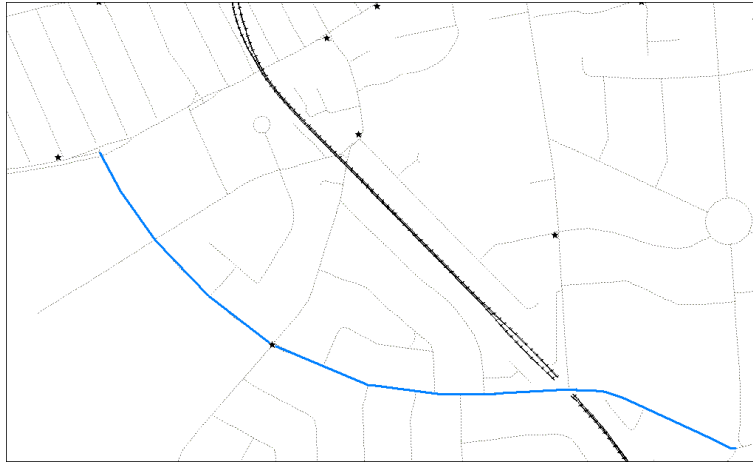
6 – 9 years



# APPENDIX M:

(continue)

## MARTIN ROAD



0 – 3 years



3 – 6 years



6 – 9 years

# APPENDIX M:

(continue)

## MORDEN ROAD



0 – 3 years



3 – 6 years

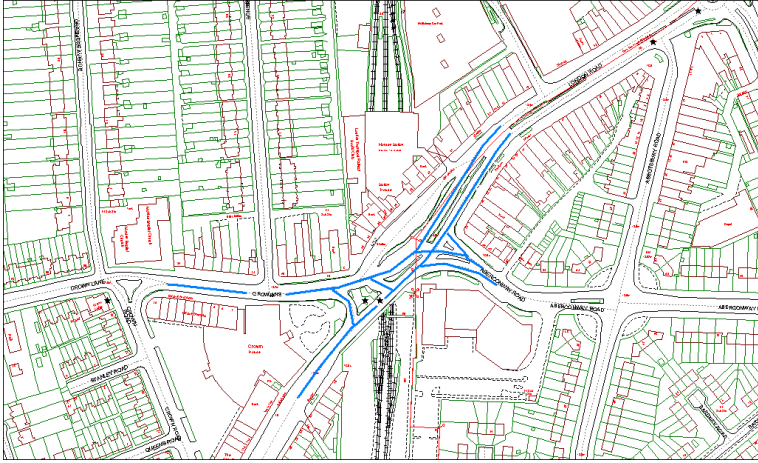


6 – 9 years

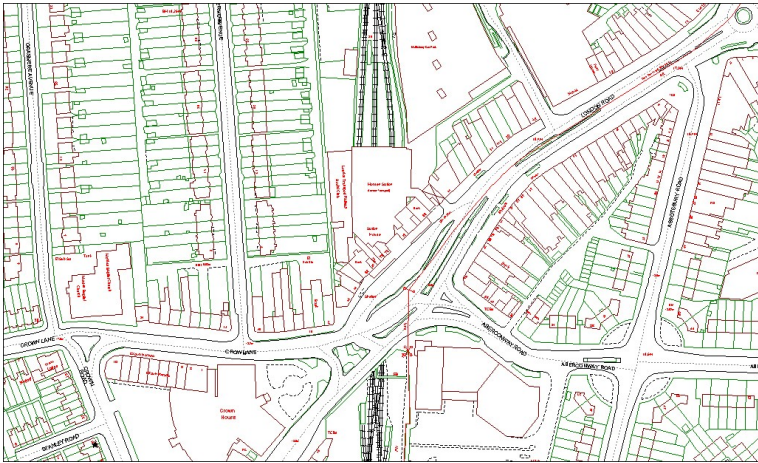
# APPENDIX M:

(continue)

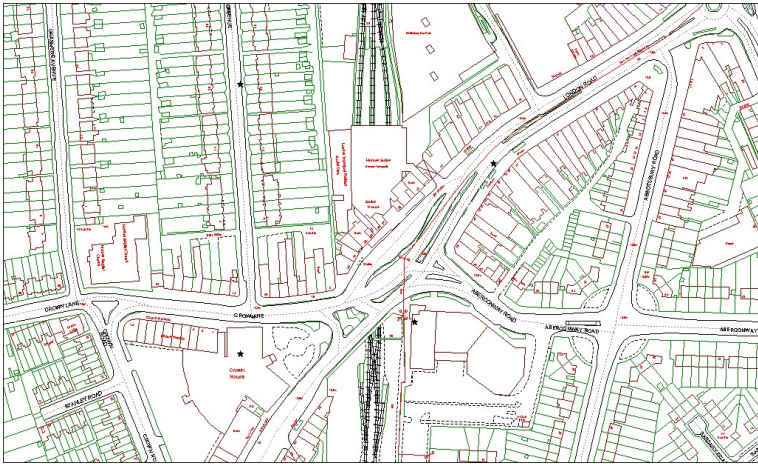
## MORDEN STATION



0 – 3 years



3 – 6 years

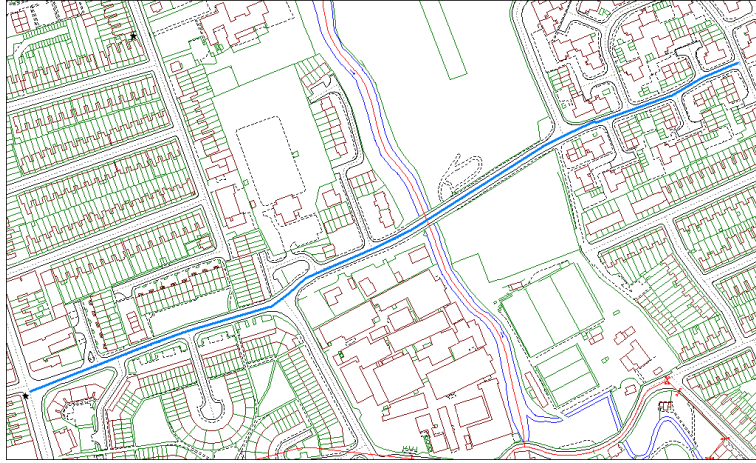


6 – 9 years

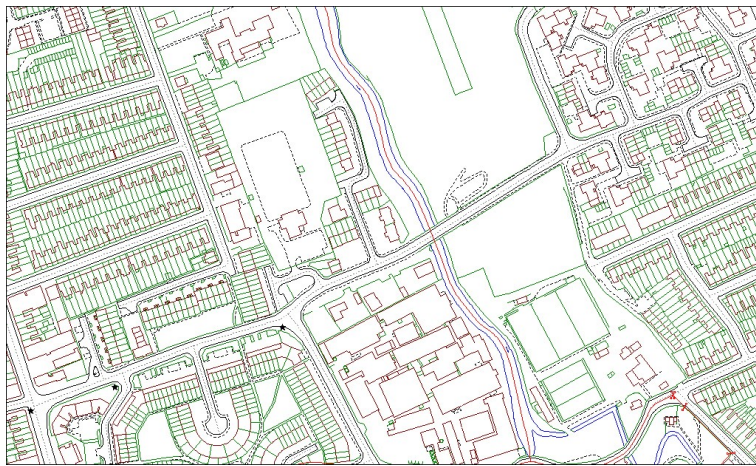
# APPENDIX M:

(continue)

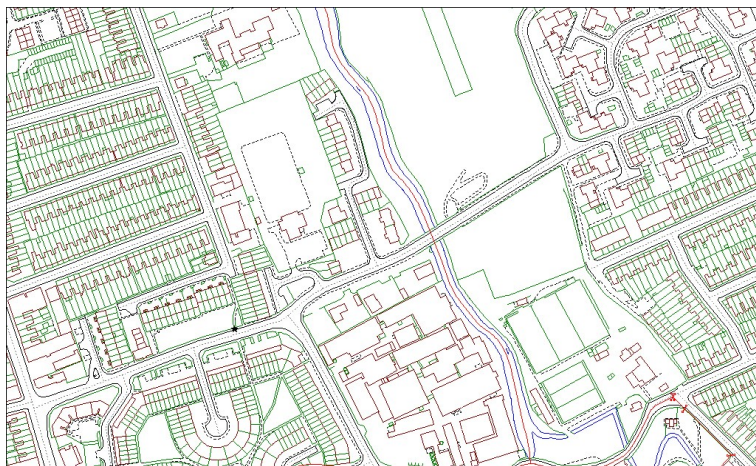
## NORTH ROAD



0 – 3 years



3 – 6 years

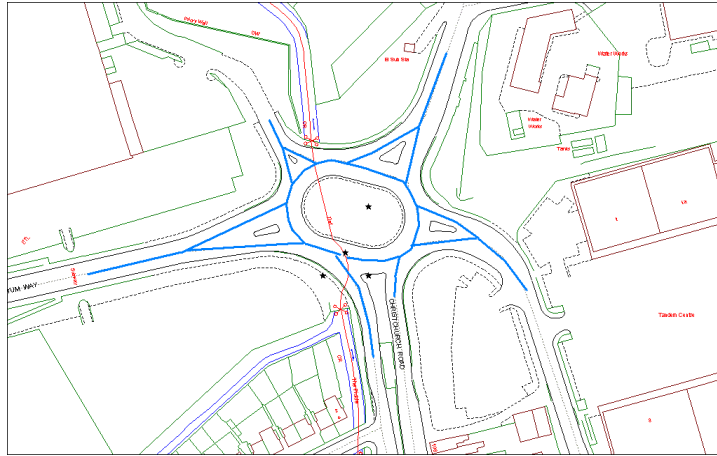


6 – 9 years

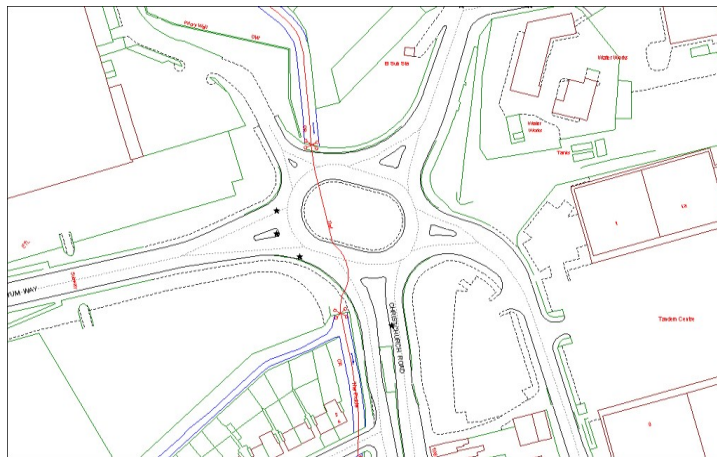
# APPENDIX M:

(continue)

## SAVACENTRE ROUNDABOUT



0 – 3 years



3 – 6 years

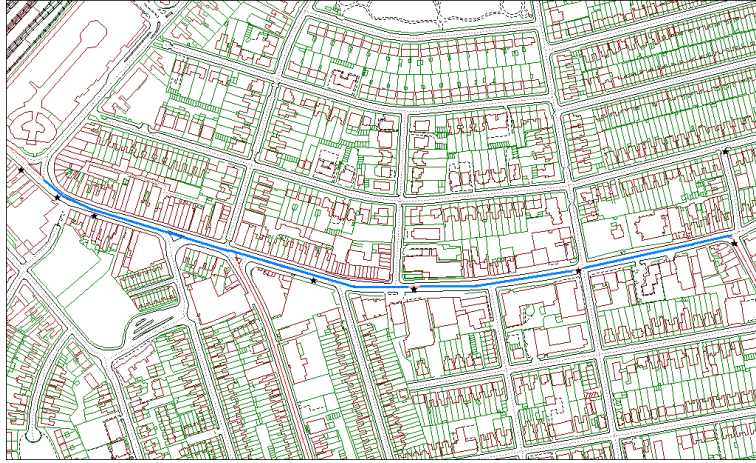


6 – 9 years

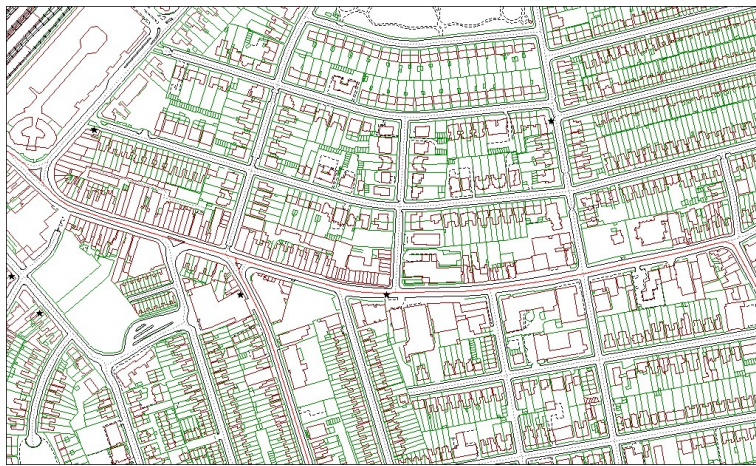
# APPENDIX M:

(continue)

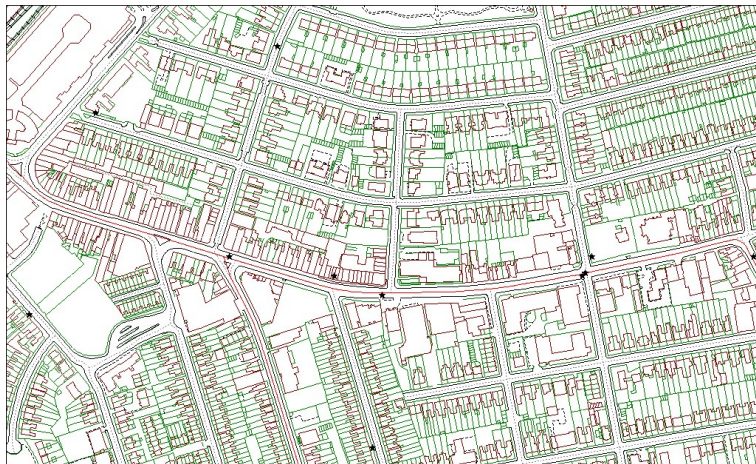
## THE BROADWAY



0 – 3 years



3 – 6 years



6 – 9 years



**APPENDIX M:**  
(continue)

**WEST BARNES LANE**



0 – 3 years



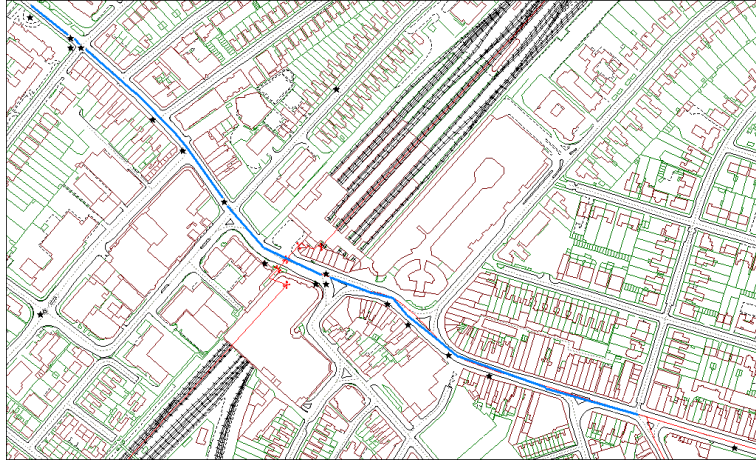
3 – 6 years



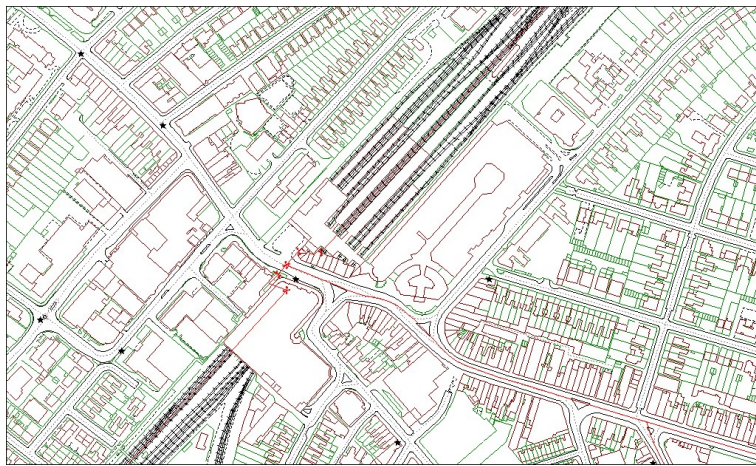
6 – 9 years

# APPENDIX M: (continue)

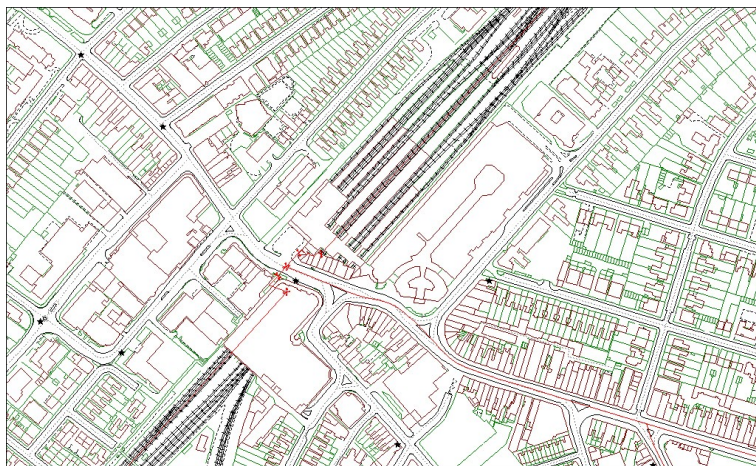
## WIMBLEDON CENTRE



0 – 3 years



3 – 6 years



6 – 9 years

# APPENDIX M:

(continue)

## WORPLE ROAD



0 – 3 years



3 – 6 years



6 – 9 years

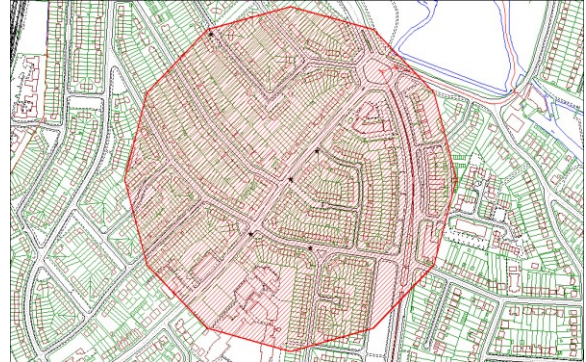
# APPENDIX N:

## ACCIDENT CLUSTERS FOR PEDESTRIANS

**BOROUGH OF MERTON**



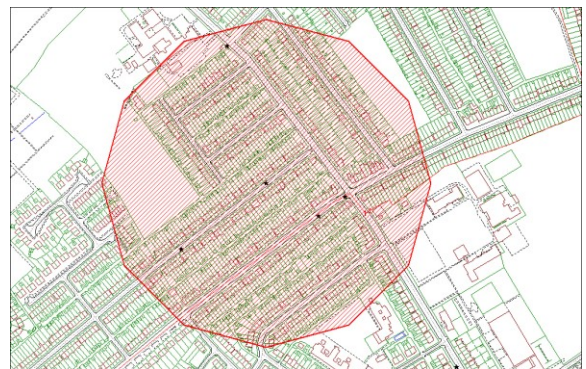
**CENTRAL ROAD**



**LONDON ROAD**



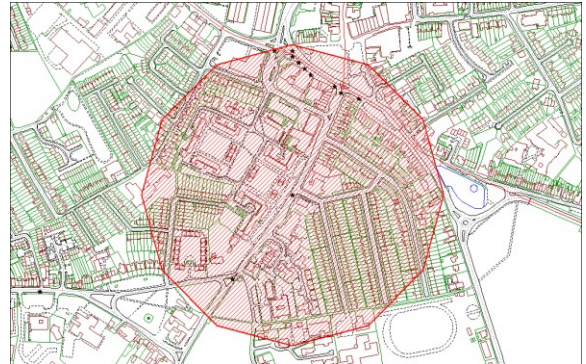
**MANOR ROAD – MANOR WAY –  
ROWAN ROAD**



**ROWAN ROAD**



**UPPER WEST ROAD**



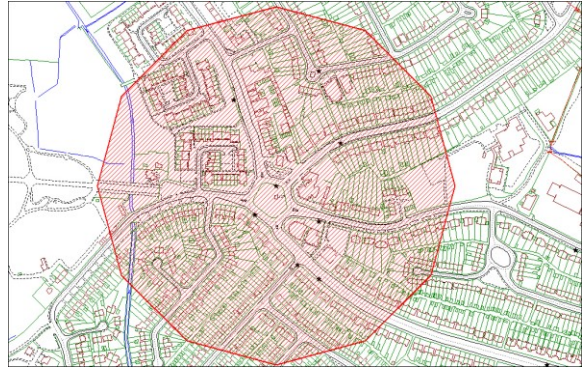
# APPENDIX O:

## ACCIDENT CLUSTERS FOR CYCLIST

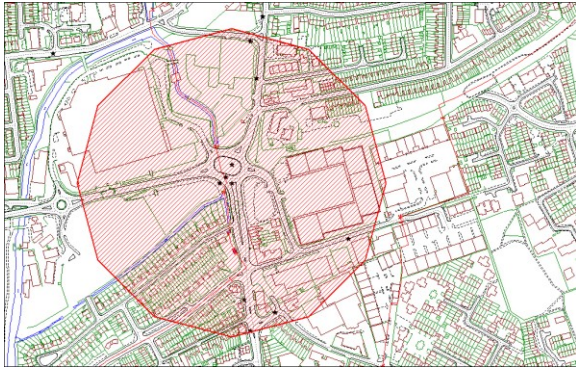
**BOROUGH OF MERTON**



**BEVERLY ROUNDABOUT**



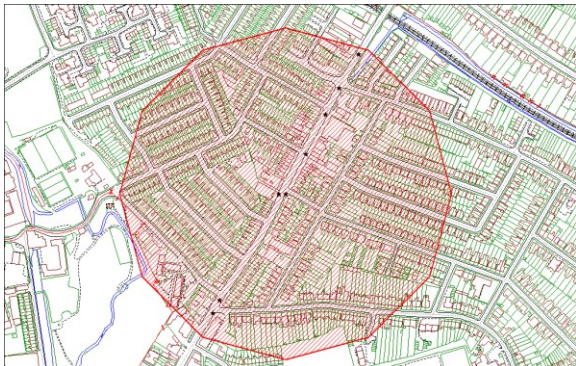
**CHRISTCHURCH ROAD ROUNDABOUT**



**MORDEN ROAD –  
MERTON HIGH STREET**



**PARK ROAD**



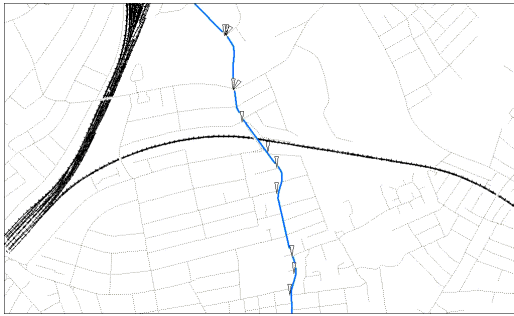
**WIMBLEDON HIGH STREET –  
WIMBLEDON BRIDGE**



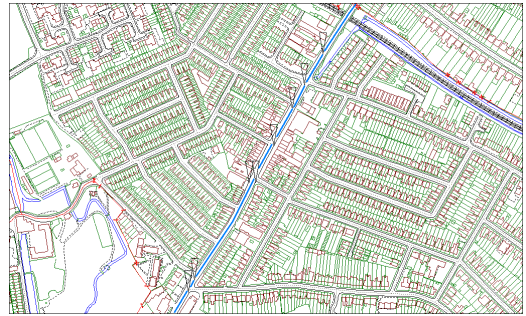
# APPENDIX P:

## DANGEROUS ROADS FOR CYCLISTS

**DUNSFORD– HAYDON’S ROAD**



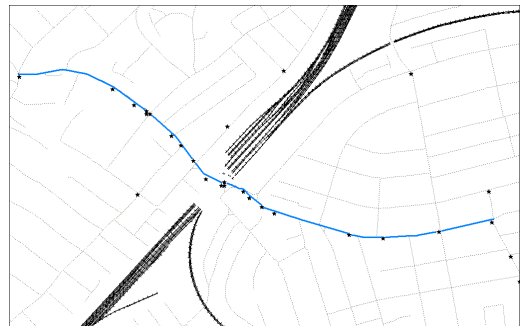
**HIGH STREET COLLIERS WOOD**



**MERTON ROAD – MORDEN ROAD**



**WIMBLEDON HILL ROAD –  
WIMBLEDON BRIDGE –  
THE BROADWAY**



# APPENDIX Q:

## KERB BUILD-OUT ILLUSTRATION

