Road Danger Reduction in Bristol

Report on a Knowledge Transfer Partnership project - August 2010

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Summary
This report explores and evaluates a Road Danger Reduction (RDR) approach to road safety, an approach that offers a radical and proactive aim of seeking to reduce road danger at its source. This means addressing the inequity and social injustice of disproportionate risks to others posed by particular modes of transport and seeks to reduce them through appropriate and proportionate interventions. The report, having described this approach, looks at the current road safety practice in Bristol City Council. It has found that some elements of current practice are in harmony with the ideas of RDR and some are contrary to it. New ways of examining casualty statistics are explored. Recommendations for the Council are made, the role of Neighbourhood Partnerships is highlighted, and a new approach related to RDR principles is outlined.

Recommendations made in this report
The project's recommendations will be recounted here in brief and are outlined more fully within the main body of the report.

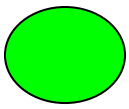
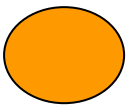
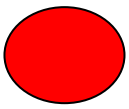
Recommendations for a city wide Vision

1) The Council should unify its road safety work around a fully adopted RDR vision for Bristol. This vision would be one of a city in which it is safe and pleasant to move around from one place to another. This vision should be agreed by political leaders, the Council Chief Executive, and other high level officials. Having adopted the vision, the vision should be cascaded out to Neighbourhood partnerships, neighbourhood groups and to Bristol residents via the local media.
2) Also in relation to a citywide vision; depending on the findings of the pilot areas, a 20mph limit in residential areas should be extended citywide.

Recommendations in the area of Road safety engineering

3) It is recommended that the Traffic Authority Approval (TAA) form that goes to the higher tier officers should have a means of summarising the scheme's effect in the light of Council policies of promoting walking and cycling. This means of summarising could either be a 'traffic lights' check box such as shown in Figure 1

Figure 1: Traffic lights check

Overall benefit to promoting walking and cycling because:	**Overall neutral effect on promoting walking and cycling because:**	**Overall disbenefit to promoting walking and cycling because:**
		

Alternatively, there could be a statement on the form highlighting the Council's policy of promoting walking and cycling. It could then ask whether the scheme in question does this, and if not, why not.

4) Whilst retaining its remit of reducing casualties, the Road safety engineering team should prioritise schemes according to walking and cycling promotion as well as according to casualty numbers.

Recommendations relating to Casualty statistics

5) The current project has looked at casualty statistics in a RDR influenced light, looking at:

- cycling casualty totals while taking account of numbers of people cycling
- what motor vehicles were doing at the time of a collision leading to a pedestrian casualty
- contributory factors in collisions leading to a cyclist casualty.

It is recommended that these ways of assessing statistics be continued and undertaken in a more formal capacity.

Recommendations in the area of Education, Training and Publicity

6) Road safety education of children should include developing critical awareness about the modal choices they will make in the future. The children should be encouraged to think critically about the effects that driving a car or cycling has, in terms of road danger, on their local community and society in general.
7) Discussion should take place between the ETP team and Smarter Choices team to work towards a greater harmony of the image of cycling that the two teams promote. There is a difference at the moment as the Smarter Choices team aim to promote cycling as a normal activity for normal people wearing normal clothes. In contrast, the ETP schemes sometimes show the cyclists wearing luminous clothing, cycle helmets etc.
8) The Parent walks presently conducted should place more emphasis on appealing to parents as drivers to look out more for child pedestrians and also about the seriousness of the decision to drive in the first place.
9) In general an intervention should be devised to highlight some of the anti-social and danger effects of ‘normal’ driving. The statistics chapter of this report supports the importance of such an approach.

Introduction

This report is the result of a nine-month Knowledge Transfer Partnership project between Bristol City Council, Bristol NHS and University of the West of England. The aim of the project was to explore an alternative approach to road safety called Road Danger Reduction, to explore the existing Casualty Reduction (CR) approach in Bristol City Council road safety and to see how a RDR approach could help align road safety practice with wider transport objectives.

Semantics

Road Danger Reduction re-examines the words used in road safety and takes language seriously. It is necessary to explain a few words and phrases used in this report.

Throughout the report Road Danger Reduction is abbreviated to RDR. The Casualty Reduction approach or ethos is abbreviated to CR.

'Road safety' - People within the Road Danger Reduction movement often use the term 'road safety' to represent the traditional establishment approach. While this is noted the term 'road safety' will be taken to refer to traditional and/or RDR efforts because this is how many interviewed understood the term. The terms 'mainstream road safety' or 'traditional road safety' will denote the traditional establishment of road safety only (which is often based on a casualty reduction ethos), as distinct from RDR.

'Hot spots' - This is the term used in the report to denote specific junctions or stretches of road that are identified in traditional road safety as being particularly dangerous and which are thus singled out for engineering treatment etc. The term 'Black spot' isn't used due to unfortunate connotations. The term 'High risk site' isn't used as RDR would suggest that at present because of fast moving cars there is risk that is too high almost everywhere on the roads.

'Collision' 'Accident' - RDR tends to refer to road users crashing into each other as collisions rather than accidents because the term 'accident' suggests that nobody was at fault in an incident or that the incident couldn't have been predicted or prevented. RDR would question these assertions. Having said this the term accident will be used when it is true to the context of a person being interviewed etc. Also collision is inappropriate when a car for instance runs off a road without hitting anything.

In order to make the main body of this document of a readable length it has been necessary to be very concise. Thus a substantial literature review and expert interview write up are only briefly represented in the main report. They are included in full as Appendices. Other Appendices provide greater detail for other elements of the report and can be read as more detailed alternatives to some of the chapters.

Introduction to RDR

An extensive literature review, drawing on international evidence relevant to RDR was conducted. The write up of this review is at Appendix 1.

The Road Danger Reduction (RDR) approach is an approach to road safety. It is based on several concepts of fundamental importance. One of these is that at present there is an inequity in our road system: At the moment it is more dangerous and more difficult for pedestrians and cyclists to get to where they want to go than it is for motorised vehicle users. This is unfortunate in an age when we are realising there are many important benefits of people walking and cycling more: including an urgent need to reduce carbon emissions across all sectors and sections of society.

The RDR approach is also based on a concern for social justice. A specific element of this is that the level of responsibility and liability taken on by road users should reflect the potential for harm posed by the means of transport that they use.

In terms of how it seeks to achieve its goals RDR suggests that the surest way to improve road safety is to reduce the volume and speed of motorised traffic on the one hand, and to promote walking and cycling as means of transport on the other. It draws on the health benefits of active travel modes to justify its promotion of non-motorised modes despite a potential short-term rise in road casualties that such a strategy might lead to. The health benefits of active travel include reduced risk of coronary heart disease, obesity, diabetes and stroke. There is robust evidence to suggest that the reduction of these effects of sedentary lifestyles would greatly outweigh any extra lives lost on the roads through more people walking and cycling (BMA, 1997; Hartog et al 2010).

RDR also points to the 'safety in numbers' theory to support its strategy of encouraging more walking and cycling. The hypothesis is that the more people walking and cycling, the safer each individual walking or cycling trip becomes (Geyer et al, 2006; Jacobsen, 2003; Robinson, 2005). There is a developing and consistent evidence base for the validity of this theory. It has been suggested that if the safety in numbers effect becomes strong enough, a large increase of people walking and cycling could actually lead to less road casualties overall (Elvik, 2009). Jacobsen concludes that as it is unlikely that walkers and cyclists would become more cautious when in greater numbers it must be the drivers who are adjusting their behaviour. An explanation for the processes at work that lead to safety in numbers has been provided by Walker (2007) who argues that motorists can only take into account a limited number of factors when they are driving. They select these factors according to the frequency with which they experience them. When they encounter cyclists and pedestrians frequently they will take them into account in their driving behaviour. When motorists encounter cyclists infrequently they do not register them at a conscious level. These mental models 'guide attention to the areas of the surrounding scene most likely to be important' and these patterns become entrenched over time (Walker, 2007).

A concern within RDR is that the present methods of collecting and reporting road casualty statistics are incomplete and not adequate to give a thorough enough understanding of the effects of the danger present on the roads. As well as advocating the revision of these methods RDR states that the wider impacts of road danger and the prohibitive fear of road danger should be accounted for in road safety strategy. These may include negative and chronic health impacts, including poor mental health, air and noise pollution, and community severance as well as the suppression of walking and cycling. So RDR sees 'road danger' as being far more prevalent than instances of casualties. Thus in light of this it recommends substantive measures to increase non-motorised modes and restrain private motorised traffic.

It should be emphasised that RDR is in most practical instances not an *opposite* approach to the UK's traditional Casualty Reduction (CR) approach. In many cases it seeks rather to extend CR strategies with more comprehensive or preventative (rather then curative) measures. RDR does though often stand in contrast to the CR approach. For instance, unlike CR that often seeks to achieve and monitor reduction in casualties, RDR seeks to achieve a reduction in danger at source. It has a lower tolerance for any instance of road danger, even if the instance hasn't so far led to casualties. It also differs from CR in that it focuses more 'road safety' attention and action on reducing the source of road danger, fast moving motor vehicles and their drivers, rather than adjusting the behaviour or attitudes of the frequent receivers of

that danger i.e. pedestrians and cyclists. It could be argued to what extent CR does this, but particularly in the field of road safety education there has been heavy focus on non motorised users adjusting their behaviour.

RDR often advocates a more proactive, geographically comprehensive approach to road safety compared to the traditional approach which is often focused on geographically specific, incident 'hot spots' although it can include wider treatments as well. RDR critiques the hot spot approach in light of 'risk compensation' theory that it also applies to other areas of road safety. As highlighted in Appendix 1, this theory suggests that drivers will normally gravitate subconsciously to a certain level of risk taking (risk homeostasis) in their driving behaviour. Because of this the theory suggests that elements that make a driver feel safer, such as a less demanding road environment or improvements in in-car safety will lead to that driver driving in a more reckless manner in order to re-establish the subconsciously preferred level of risk.

RDR itself has not been tested on an area wide basis. The road safety strategy in York in the 1990s was near to it in emphasis and demonstrates that RDR can operate within mainstream road safety work. The elements it has in common with other European visions for road safety such as Vision Zero in Sweden and particularly, the Sustainable Safety vision in the Netherlands are discussed in the literature review. In short, the review found that Vision Zero has substantial differences to RDR in its emphasis of eliminating road danger through road design rather then behaviour changing methods and also its favouring of segregating cyclists from motor traffic. The Sustainable Safety vision also often favours segregation. However the latter is akin to RDR in its emphasis on altering road user behaviour in order to reduce road danger. The Sustainable Safety vision was also found to share a number of other important principles and strategies with RDR.

The concerns of equity, accessibility and justice underpinning Road Danger Reduction inform a new approach to a raft of old and new safety measures.

Expert interviews
Following the literature review a select number of road safety experts were interviewed for their opinions on the Road Danger Reduction approach. A full write up of these interviews can be found in Appendix 2. Elements of the interviews that particularly relate to this project are summarised below.

Interviewees were asked for opinions on what road safety is about and whether the UK road safety strategy at present is socially just. In relation to the latter question, Dr Robert Davis, a central actor in RDR thinking, suggested that RDR:

> "deals with the fact that we've never dealt with at all; that people are able to go out using motor vehicles, endanger other people and more or less get away with it."

Highlighting the strengths of RDR Dr Davis thought that the approach emphasises:

> "your responsibility to other road users as being the most important thing."

He also suggested that it is the only approach that would succeed in promoting more non-motorised and less motorised use.

Some interviewees were critical of the 'hard line' tone that RDR sometimes takes, suggesting that it can alienate potential support. This raises an important question for a Bristol City Council RDR policy: Should it maintain a strong, radical and critical tone

which would enable it to be true to the aim of making radical changes but which may alienate support from inside and outside the Council? Alternatively should it temper its tone in order to increase support but risk becoming 'watered down' and less true to its aims in the process? It is undeniable that RDR can be perceived as being hostile towards the mainstream of road safety. It could be argued though that a radical critique of present approaches underpins RDR and is necessary to inform a future alternative strategy for action. A possible way forward is to focus less on RDR's critique of the present road safety system and more on the alternative strategies that RDR puts forward.

One such strategy is the promotion of higher levels of walking and cycling. Support of this strategy from a road safety point of view was present from most of the interviewees (although it was not unanimous). With regard to this two of the interviewees raised the idea that the health benefits of more people walking and cycling would outweigh the extra people experiencing greater danger on the road. Another strategy suggested by RDR is the reduction of volume and speed of motorised traffic. The majority of the interviewees approved of 20mph limits being put in place in residential streets.

To what degree does this project propose an RDR approach for Bristol City Council?
It is important to note that RDR is a holistic approach to road safety, which is in some areas radically different to the traditional CR approach. In light of this the recommendations made here, if taken up, would represent only an incremental move towards an RDR approach. Thus, the Council if accepting the recommendations should think of its approach as an '*RDR influenced'* one rather then a pure RDR approach unless further and more radical changes are added to those recommended here.

A very important element of RDR thinking is that of social justice: the idea that those using motorised vehicles should face higher levels of police enforcement and stricter legal penalties when endangering the lives of other road users. The motivation behind this idea is partly in terms of pure justice; that the present leniency towards careless drivers is simply unfair, but is mainly that stricter law and enforcement can act as an effective deterrent to bad driving and even the decision to drive at all (Davis, 1992). As such an important part of an RDR strategy should be to seek to change the enforcement and legal systems relating to road traffic laws. However, the ability for Bristol City Council to do this is limited. It could only seek to do so by lobbying central government. It is unlikely that the Council would support such an effort as part of its expenditure and so this element of RDR has not been highlighted in the following research and recommendations. The elements of RDR that have thus been emphasised in this project are the need to promote walking and cycling and to decrease the volume and speed of private motorised traffic.

Next stage of research
Having examined RDR through a literature review and national expert interviews, Bristol City Council's road safety policy, the views of the specialist teams and their programmes were examined.

Examining the Joint Local Transport Plan 2 from a RDR perspective
Policy should highlight the priorities that day to day practice will follow. Thus Bristol City Council's present transport policy was examined.

Bristol City Council shares its Local Transport Plan with surrounding local authorities that together form the West of England Partnership. This partnership produces a

Joint Local Transport Plan (JLTP) that sets out transport related policies, priorities and strategies. At the time of writing the plan currently in operation is JLTP 2, which runs from 2006 to 2011. This document was assessed to see which elements are in harmony with RDR and which elements are not.

There are many ideas sympathetic to an RDR viewpoint in the document. JLTP2 recognises for instance that fast motor traffic can:

> "create a physical or psychological barrier that in turn may affect accessibility to essential services". p156

JLTP2 says such traffic can deter walking and cycling. It recognises the desirability of walking and cycling, noting that there is a significant challenge to seek to 'reduce congestion, improve air quality and promote healthy lifestyles by encouraging people to walk and cycle.' It notes that increased levels of walking and cycling have major positive impacts on road safety.

The document notes the importance of perceptions of danger: It states that they hinder 'attempts to promote modal shift towards sustainable modes such as walking and cycling' and that perceived safety should be, a 'key aspect of the liveability agenda.'

In terms of promoting cycling, the JLTP2 suggests that:

> "The intention is that the needs of cyclists will be integrated into all the highway schemes and incorporated into the prioritisation and design processes." p166

The document also alludes to the importance of non-motorised modes for public health, stating that:

> "The link between transport, physical activity and health is now recognised at the highest levels." p53

All the above ideas are in harmony with a RDR perspective. There are though some elements in JLTP2 not in harmony with RDR; one is that the document uses 'Killed or Seriously Injured' (KSI) statistics heavily as a measure of progress in transport policy. The road safety chapter, for instance, uses KSI statistics to describe the road safety situation in Bristol and four of the road safety objectives in the chapter are related to reducing casualties. RDR would question whether KSIs are an accurate and comprehensive measure of the safety of a road environment. In addition it could be argued that there is a lack of consistency in BCC's policy between modal shift aspirations and road safety objectives. This could be addressed by RDR.

In conclusion, much (although not all) of Bristol's transport and road safety policy is in harmony with RDR ideas. The next question is whether in practice Bristol City Council road safety works in ways resonant with a RDR viewpoint. Interviews with the teams at the Council relevant to Road Danger Reduction were conducted and common themes emerging from these will be discussed next.

Themes arising in common from team leader interviews

The importance of policy
As has previously been described, Bristol transport policy appears in some ways in harmony with a RDR approach. In light of this, traffic management team leaders were asked how important policy was in processes

The area engineering team leader thought that few local policies affected what his team does 'day to day.' The walking and cycling engineering team leader felt that in his area of promoting walking and cycling Bristol policies, such as the hierarchy of solutions for promoting non-motorised modes, were starting to slowly effect practice in a 'drip, drip, drip' incremental process.

From an RDR perspective policy regarding walking and cycling accessibility is particularly important. The team leaders are aware of pedestrians and cyclists being at the top of the road user hierarchy and thus of the desirability of considering their safe access.

The area engineering team leader suggested that *already* when designing schemes considering walking and cycling may be a necessity whereas considering car mobility may not be. He said that there is a priority for pedestrians and cyclists in that the team would avoid at all costs putting 'anything that is dangerous or inappropriate for pedestrians of cyclists.'

The role of higher tier officers and Elected Members in improving road safety practice
Team leaders suggested that higher tier officers and Members are important in a number of respects**.**

Some of the team leaders suggested that there is a culture within the Council that does not support interventions that are more on the edge of what can be done. It was suggested that officers feel that if they do something new and it goes wrong they will be held accountable for it rather then supported by higher tier officers.

The walking and cycling engineering team leader felt that it is the politicians who need to make the big decisions that can really change things (in terms of area wide traffic reduction, speed reduction etc). Regarding this he thought that councillors were saying the right things and that it 'is quite exciting times.'

It is important that higher tier officers are engaged by RDR, partly because when team leaders have conflicting opinions on a scheme due to their team interests and can't come to an agreement amongst themselves the issue goes to higher tiers for a decision. Such decisions may then be made adjudicating situations where improvements to walking and cycling (a priority of RDR) are in conflict with other factors.

Some common themes from the team leader interviews have been highlighted above. We now address the relevant road safety teams and their practices.

Road Safety Education, Training and Publicity (ETP) Team
The ETP Team Leader is also on the steering group for this KTP project. As such he is very supportive of RDR. However, he highlighted that his team is constrained to a CR ethos in a number of ways. As described in more detail in the literature review, Appendix 1, the CR approach to road safety is based on and measured by the reduction in casualty numbers that schemes achieve. RDR suggests that this may be an inappropriate guide to action as it doesn't take full account of the costs of road danger and the fear it imposes (e.g. loss to health from suppression of walking and cycling and increased pollution). CR tends by its nature to react to problem road user groups or areas once they have already come into existence and so is reactive (hence claims from residents groups that 'does someone have to die or be injured before remedial action is taken?). RDR suggests that strategies based on the ethos of reducing casualties only, will fail to get at the roots or source of the road danger problem.

One of the ways the education training and publicity team is tied to CR is through casualty targets, which the Council collectively has, and which the ETP team are expected to contribute to reducing. Moreover the ETP team is in partnership with corresponding teams in the surrounding councils as part of the West of England partnership. These Councils have a strong CR ethos. Some of the ETP's budget is tied into joint schemes agreed upon among the partnership councils. Nonetheless, each Council ETP team keeps a part of its budget to implement schemes specifically for their Council only. This then is most likely to be the area through which the ETP team can pursue RDR most.

Despite CR's constraints the team leader thought that there should be a clear focus when considering road safety on where the main source of danger comes from and trying to address that. He thus thought that a key focus should be on driver behaviour. The team leader reported that although pedestrians and cyclists are a 'key traffic group' within the Council they might not come that high up in the road safety priorities. For example, motorcyclists would have a higher road safety priority because the casualty rate for motorcyclists is greater.

Specific schemes
Having examined some of the factors influencing choice and management of schemes the specific schemes that the ETP team is engaged in were investigated. Space in this main body of this text only allows brief comments on some of the schemes:

'Made you look' is a scheme targeting bad driving behaviours. It includes a website with a character called 'Mr Lumo' who serves as a focal point and draws attention to issues in various ways. 'Made you look' is based on the idea that people behave as motorists in ways that they would never dream of in other areas of life, exhibiting a reduced respect for other people. In part the campaign is aimed at motorists becoming more self critical of their driving behaviours. RDR would approve of this, however it would suggest a wider range of driving behaviour could be addressed, including the decision to drive at all.

'Pavement Professors' and **'Trailblazers'** are schemes aimed at teaching young children pedestrian skills. The children are encouraged to think for themselves and hence it could be suggested to become more confident in their ability to assess traffic situations.

When asked what messages about traffic that Pavement Professors teaches, the road safety officer managing the scheme reflected that:

> "The way I train the trainers is to get them to not make it a scary experience."

The officer stressed that the scheme emphasises a two-way responsibility between driver and pedestrian. Children are taught for instance that drivers should be giving clues to pedestrians by positioning of the car and indicator lights and should be stopping at crossings and zebra crossings although they also teach that drivers might not always do these things. She said that it is an important challenge to find the right words in road safety education because once words like 'danger' 'safe' and 'safer' are used they imply that the roads are a 'horrendous place.' In general the team is reluctant to present road danger in ways that would intimidate and deter children from walking and cycling. RDR would approve of this reticence.

The officer also noted that she would like to see a scheme for parents that would help them to look at the roads through the eyes of their children. If they were drivers it would also help them to be more aware of child pedestrians when driving. She stressed that it is the adults who need to be reached.

'Speed awareness.' This scheme teaches children to be able to judge the speeds and stopping distances of cars. This report makes a recommendation regarding this scheme.

Parent walk. This scheme is only for parents of young children. The walks used to be for parents and their children together but the parents would 'switch off' due to assuming the teaching was aimed at their children. The team feel it is important to target the parents because with young children, parent behaviour sets an example. A presentation is made to the parents in the school and then there is a walk in the roads surrounding their children's school. The session is aimed at helping parents to understand how to safeguard their children as pedestrians and how to train their children as pedestrians. The parent walk might include a comment to parents that it is parents in cars who cause much of the danger around schools, but this would only be a brief comment. This raises the issue that speaking about the negative effects of car use is often a difficult societal taboo to break. The parent walk session doesn't focus on the responsibilities of parents as drivers.

'Bikeability' is a nationwide scheme that local authorities can use to provide cycle training. The aims of the course include:

- To develop positive attitudes towards road users
- To give trainees the confidence to use their cycles on local roads.

The road safety officer who manages the provision of the scheme in Bristol thought that the course helps to encourage mutual awareness between cyclists and motorists. For example, in unclear traffic situations the cyclist is encouraged to make eye contact with the motorist in order to negotiate as to who will do what. The officer suggested that the course is very much about giving children confidence about cycling as well as skills. Assertiveness on the road is also taught. This includes not giving way to motorists when the cyclist has right of way (which children may be tempted to do.) Essentially the approach appears to be that the Highway Code should be followed.

The course stresses that this code applies to all road users and that cyclists have equal rights with other road users. Encouraging assertiveness also includes taking up a road position that may hold up cars, where necessary.
Children are gently encouraged to continue cycling after the sessions although younger children are told to ask their parents about where they can or can't cycle. The officer reported that children often tend to think of cycling as fun rather than dangerous and the Bikeability instructors don't do anything to change this attitude. Thus the focus in Bikeability seems to be firmly on encouraging cycling as well as training and isn't on focusing excessively on the 'danger' of the road.

In general Bikeability seems to be very positive from a RDR perspective: It is training cyclists so they are confident of their skills, promoting the take up of cycling as a practical means of transport, and encouraging both assertiveness and a degree of mutual awareness between different mode users. The one way in which it differs from an RDR perspective is that the latter would place less emphasis on the promotion of high visibility clothing for cycling.

Discussion of Education Training and Publicity team
When given a short presentation about RDR the team were very open to its ideas. While the team does face constraints to be a CR team there is some space to work beyond this due to the budget the team keeps to implement its own schemes. In general RDR is a system of thought that interfaces more easily with road safety education training and publicity efforts then it does with engineering schemes.

Walking, Cycling and public rights of way team
The leader of this team described part of its role as including the provision of infrastructure in order to give walking and cycling 'a distinct benefit over motor traffic.' As previously described, the promotion of higher levels of walking and cycling is one of the main strategies of RDR. (This is because pedestrians and cyclists exert far less of the negative impacts that motor vehicle drivers impose on those around their vehicle.) Clearly this team's work then is relevant to a RDR approach.

The team leader related that although ideally there would be significant funding within Bristol City Council to implement walking and cycling engineering schemes this wasn't the case. A common tactic for his team then is to 'piggyback' onto other teams' schemes: In other words to add walking and cycling promotion aspects to the designs of other schemes. Another way in which his team can influence scheme designs of other teams is through the TAA process, of which he approves.

The team leader stated that his team's priorities for walking and cycling provision were taken from a hierarchy of solutions. In this hierarchy, traffic reduction is the preferred option, then speed reduction, then reallocation of road space through cycle lanes then, at the bottom of the list, shared use of provision away from the carriageway (shared between cyclists and pedestrians). RDR would approve of this order of priority.

Commenting on the hierarchy of users Bristol City Council has adopted since 1997 which places pedestrians at the top etc, the team leader commented that:

> "In reality I'm not sure that we (as a Council) do take that on board, but we are starting to move that way."

The team leader highlighted that walking provision and cycling provision cannot be always taken to be in harmony. Some measures to increase safety for pedestrians

such as a central island can make cycling more dangerous and difficult. Other engineers also made this point.

In terms of creating walking and cycling provision, the walking and cycling engineering team leader thought that for this to be really effective high level decisions would have to be made. He thought that:

> "At our level unfortunately it is about dealing with local problems as they arise and prioritising those local problems and getting the best out of walking and cycling."

The team leader thought it was hard to make the bold political decisions necessary when there are elections almost every year. A year is insufficient time for a big scheme to be planned, implemented, monitored and proved successful (or otherwise). He added that until people were empowered and big strategic decisions were made, 'the right thing to do' or 'perfect solution' wouldn't be done.

Significantly, the walking and cycling engineering team leader felt that a barrier to the promotion of cycling in the city was the subconscious barriers council officers have against getting on a bike, as members of the public, which they then bring to the workplace. He felt there was a deep-seated subconscious anti cycling feeling in some people within the Council.

From a walking and cycling perspective the team leader thought the 20mph limit pilot areas were a 'perfect start.' He thought that in the scenario that walking and cycling was an overriding priority in the Council 'fantastic' measures to implement would be those at the top of the hierarchy -traffic reduction- not least congestion charging.

Very much in keeping with RDR, the team leader highlighted the importance of liability measures for ensuring that drivers treat pedestrians and cyclists with a due degree of respect. He commented:

> "I think some people forget just how vulnerable cyclists and pedestrians are and their behaviour can be completely inappropriate and intimidating."

Road Safety Engineering Team.
This team is predominantly based on CR. The team leader stated that the number of casualties at any particular site would be 'the number one' way of identifying schemes. In terms of importance, this number of casualties stands out above and beyond the next most important prioritising considerations. He considered that the only measure the team uses for how dangerous a junction is at present the number of casualties sustained there. For instance, the team wouldn't look at a site where there were no casualties because cyclists were too scared to cycle there. Neither 'car mobility' nor 'walking and cycling accessibility' were considered when prioritising schemes, not even implicitly.

Casualty targets set for the team relate to people killed or seriously injured. There is also a target for slight injuries but this does not require a significant reduction.

The team leader highlighted that he thought the strength of CR was that it is an impartial way of prioritising schemes based on hard data. Using CR targets also ties the team into central government road safety strategy. He thought the weakness of the method is that it is not very flexible: If the experience of an officer tells them that a new road situation will lead to casualties but hasn't so far, it can not be prioritised under CR until after the casualties happen.

When asked whether his team might wish to discourage walking and cycling in order to reduce casualties, the team leader indicated that it was more 'the old school' of engineers who would think like that. It was not the approach that he took. He reported that sometimes he says 'no' to a certain type of intervention because he knows walking and cycling is a Council priority: 'You've got to be brave with these things sometimes.' This shows in general that the individual preferences of officers within the council *can* have some influence but that RDR in Bristol City Council with its emphasis on discouraging motorised modes and encouraging non-motorised modes would at present be reliant on the sympathetic approach or otherwise of officers with CR responsibilities. This puts the existing RDR elements at risk of individual officer dispositions and hence there is a need for RDR elements to be *embedded* into Council policy and practice

Specific schemes.
Having interviewed the team leader about processes like the prioritisation of schemes, specific schemes that the Road Safety Engineering team have managed/are managing were examined; on Marksbury Road, Bishopsworth Road, St Augustines Parade and Portway. The 20mph limit pilot areas in the city were also examined. Space in the main body of this report allows only brief conclusions on these schemes but diagrams and fuller descriptions are at Appendices 3 to 10.

As previously noted, prioritisation of schemes for this team is largely undertaken for CR reasons. However, the ways the team *design* the schemes show a mixture of elements: Some would and some wouldn't be in harmony with an RDR approach.

There were many elements in the projects that RDR would approve of:

- The Marksbury road scheme shows good awareness of the local important cycle route (Malago route) and improves the safety and accessibility of that route.
- The Bishopworth Road Scheme is clearly aimed at making walking and cycling in the area safer. It also improves pedestrian accessibility in the area with the pedestrian refuge islands and the new footway element, which was not added for direct casualty reduction reasons and which facilitates walks to school. It seems then a very RDR friendly scheme. It shows that in engineering practice RDR and CR can be in harmony.
- In the St Augustine parade scheme, RDR would approve of the installation of a central pedestrian refuge with a straight across crossing point for pedestrians, which improves accessibility and safety for pedestrians along a desire line. Also there has clearly been consultation with walking and cycling engineers.
- RDR would approve of the Portway scheme in that it is improving accessibility and safety for pedestrians and cyclists, particularly it would approve of the straight through crossing.

In general, when treating a specific casualty problem in an area the team will often look for other danger issues, and walking and cycling accessibility issues in the vicinity and address them as well, as part of the scheme. However, there are also elements that would be perceived as negative from a RDR perspective: In general, RDR would be critical of the approach of focusing on casualty 'hot spots' in the first place.

More specifically, a number of the schemes employ high friction surfacing which increases the ability of vehicles to brake when approaching a junction. RDR would be

critical of this treatment because of risk compensation theory which would suggest motorists will respond to the junctions' treatment by braking later and driving worse, in reaction, on subsequent junctions and surrounding areas. To counter this the team can point to the specific non-migrating nature of the road conditions that cause the danger and accidents at the specific junctions in question. They can also point to research they have undertaken which highlighted the past success of high friction surfacing.

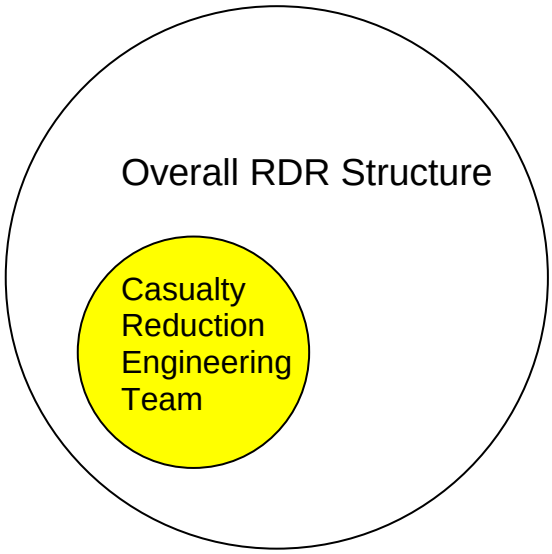
The St Augustine Parade scheme includes pedestrian guard railing, partly to keep inebriated pedestrians from moving onto the road. There were also pressures of anti-social behaviour here and police wanted barriers to control the behaviour. RDR would suggest that the pedestrians are not the problem, to be penned in, even if they are drunk, it is the inappropriate speed of motor vehicles in an area of high pedestrian activity that are posing the danger and so, to be just, it is the vehicles' access that should be adjusted or restricted rather than that of the pedestrians. Thus RDR would advocate wider, more radical measures such as pedestrianisation and Vehicle Restricted Areas. However such solutions may be deemed too difficult and expensive in this prime site in the city centre with the pressures and practical considerations that are attendant on it. Nonetheless, by separating pedestrians from the road by railings, in this area of the city centre the dominance of the car has overridden pedestrian accessibility.

Discussion

It is important to restate that the road safety engineering team is very strongly tied to a CR rationale. In a positive light this makes it less vulnerable to being influenced by councillors' or vociferous sections of the public's wishes. Negatively however it makes their operations less receptive to policy aims such as the promotion of walking and cycling. Having said this, the team are clearly aware of such priorities and often design according to them. In terms of the team's design of engineering schemes RDR would approve of some elements and not others. It is not a recommendation that the team consider pedestrian and cyclist accessibility when designing schemes as clearly they do this already.

RDR would disapprove of a team specifically justified by reducing casualty numbers. It is hard to see how the team can really be rendered into a RDR team. It maybe that it should stay as a 'CR yolk' within a 'RDR egg' of the Council's road safety effort (as shown in Figure 2). Whilst remembering that RDR isn't in opposition to the aim of trying to reduce casualties this evaluation does suggest that being too occupied with the reduction of casualty numbers can mean focus is drawn away from the source of the road danger problem, which is fast moving (for the circumstances), motorised traffic.

Figure 2: Showing CR engineering team fitting in overall RDR structure



20mph Pilot areas
The Road safety engineering team also manages two pilot 20mph limit areas in Bristol. These pilot areas were chosen to test the effectiveness of 20mph limits (speed limits without traffic calming) in residential areas of the city. One of the areas is in the south of Bristol and the other is in the inner east area of the city. Of the two the east area is more economically deprived and relates more easily to a CR approach due to higher levels of traffic injury among lower social class groups, not least child pedestrians.

The programme was designed to make walking and cycling within the areas safer and more popular. It received some funding from the Cycling City programme (Cycling England funded 2008-2011). The 20mph limit schemes were also intended to reduce the number and particularly the severity of road casualties. Making walking and cycling safer is in harmony with RDR principles as is the stated aim of making streets more accessible and thus 'encouraging community interaction.'

At the informal consultation stage of the scheme there were requests to include in the areas some of the higher speed roads which had an average speed of more than 24mph. Including these roads in the 20mph limits was contentious amongst the police, First Bus and with many teams within the Councils who raised issues with it through the TAA process.

The motive of reducing speeds with a blanket measure such as 20mph limits is seen as very positive by RDR. Additionally, as part of the expert interview stage of the research 5 of the 7 interviewed national specialists in the field broadly approved of 20mph limits. See Appendix 2. However, although these included Dr Robert Davis he has commented that 20 limits usually exclude main roads where many people want to cycle and also that proper enforcement is essential.

Area Engineering team and Neighbourhood Partnerships
Traditionally this team managed engineering schemes aimed at reducing danger but which did not have significant casualty numbers and so would not be picked up by the Road safety engineering team. Conventionally the basis on which schemes were chosen by this team was very much one of professional judgement. However, this

year is the first year of a new structure for the team's programme. Which schemes the team prioritise is being decided by local Neighbourhood Partnerships. There are 14 of these in the city. They are intended to provide local communities with the means of having a greater say in the way services are run by the Council. Each Neighbourhood partnership has just over £17,000 or just over £25,000 for the road safety schemes depending on how many wards it comprises of. This isn't a great amount considering that an average zebra crossing costs £10,000 to £15,000.

Some of the issues raised by the prioritisation of schemes by Neighbourhood Partnerships

The area engineering team leader recounted how some of the scheme prioritisation meetings with the Partnerships had gone. Some Partnerships had chosen their schemes wisely and had had meetings that ran smoothly. Others had been more problematic and had difficulties reaching decisions about which schemes to do. The team leader hopes that in future years more ideas about local road safety schemes will come from the public, committee members and councillors themselves. He is in general positive about Neighbourhood Partnerships and thinks they are 'the way forward.'

Looking at the Neighbourhood Partnerships through RDR eyes

It is important that as organisations that will prioritise some of the road safety schemes in their area, the Neighbourhood Partnerships should be informed about the principles of RDR. For this reason it was decided as part of the current project to inform Neighbourhood partnerships about the tenets of RDR.

Bristol casualty statistics

As part of this project Bristol's road casualty statistics were examined in ways relevant to RDR. A fuller account of the statistics research can be found at appendices 11 to 13. The new ways in which the statistics were examined included looking at cyclist casualties as a rate according to numbers cycling and also noting what motor vehicles were doing at the time at which they were involved in an incident resulting in a cyclist casualty.

Figure3: Showing casualty trends both unadjusted and adjusted for numbers cycling in Bristol

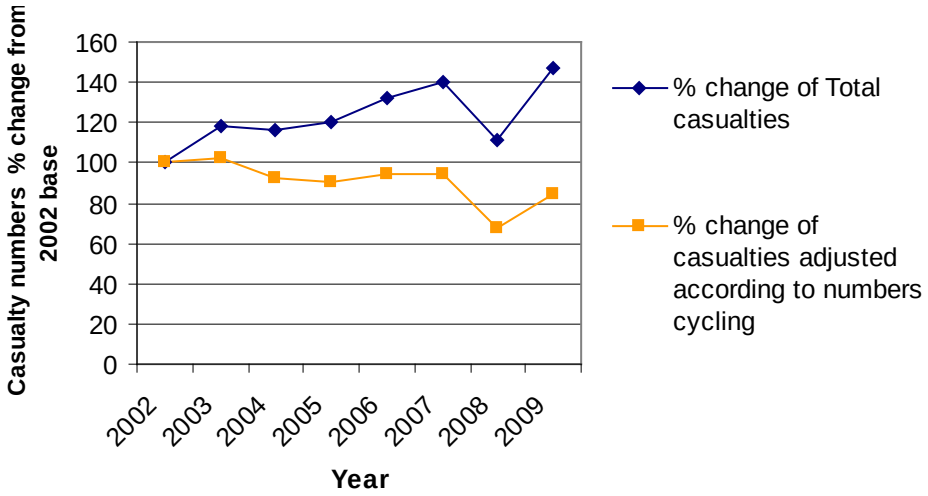


Figure 3 shows that if the growing number of people cycling in Bristol is accounted for (estimated using JLTP2 year on year cycle cordon information) the number of

cyclist casualties relative to the numbers cycling has decreased slightly in recent years. It should be noted this graph is an informal indicator only and hasn't been formally endorsed by the Council. Further information and caveats about this graph can be seen in Appendix 11. The graph is encouraging from an RDR perspective as it suggests cycling is becoming safer in Bristol. It is possible that in some areas or sections of road a safety in numbers effect is coming into play.

Analysis of contributory factors leading to cyclist casualties

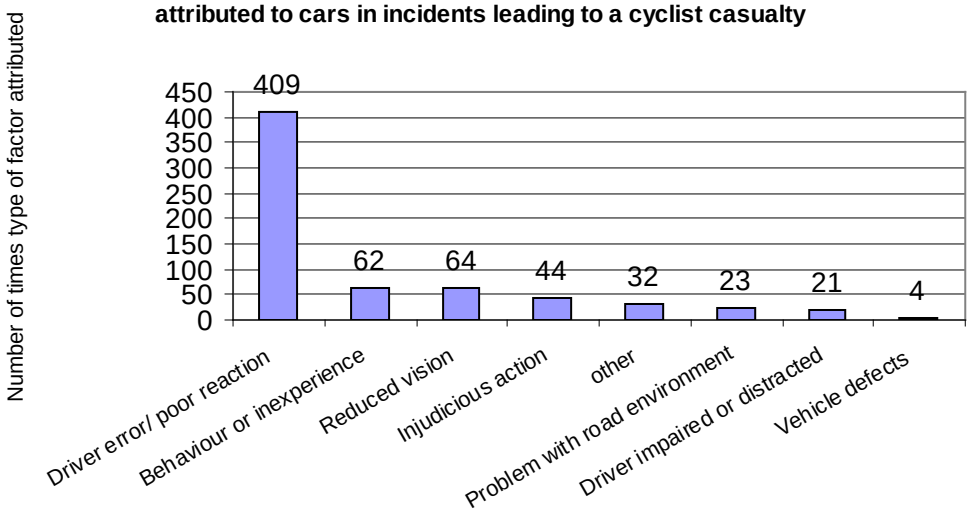
Analysis of what contributory factors had been attributed to car drivers in incidents that led to cyclist casualties was undertaken. These contributory factors had been recorded in the forms that police complete at the scene of collisions – (Statistics 19). Caveats should be applied to the accuracy of the data. The main caveat is that the judgment of what contributed to the 'accident' is made by the police officer at the scene of the collision. As such it will have elements of subjectivity. Also it may be that the car cited may not be the vehicle that collided with the cyclist. However, the designation 'contributory factors' suggests that the actions recorded played some part in the injury/fatality caused. More than one contributory factor can be applied to one car involved in an incident.

Figure 4 below is very significant in that it shows by far the most common type of contributory factors that car drivers made were 'Driver error/ poor reaction errors.' This is telling, as most of these factors would not usually be considered as illegal activity. They include, for instance:

- 'Poor turn or manoeuvre'
- 'Failed to look properly', and
- 'Failed to judge other person's path or speed.'

These then are mistakes that 'normal' drivers might make. This leads to the conclusion that these statistics highlight that it is 'normal' driving that contributes to most cyclist casualties, not what most would consider to be 'illegal driving'. Some specific factors can be given to emphasise this: 'Failing to look properly' was a contributory factor attributed in 209 cases. 'Failing to judge person's path or speed' was attributed in 67 cases. 'Poor turn or manoeuvre' was attributed in 49 cases. The predominance of 'failing to look properly' as a causation factor has also been found at a national level (DfT 2009).

Figure 4: Showing total counts of type groups of contributing factors attributed to cars in incidents leading to a cyclist casualty



In contrast, 'Impairment by alcohol' was attributed in only 5 cases. 'Aggressive driving' was attributed in only 3 cases. 'Stolen vehicle' was attributed in only 1 case. Further detail about investigation about contributory factors can be found in Appendix 12. One caveat about the above conclusions is that perhaps it is 'easier' for police to record factors such as 'Failing to look properly' as being a contributory factor in incidents then other types of factors.

Bristol statistics were further analysed to find information about what motor vehicles were doing in incidents in which there was a pedestrian casualty. The following are some figures from the statistics:

Incidents that led to pedestrian casualties

- 123 of 1402 (9%) of the pedestrians injured were on the 'footway or verge.'
- 20 of the 387 (5%) of the child pedestrians were on the footway or verge.
- 225 of the 1402 (16%) of the pedestrians were crossing on a pedestrian crossing.
- 45 of the 387 (12%) of the child pedestrians were crossing on a pedestrian crossing.
- Incidents causing pedestrian injuries involved 13 cycles, 21 mopeds, 39 motorcycles but 1174 cars and taxis.

These statistics indicate that it is cars that are involved in many more incidents leading to cyclist/pedestrian casualties than other forms of transport. The statistics show that many pedestrians are injured when on footways or verges or when crossing at a pedestrian crossing. This is obviously concerning and suggests that it is not only the carriageway where drivers are endangering non-motorised users.

Factors which are potentially blocking or aiding an effective RDR policy in Bristol City Council

In brief, team leaders identified a number of agendas that would be in harmony with, and thus might add momentum to, promotion of walking and cycling from a RDR perspective. These include

- The health agenda,
- The air quality action plan,
- Parks and open spaces strategy,
- The congestion reduction agenda,
- Active Bristol including Active Travel,
- Transition Bristol
- Green capital
- Tourism agendas.
- The pro cycling attitudes held by many of those in the road safety teams, as will be discussed later.

There are also a number of factors that would hinder take up of RDR in the Council. A fundamental factor is that two of the road safety teams, Road safety engineering and Road safety education, training and publicity have CR targets that they are 'tied to.' In fact the council has a statutory duty to make efforts to reduce casualties. If it does not do so it is open to being sued in cases of accidents. Thus it would be impractical for the Council to completely abandon CR focused efforts.

Perhaps a bigger blockage that opposes any *vision* for how to approach reducing the danger on the roads is the fact that Council road safety interventions are usually the result of many practicalities, consultation outcomes, constraints and compromises.

Considering engineering schemes for instance, the road safety engineering team leader commented that with road safety schemes the initial intention is often good but by the time everyone has 'had their say' it becomes so watered down that it doesn't achieve what it set out to. He added that with all the different teams commenting on a scheme, if their views are contrasting then 'It's a very complex web to get through.' Another source of constraint and compromise is funding. The area engineering team leader commented:

> "The disappointing part of being a traffic engineer is that we can come across as being negative, having to give reasons why we can't do something that has been requested or suggested rather than being more positive. Unfortunately, there are many constraints placed upon, in particular the limited funding that is available, but there are also relatively strict regulations that we must follow"

Two engineering team leaders pointed to practical considerations and consultation concerns as leading to compromises of the original scheme. The walking and cycling engineering team leader implied that in relation to walking and cycling provision so many compromises were being made to take account of concerns such as bus stops, taxi ranks and loading for shops, that 'it sometimes feels like you're having to make the best of a compromise.' Such considerations seem then to affect a very complex and resilient force on any given scheme.

Can an RDR approach only move incrementally in the face of them? Possibly, but it may also be worth considering the walking and cycling engineering team leader's comment that it is the politicians who need to make big decisions that can really change things to promote walking and cycling (including area wide traffic reduction and speed reduction). The inclusion of the higher speed roads within the 20mph pilot areas, whether a good thing or otherwise, shows that political will can push radical schemes through, overriding objections raised in TAA and consultation processes. Without strong political will, changes towards RDR practice may need to be incremental.

The Education, Training and Publicity team have their own constraints to get through, including a CR rationale and partnership with the other councils within the West of England Partnership.

The wider Council also contains hindrances to a RDR policy. The health and safety mandatory helmet wearing by all Council staff cycling during the course of work and the lack of pedestrian facilities at road works are two specific examples.

Support

Team leaders raised several times the issue of the need for support if promoting walking and cycling is to become a real priority within Bristol Road Safety. This support would be in the form of national legislation and Council support from higher tiers and politicians.

The needed national legislation was likened to the disability discrimination act, which overrides other considerations to enforce things like raised platforms at bus stops. The walking and cycling legislation would have to be of the scale of magnitude of the disability discrimination act.

Team leaders also commented that they are sometimes straight jacketed by having to follow guidance and that if they don't follow guidance people will ask 'why not?'

Although there is a hierarchy of provision in which cyclists and pedestrians should come first, and thus schemes to help them should be prioritised, in reality they believe that amongst a range of schemes if they move too far in the direction of those promoting walking and cycling at the expense of other things they will not get support from other areas of the Council, including Councillors. In addition, funding wouldn't be there for those schemes.

Road Danger Reduction based recommendations
Having conducted an audit of Bristol City Council work, recommendations to move nearer to an RDR approach are presented.

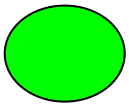
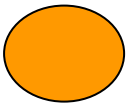
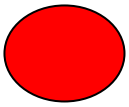
Recommendation for a city wide Vision

1) The Council should unify its road safety work around a fully adopted RDR vision for Bristol. This vision would be one of a city in which it is safe and pleasant to move around from one place to another. This vision should be agreed by political leaders, the Council Chief Executive, and other high level officials. Bristol Council already has the elements it needs to follow a RDR vision, including teams promoting walking and cycling through engineering and smarter choices and teams addressing road safety. What is needed is a guiding vision to orientate the teams around a RDR framework. Having adopted the vision, the vision should be cascaded out to Neighbourhood Partnership, other Neighbourhood groups and to Bristol residents via the local media. This would include publicising the safety in numbers theory. The RDR vision should be presented to people in terms of positive aspects (an attractive city etc) rather then negative aspects (the negative effects of cars etc.)
2) Also In relation to a city-wide vision, depending on the findings of the pilot areas, a 20mph limit in residential areas should be extended citywide.

Recommendations in the area of Road safety engineering

3) TAA process. This is a process by which an engineering scheme being designed by one team is sent round to all the other teams who may have an interest in it. The other teams then make comments on the scheme design or raise issues with it. The TAA form is part of the paperwork that goes to a higher tier officer in order for the scheme to be given the 'go ahead.' It is recommended that the TAA form that goes to the higher tier officer should have a means of summarising the scheme's effect in the light of Council policies of promoting walking and cycling. This means of summarising could either be a 'traffic lights' tick box such as shown in Figure 5. Alternatively, there could be a statement on the form highlighting the Council's policy of promoting walking and cycling. It could then ask whether the scheme in question does this, and if not, why not.

Figure 5

Overall benefit to promoting walking and cycling because:	**Overall neutral effect on promoting walking and cycling because:**	**Overall disbenefit to promoting walking and cycling because:**
		

4) Whilst retaining its remit of reducing casualties, the Road safety engineering team should prioritise schemes according to walking and cycling promotion as well as according to casualty numbers.

Recommendations relating to Casualty statistics

5) The current project has looked at casualty statistics in a RDR influenced light, looking at:

- cycling casualty totals while taking account of numbers of people cycling
- what motor vehicles were doing at the time of a collision leading to a pedestrian casualty
- contributory factors in collisions leading to a cyclist casualty.

It is recommended that these ways of assessing statistics be continued and undertaken in a more formal capacity.

Recommendations in the area of Education, Training and Publicity

6) Road safety education of children should include developing critical awareness about the modal choices they will make in the future. The children should be encouraged to think critically about the effects that driving a car or cycling has, in terms of road danger, on their local community and society in general. The effectiveness of such education has been evidenced by Fujji (2007). He suggests that those too young to drive in 'heavily motorised countries are not completely aware of the negative aspects of car use.' He found that non drivers who were given information about the negative effects of driving (including costs, risks and stresses of driving) were statistically less likely to have obtained a driving licence 18 months later. This suggests that education about the negatives of driving can be effective.
7) Discussion should take place between the ETP team leader and Smarter Choices team to work towards a greater harmony of the image of cycling that the two teams promote. There is a difference at the moment as the Smarter choices team aim to promote cycling as a normal activity for normal people wearing normal clothes. This is important as it can make cycling a more popular activity among certain groups. In contrast the ETP schemes sometimes show the cyclists wearing luminous clothing, cycle helmets etc. It can be noted that the Road Danger Reduction Forum would approve of the Smarter choices approach to cycling image. Possible abandoning high viz might be easier in relation to adult cyclists then children?
8) The Parent walks presently conducted should place more emphasis on appealing to parents as drivers to look out more for child pedestrians and also about the seriousness of the decision to drive in the first place.
9) In general an intervention should be devised to highlight some of the antisocial and danger effects of even 'normal' driving. In other words it should be made plain that everyday lapses by 'normal' people driving cause many of the casualties in Bristol. The statistics chapter of this report supports the importance of such an approach

Reshuffle of Road safety teams

At time of writing the organisation of Bristol Council's road safety teams, housed on one floor of an office block, is being reconsidered due to the need to reduce costs. This means there is an opportunity to suggest how the teams should be reformed in light of an RDR approach. Actually there is a strong case that in light of an RDR approach the way the teams are presently structured is effective: This is because at

present the Education, training and publicity team, the Road safety engineering team and the Walking and cycling engineering team are all under the management of one fourth tier officer. The fact of his managing all three teams strengthens the links between them in terms of shared objectives and communication. In addition, the close physical proximity of the walking and cycling engineers and road safety engineers facilitates good relationships between them.

There was some suggestion that the walking and cycling engineer roles are not needed, as every engineer should consider walking and cycling in their designs anyway. However, clearly having experts in walking and cycling engineering is vital and in line with the Councils prioritisation of those modes. Thus this report proposes that the team should be continued in present form. Ideally there should be more walking and cycling engineering staff to further enhance their influence.

As an observation, the first author has been working in the Bristol Road Safety office during the course of the project and has thus 'absorbed' a lot of the ethos of the teams. A general conclusion from this is that there is a pro cycling culture in the office and a good amount of discussion about and awareness of cycling; not only by the walking and cycling team. A number of officers in the office cycle in to work. It is likely that the walking and cycling engineers being situated near the road safety officers may add to this beneficial culture. This ethos is likely to feed into the professional practice of the latter. This is desirable from an RDR perspective. It should be added though that an ethos that is fairly favourable to RDR is at risk if it is sustained only by the views of officers employed in the Council at this point in time. The risk is that when those officers move on the ethos may be lost. Thus it is important that RDR be embedded in the structure and practice of the Council as well.

Doing more for less, and better

In the current economic climate, it is vital for any proposed changes to a local authority's practice to be economically astute. What follows is evidence that a Road Danger Reduction strategy can add significant value to Bristol City Council's 'Doing more for less, and better' vision.

Aligning road safety interventions with the encouragement of walking and cycling, and decreased levels of private motor vehicle use will be partly responsible for the economic benefit that will arise from a Road Danger Reduction policy.

The economic benefits of encouraging higher levels of walking are well known. They include 'improved accessibility, particularly for non drivers, reduced transportation costs, increased parking efficiency, increased local business activity and employment, support for public transport, special support for some businesses, such as walking tourism and health cost savings from improved physical activity which includes reduced absenteeism (Litman 2010).

A report for Cycling England (2007) has highlighted economic benefits of encouraging more cycling in three main areas:

- Increasing health and fitness
- Reducing transport congestion and
- Reducing pollution.

The report estimates that total health benefits of individuals cycling would be £87/year for 16 to 44 year olds and £175 for 45 to 64 year olds. It estimates that the economic benefit in reduced congestion of one person in an urban area changing from car use to cycling would be £137/year. It also estimates that an average cyclist

in a major city saves pollution costs worth £69 a year. This is mainly based on reduced ill health related to air pollution. A consensus exists among experts in many OECD countries that significant public health benefits can be realised through greater use of active transport modes. In England there is evidence of change at the policy level. Cost Benefit Analysis is of growing importance. Not least, the Cabinet Office has considered physical inactivity costs (among others) and the need to reflect these by steering transport policy in urban areas to promote cost effective interventions.

In terms of value for money, although all schemes with a benefit-cost ratio greater than 1 might be worth pursuing, financial constraints, not least during periods of public finance contraction, mean that it is necessary to prioritise some schemes above others, at least in terms of value for money. The Department for Transport's Webtag Guidance categories value for money (V*f*M) as per Table 1 below so that schemes over 2 are those most worth pursuing.

Table 1: Value for money

BCR	**V*f*M**
Less than 1	Poor
Between 1 and 1.5	Low
Between 1.5 and 2	Medium
Over 2	High

(source Webtag 2.6.4)[1]

An economic assessment of the health benefits of active travel which assessed the evidence base from both peer reviewed and grey literature both in the UK and beyond found that almost all of the studies identified (UK and beyond) report economic benefits of walking and cycling interventions which are highly significant, and these average 11.5:1 (Davis, 2010). For UK interventions only the average figure is higher, at 19:1. The report concluded that:

"Environmental and other interventions to facilitate increased population physical activity through cycling and walking is likely to be a 'best buy' for public health, the NHS at large in terms of cost savings, as well as for the road transport sector." p.2. RDR advocates encouraging a reduction in private motor vehicle use. The economic benefits of this in Bristol will be large given that the Joint Local Transport Plan 2 for the area suggests that congestion costs the local economy £350m a year.

Further important economic benefits of following a Road Danger Reduction strategy are the reduced infrastructure, environmental and health costs associated with implementing a road network geared towards less motorised traffic and more non-motorised traffic. Litman (2002) estimates that a significant amount in general taxes are paid by each household to fund local roads and traffic services. The higher the annual car kilometres per capita in a city the higher the Annual per capita road expenditures will be. Littman also reports that car use has a negative impact in terms of land use:

> "Automobile oriented cities devote up to three times as much land to roads and parking as traditional, pedestrian-oriented cities.''

An important way in which the reforming of Bristol City Council's road safety around a Road Danger Reduction strategy could be economically beneficial derives from greater possible homogeneity and efficiency: at the moment the Council is in many

[1] See http://www.dft.gov.uk/webtag/topics/cost.php accessed 8th December 2009.

ways ‘pulling’ in two opposite directions. In some of the Council’s schemes and teams (e.g. Smarter choices) it is seeking to promote the non-motorised modes. At the same time the road safety teams, under a CR rationale, are in some ways discouraging non-motorised modes, either through safety education that scares people away from walking and cycling or through engineering that doesn’t have promoting walking and cycling as an overriding priority. This pulling in two opposite directions can largely be explained by the Council’s road safety priority and ethos of reducing casualties. It could be suggested that a Road Danger Reduction structure would realign the two priorities of encouraging non-motorised modes and increasing safety, thus creating greater efficiencies, including financial efficiencies.

Bristol City Council is obviously not unaware of the economic benefits of encouraging a shift to non-motorised modes as outlined above. However Road Danger Reduction provides a framework in which road safety practice can be included in the efforts to achieve such benefits whilst improving the road environment for all users.

Conclusion

The literature review highlighted evidence that many of the strategies of RDR would indeed reduce the danger effects of our roads and so improve overall health and wellbeing for the citizens of the city.

Walking and cycling is acknowledged in the Council’s road safety teams. However it may be that the importance needs to be raised to a priority level that can override other concerns.

Having conducted the research, an important question to answer is, could Bristol City Council take up an RDR strategy? Although RDR is a radical approach, every incremental change towards an education approach aimed more at discouraging driving or every engineering scheme in which pedestrians and cyclists are prioritised over motorised vehicles is a move towards the influence of RDR and the wider policy goals to promote health and reduce carbon emissions. Thus changes could be made within the Council’s Road safety approach in an incremental process. However, to achieve the vision set out by Road Danger Reduction Forum big political decisions need to be made that would achieve a reduction of volume and speed of motorised traffic.

This report suggests that it would be beneficial for Bristol City Council road safety to develop an RDR influenced vision for its road safety practice. Such a vision would yield the benefits of being more consistent with wider transport policy imperatives such as reducing congestion and encouraging walking and cycling. Almost of greater importance than the creation of such a vision lies in the vision being given the weight and strength, with Member support, to override competing priorities in the day to day practice of the Council’s teams.

Glossary

CR is an abbreviation for Casualty Reduction
ETP is an abbreviation for the (road safety) Education Training and Publicity team
KSI is an abbreviation for Killed or seriously injured statistics
KTP is an abbreviation for the Knowledge Transfer Partnership
RDR is an abbreviation for Road Danger Reduction
TAA is an abbreviation for Traffic Authority Approval

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Appendices

Appendix 1 – Literature review

This literature review will explore both the theory and evidence supporting take up of a Road Danger Reduction (RDR) approach to road safety. It will do this by examining the components of RDR thinking. It will also look at similarities to international approaches to road safety including Vision Zero, Sustainable Safety and Shared Space. The review will also look at the possible challenges facing an RDR approach.

Methodology of Literature review

Documents for this literature review were found by searching electronic databases. One researcher searched databases during 30th November 2009 to 8th December 2009.

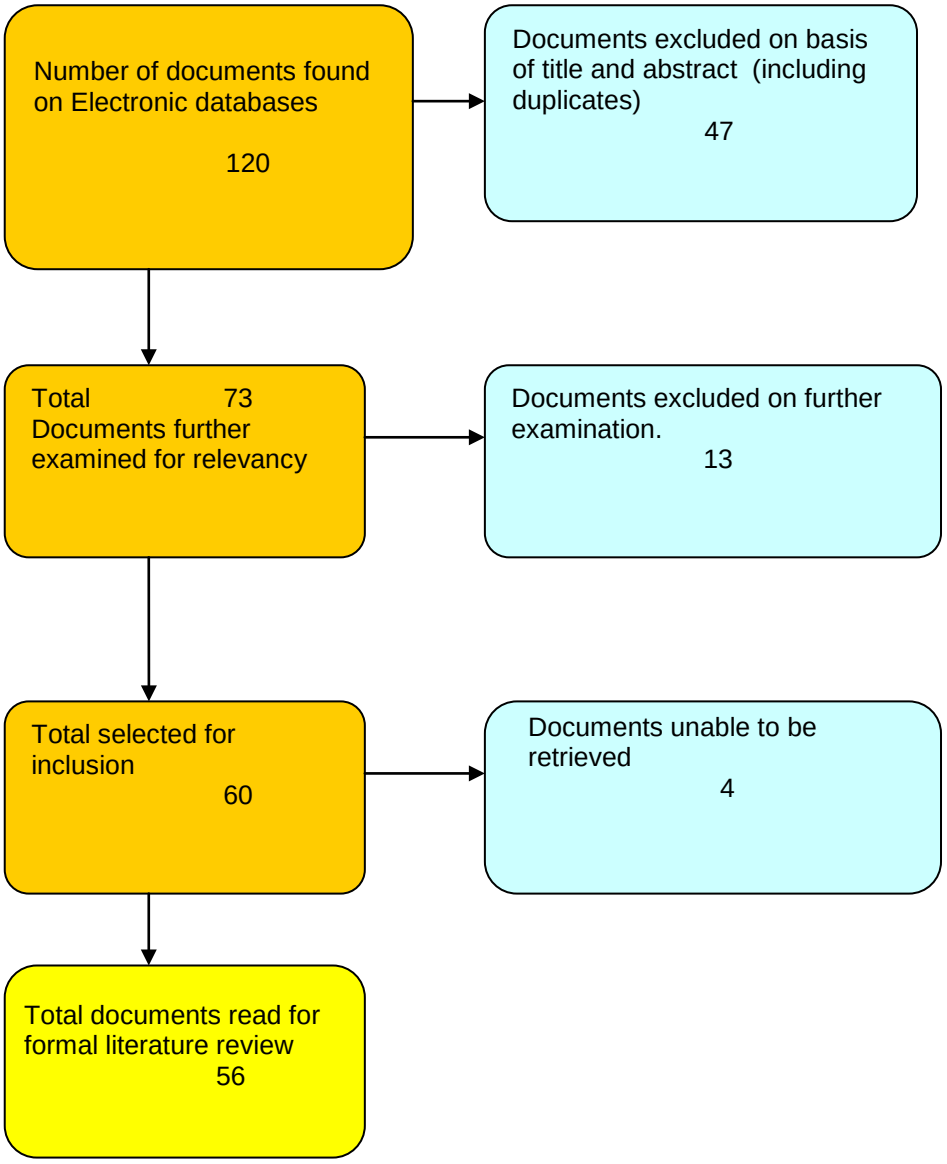
The databases searched were AMED, ASSIA, Embase, Medline, Planex, PsychINFO, Science Direct, Social sciences citation index, Transport, Transportation research record online, TRIS and Urbadoc.

It was anticipated that there would be few papers written explicitly about RDR. Therefore search terms were intended to capture papers about international schemes that had elements in common with RDR as well. Search terms used for the search were; 'Danger reduction', 'Vision Zero', Denmark, Netherlands, Sweden, Impacts, Benefits, 'Safety in numbers', 'Shared space', 'Equity' and 'Road users hierarchy'. Papers accepted between 1980 and 2010 only were included.

Figure 1 shows the numbers involved in selecting documents for review. The search returned 120 documents that were possibly relevant. Two researchers examined the abstracts for these documents. 47 were excluded, usually on the basis that they were not about RDR approach and would be unlikely to cover areas relevant to the approach. The remaining 73 document abstracts were re-examined and a further 13 were excluded. This left 60 documents that were included to be read for the review. For 4 of these the full documents could not be retrieved and so a total of 56 papers were read for the review.

One researcher read the documents. He made a data extraction form for each document. Two other researchers read 20% of the documents to validate the first researcher's data extraction.

Number of documents selected for review



Context section

This short section will briefly set road safety within the wider contexts of public health, other areas of transport safety and safety in the workplace.

There is the concept in health policy that society should concentrate more on building 'supportive environments which are conducive to good health' rather than focusing on individuals changing their behaviour in order to live longer. An example of this is in relation to cigarettes where the approach could be to tackle the 'source' of cigarettes; the tobacco industry and tobacco advertising, and to raise taxes rather than campaigning to make those smoking adjust their behaviour. Thus in general 'the approach is to make the healthier choice the easier choice' (Tight et al 1998).

Similarly in relation to road safety a recurring theme in the literature reviewed is that the traditional approach to road safety has often focused responsibility for safety on the victims of danger (often those walking or cycling) rather than the source of danger (fast moving motor vehicles) (Tight et al.1998) (Stewart 2001) (Johansson 2009). This has sometimes been to the extent that victims are 'blamed for their injuries' (Jacobsen et al 2009) and are 'made to believe that they are the problem' (Davis 1995).[2] Hence walking and cycling can be made an unattractive option for many. Thus an approach to road safety can be conceived of which instead of focusing on making walkers and cyclists 'protect' themselves with helmets and careful behaviour, focuses instead on making the environment which they navigate safer, by reducing fast motor traffic (Tight et al. 1998).

The area of road safety can then be compared to issues in the wider health movement. It can also be compared to health and safety standards in other sectors. It is a common observation in the literature documents reviewed that low standards of safety have traditionally been accepted for the road system that would never be accepted in other sectors, including other transport modes such as aviation and train travel as well as non transport sectors such as the workplace and hospital (Stewart 2001) (Elvebakk & Steiro 2009) (Whitelegg & Haq 2006) Holzapfel (2003). As a specific example Wegman (2007) reports that aviation is thirty times safer than road transport and asks why we 'just shrug' at these differences. Comparing the road environment to the work environment, Swedish National Road Administration (2000) notes that driving is an activity that entails many times the risk involved in jobs that require 3 years or more training. Hence present levels of driver training and regulation may appear inadequate by comparison. Also comparing road safety with standards required in the workplace, Evans (1994) suggests that if the maximum and minimum risk tolerance levels that are applied in industry were applied to the road environment, then the present risks involved in walking and cycling would most likely be deemed unacceptable.

Why then are traditional safety requirements applied to the roads so poor compared to other sectors? Wegman et al. (2008) supply two possible explanations: one is that traffic induced injuries tend to happen a few at a time and thus 1000 individual road deaths don't have the same impact on us that an event claiming 1000 lives at one time would have. The second is that the danger of dying or being seriously injured on the roads can seem very abstract to us until it happens to us or someone close to us. Added to these explanations could be the concept that our culture is addicted to mobility. Most of us choose to risk injury to ourselves or others through using motor vehicles at speed rather than lose the object of our addiction: the easy and far reaching mobility that a car can afford. This addiction has led to a number of crash-related deaths that is so large as to constitute a 'national tragedy' and which means road safety must be elevated to the level of a 'true societal value'. (Dula and Gella 2007, quoted in May et al 2008)

[2] See also Roberts, I. & Coggan, C. (1994) Blaming children for child pedestrian injuries. Social science and medicine. 38 (5)

Introduction to Road Danger Reduction

Road Danger Reduction can be partly understood by contrasting it with the Casualty Reduction (CR) approach that is the traditional road safety approach in the UK. CR takes as its prime motive the reduction of the numbers killed or seriously injured on the roads. Clearly this is a commendable motive. The problem is that it leads to specific parts of the road network, where there have been number of casualties being focused on for specific treatment. This treatment may well be effective, but the problem remains that surrounding these treated 'hot spots' the danger of high volumes of fast moving motor vehicles remains. In fact RDR suggests the level of danger surrounding the hot spots may increase after their treatment due to a phenomenon called 'accident migration' (Tight et al 1998). This phenomenon, if a reality, is due to risk compensation, a process that will be discussed below. Another problem with hot spot treatment is that having treated the worst sections of the road network there may remain the more diffuse incidents; a large number of locations where there has been only one collision for instance (Tight et al 1998). This diffuse occurrence of individual collisions is clearly difficult to predict and hence treat by a strategy that is guided by casualty figures alone.

In comparison to CR, RDR seeks to implement measures that would lead to all sections of the network being safer and not just the hot spots. It seeks to achieve this by proactive and preventative measures that comprehensively make the roads safer. These include reducing the speed and volumes of car traffic, educating motorists about the safety of walkers and cyclists, having stricter road traffic laws and better enforcement etc.

Another unfortunate possible effect of a CR ethos is that there may be a motivation to discourage walking and cycling in order to control casualty rates. The effects of this will be discussed below. In comparison to Casualty Reduction RDR seeks to promote walking and cycling. This is part of the wider understanding of the effects of road safety strategy that is inherent in RDR.

It should be emphasised that RDR is in most instances not an *opposite* approach to CR approach. In most cases it seeks rather to extend or replace CR strategies with more comprehensive or preventative (rather than curative) measures. It should also be noted that Tight et al (1998) suggest that there is much evidence that the CR approach has been successful in reducing collisions and casualties down to a certain point.

The following review will look at RDR's basic principles, finer details and similarities to other internationally implemented strategies. The review will also seek to highlight the specific and overall benefits of a RDR approach.

Underlying imperatives informing Road Danger Reduction

RDR is based both on applying logical principles to the evidence gleaned from trends in road safety and on ethical imperatives common to the human heart and which are also necessary for a healthy society. Perhaps the single most important logical principle behind RDR is that road danger should be reduced at source (Davis 1995). It is motor traffic travelling at speed that is the ultimate source of danger (Jacobsen et al. 2009) and therefore reducing the danger at source can be achieved by reducing the volume and particularly speed of motor traffic (Tight et al.1998).

A benefit of reducing danger at source is that it is a preventative rather than curative approach to road danger: it prevents danger from coming into existence rather then trying to manage it once it has already appeared (which it could be argued is part of the CR paradigm.)(Wegman et al. 2006).

A point that comes out of the aim to reduce danger at source is the terminology of the word ‘safe’. In terms of which modes are most *exposed* to danger on the roads, then cars are indeed ‘safer’ than walking or cycling. But in terms of which modes are *causing* danger to other people, clearly walking and cycling are very much safer then car (Tight et al.1998), (Davis 1995). Hillman (1992) illustrates this point by reporting that,

‘For every 100 persons killed in a heavy goods vehicle per kilometre travelled by that vehicle, 1200 other road users are killed. On the other hand for every 100 cyclists killed per kilometre travelled by cycle only 4 other road users are killed.’

Hillman suggests that this reversal of the common understanding of which modes are ‘safer’ logically leads to a ‘reversal of the direction of policy on promoting road safety.’ This reversal could mean spending extensive efforts to promote the modes that do less harm to others such as walking and cycling and to constrain the modes that are more harmful to others, such as personal motor vehicles. The vision is ultimately that if enough travellers swap from modes of travel that are harmful to others towards those which are not, then the amount of danger at large on the roads will be significantly reduced (Jacobsen 2003).

Three main ethical imperatives of RDR are those of equity, social justice and accessibility. RDR states that there should be equity of danger experienced and ease of travel between motorised and non-motorised road users (mainly pedestrians and cyclists)(Tight et al. 1998). Papers reviewed suggest that at present non-motorised road users do not have this equity both in terms of danger experienced and the difficulty with which they navigate the roads. Jacobsen et al. (2009) highlight the ways in which streets at present are often accommodating or easy for motorists but not for cyclists or pedestrians. In other words when there is a conflict of interests between the different groups the motorists’ interests are given first priority. A specific example of this set of priorities can be pedestrians being given only minimal shares of the time in each traffic signal cycle (Corben & Oxley 2006).

The obvious difficulties that unimpeded motorised traffic can cause for non-motorised users include physical danger and fear of that danger. Additionally non motorised users have to negotiate measures designed for their safety but which nonetheless hamper their movement, such as only being able to cross roads at designated points, having to walk to the end of barriers separating pavement from road and braving intimidating underpasses etc. Thus some of the interviewees questioned by Elvebakk & Steiro (2009) felt that the price paid for the relatively uninhibited freedom of car users, is limitation placed on the freedom of walkers and cyclists. Evidence for this theory is provided by a study of a street in Edinburgh Scotland where Hine and Russell (1993) found busy trafficked streets inhibited pedestrians who instead of trying to negotiate it reported sometimes taking a different route (16% of respondents) or using a different mode (34%).

It can be asked why at present car drivers so often have such a powerful priority over walkers and cyclists. In their examination of yielding behaviour between cars and cyclists and pedestrians Hyden et al. (2007) implied the interesting idea that an important factor is the momentum of the car; its mass and speed. It may be then that the current priority may be a result of ‘might’ being taken to be ‘right’. Hyden et al. (2007) found that when travelling more slowly cars yielded more often. Thus at lower car speeds those inside and outside of cars are in a more equitable relationship.

The general inequity between car users and walkers and pedestrians is reiterated by Elvik (2009b) who states that car drivers are the most unfairly advantaged group in the present road system although he is unclear how a fairer system can be realised. He states that a truly equitable road safety strategy would have, at some points, to be at odds with the approach which would be the most efficient financially. He suggests that proceeding with Road safety schemes on a cost benefit basis will always benefit car users more then walkers and cyclists. This implies that a fair approach to road safety is needed which is informed by ethics, ideals and vision as well by financial considerations, particularly it could be suggested those attendant on unrestrained car use. The call for such a 'fair' approach to road safety is also made by Hokstad & Vatn (2008).

Concluding on equity, Tight et al. (1998) suggests that RDR accounts for a wider spread of equity issues resulting from safety intervention than other approaches. Tight et al. assert that it is thus "more in tune with the public's perceptions of what road safety should be about."

A second ethical principle informing RDR is that of social justice. Much of this concern for justice is that the present justice system is inadequate in its fulfilling of duties to provide justice for those who lose a loved one on the roads. The concern is also that appropriate punishments aren't given to those who through their choice of mode and careless driving kill or seriously injure others. RDR states that motorists should be made aware of the danger they are causing to other road users by their choice of mode (Tight 1998). At present this isn't always the case. Stewart (2001) states that currently 'Law and practice discriminates very much in (motorists) favour.' He claims that while this isn't always understood by motorists because of a large number of minor rules applied to them, the overall legal system is at present 'very much in their favour.'

Stewart compares the extent of investigation that is dedicated to a fatal road collision with the resources dedicated to for instance a murder case. He concedes that the legal system could not stand up under the 3000 road fatality investigations a year in the UK if each fatal road collision was given the resources of a murder trial. But this, he argues is only proof that our 'car culture' and its legal implications is too 'rampant' and unguided for our social institutions of justice to handle. He concludes that 'Streets cannot be transformed until other road users are given greater legal protection.' Similar ideas are found in Davis (1995) who suggests a current block to full social justice being applied to the road safety situation is that the prosecution procedure is so difficult and unwieldy that if full enforcement of traffic laws was brought about it would 'quickly overload' the legal system. In a similar vein to Stewart, Davis points to the present charges for motorists who kill someone with their car as being inadequate, stating that often a driver will suffer only a minimal penalty and only a possibility of losing their driving license. Stewart adds to this idea of inadequacy of penalties, suggesting that manslaughter type charges carrying greater consequences could be implemented for causing death to other road users.

Both Davis and Stewart point to greater legal liability for drivers as being essential for a more just system of dealing with road collisions. Davis suggests there should be strict liability being applied to a motorist who collides with a pedestrian or cyclist, 'with the onus of proof being on the motorist.' In such a case insurance payments after a collision would automatically go the pedestrian or cyclist unless the motorist could be proved innocent. Stewart similarly points to other countries where the presumption of guilt when a motorist collides with a more vulnerable road user is on the motorist. In the Netherlands for instance the law was changed in 1998 for collisions between motorists and cyclists and pedestrians, so that motorists 'are now considered to be

wholly at fault' (Parker 2001). Having the right of way in a road does not protect a motorist legally, should they hit a more vulnerable road user and they are also expected to anticipate even unsafe or illegal behaviour by pedestrians (Pucher & Dijkstra 2003), (Parker 2001). In the case of a collision between motorist and vulnerable road user Dutch insurance companies pay damages automatically to cyclists and pedestrians regardless of guilt.

RDR then demands a stricter and more efficient legal system to be applied to incidents of collision. Related to the issue of justice and law is that of police enforcement. It is a common assertion in papers that effective enforcement of road laws is vital for road safety (Wegman et al. 2006). Wegman et al. (2008) suggest that it is desirable for enforcement to be at a level where someone violating traffic law faces a reasonable chance of being caught. In his predictive analysis of what types of road safety schemes would be effective in Norway, Elvik (2001) found that 'enforcement and sanction' schemes would be the third most effective type of scheme. The enforcement of speed limits in particular can be effective and Corben & Oxley (2006) report that after the introduction of stronger enforcement of speed limits in 2002 pedestrian deaths in Victoria Australia fell dramatically by 39%.

Despite widespread recognition of the importance of road law enforcement, another common theme in the literature is that enforcement in the UK, and many countries, is poor. Elvik (1999) for instance talks about the complacency of most countries where 'widespread violations' of road laws are tolerated. Stewart (2001) says the UK's enforcement of road laws is poor and should be improved. Davis (1995) noted that enforcement levels of speed laws in the UK did not support the advertising campaigns for lower speeds, which would hence have small success. His general conclusion on the UK's enforcement of road laws was that it is weak due to a lack of dedicated resources being made available to the police for upholding road laws. RDR then states that enforcement of road traffic laws should have a far greater presence on the road network.

There are a few countries where enforcement seems to be more adequate. In the Netherlands for instance, low speed limits are strictly enforced and the punishment of driving offenders is more severe. (Parker 2001). Pucher & Dijkstra (2003) attribute the relative safety of walking and cycling in that country to strict enforcement of traffic laws that protect pedestrians and bicyclists.

Accessibility is a third imperative informing RDR (Tight 1998). Davis (1995) reports that society's increasing bias towards car use has 'discriminated against those who do not have cars.' Out of town shopping malls have drained business and competition from the city centre areas that are more accessible by foot or cycle. Hence those who can't afford access to these out of town developments may end up paying more in the shops that are left within their travel range. So there is a strong ethical basis for increasing accessibility to facilities by walking and cycling. This aim is also in harmony with reducing the harmful effects of motor traffic on climate change and congestion and is strongly supported by recent government planning policy guidance papers (Department for communities and local government 2001).

The literature reviewed had few references to accessibility, however Manning (1981) comments that urban design often assumes falsely that all adults drive a car. Because of this it can put pressure on families to strain their budgets in order to afford a car that can give them access to distant facilities. Manning considers the accessibility problems experienced by those who don't drive to be one of the main inequities imposed by the dominance of the car. Good accessibility can be contrasted with an addiction to 'Hypermobility' facilitated by heavy car use that has been called

'one of the major failings of modern society.' (Adams 2006 quoted in Toleman & Rose 2008).

So far a number of the basic logical principles and ethical imperatives informing RDR have been investigated, the next sections will look at some of the main strategies with which the approach seeks to reduce danger at source and increase accessibility in an equitable and socially just way.

Promoting walking and cycling

A main branch of strategy within the RDR approach is to promote higher levels of walking and cycling. The first obvious questions to ask are whether and why promoting walking and cycling is important to improving road safety. RDR supports the increase of walking and cycling for the simple reasons that those modes of travel pose less danger should one traveller collide with another. In addition to this they can enable inexpensive accessibility to facilities for a majority of people. They can enable a more equitable transport system and they also carry wider health and social benefits that will be discussed below.

There is international recognition in the literature reviewed that the promotion of walking and cycling can be important for a successful approach to road safety. Whitelegg and Haq (2006) for instance suggest that an effective road safety policy 'requires a much improved level of performance in …walking and cycling.' As will be described later the relatively successful 'Sustainable safety' vision in the Netherlands combines a good road safety record with high levels of walking and cycling. This has partly been achieved through a prioritisation of the needs of walkers and cyclists (Parker 2001).

Another important question regarding increasing levels of walking and cycling is 'How can it be done?' i.e. what factors need to be changed for it to occur?
Jacobsen et al. (2009) suggest that both the level and fear of motorised traffic are important suppressants on the take up of walking and cycling. This finding was also 'suspected' by Vandenbulcke et al. (2009) and highlighted for walkers specifically by Hine and Russell (1993). Jacobsen et al. (2009) report consistent evidence that an inverse correlation exists such that the higher the level of motor traffic, the less people will walk or cycle. This is to such an extent that they quote WHO Regional office for Europe (2000) as estimating that health effects related to the inhibition of walking and cycling may be the greatest adverse impact on health caused by motor traffic; even greater than, for instance, road collisions. Unwin (1995) also found that fear of traffic was the greatest discouragement for people who might otherwise cycle. Unsurprisingly Unwin concludes that making cycling safer could help encourage cycling and the general conclusion from the above papers is that if walking and cycling are made safer and if they are perceived as being safer, due to a reduction in speed and volume of motorised traffic, then those modes will become more popular.

A specific group whose walking and cycling activity have been affected by fear of traffic are children (Stewart 2001)[3]. Davis (1995) raises the idea that this inhibition has had serious adverse health effects on children. Tight (1998) reiterates that the main cause of the restriction on children's mobility has been motor traffic. Mullan (2003) looked through a survey at the effects of motor traffic levels on the well being of young people. She notes possible effects of heavily trafficked streets as being, 'journeys foregone' and 'restricted independent mobility' She also suggests that

[3] See also Hillman, M., Adams, J. & Whitelegg, J. (1990) *One False Move*. London: Policy studies institute

heavy traffic can cause ‘fear and worry, and reduced social and play activities’ in the young.

Motorised traffic not only inhibits walking and cycling through fear and risk of injury. It can also form an actual physical obstacle that hampers pedestrians and cyclists from getting from one place to another. Hine and Russell (1993) report a specific example of this where heavy traffic on a road in Edinburgh created ‘barrier effects’. These barrier effects prevented pedestrians from crossing with ease, forced them to cross only at certain points or after lengthy waits and led to some using other roads or other modes for transport. Again it can be inferred from this that a reduction in motor traffic on that road would further facilitate walking activity.

So then the RDR approach notes that higher levels of walking and cycling are beneficial for road safety. It also notes that one main way of achieving these levels is to reduce motor traffic that inhibits walking and cycling through creating fear, danger and physical obstruction.

If the danger from motor traffic can be reduced, another important aspect in promoting walking and cycling is to release a latent enthusiasm for those modes. Sherborne et al. (1997) indicate in their study of schools in Leeds that such an enthusiasm does exist: The school children involved in their experiment (aimed at developing a ‘whole school’ approach to road safety) wished to walk and cycle more than they were allowed: Although the percentage of trips to school by these modes was small, 33% gave cycling as their preferred mode, walking was second most popular mode. The commission for architecture and the built environment (2008) states that this latent potential should be realised through street design and low traffic speeds that enable children to walk and cycle.

As well as a general strategy level, implementation of specific interventions is necessary in order to promote walking and cycling. Pucher et al. (2009) is a report on studies investigating the impact of many such specific interventions. They found that bicycle lanes and paths particularly encourage cycling. The quality of provision is important; the paper reported for instance a study that found resurfacing a particular path led to a doubling of cyclists using it. They also reported evidence that traffic calming led to perceptions of increased safety for cyclists. Another study they examined found that an education programme in Sydney was very effective, with 56% of people cycling more, two months after the programme. So there are a large variety of specific schemes that RDR would advocate due to their effect of increasing levels of cycling. It should be noted that Pucher et al. (2009) suggest that specific interventions need to be integrated into ‘fully integrated’ packages of cycle promotion strategies in order to be effective.

An issue related to the promotion of walking and cycling is whether there should be a hierarchy amongst users of different modes of transport, and if there is what it should be. In fact this question may be naïve: There is clearly already a very firm hierarchy in the majority of cities within the UK with motorised traffic possessing an extreme priority over pedestrians and cyclists. In direct contrast, RDR firmly suggests that walking and cycling should be given priority over motor traffic. This is due to these modes being more benign in terms of safety and wider impacts.

There is some international support for prioritising walking and cycling. Corben and Oxley (2006) looking at current international approaches to safety concluded that pedestrians and cyclists should be given the greatest level of protection and should be placed first in a hierarchy of the different modes. This idea is echoed by Jacobsen et al. (2009). Similarly, Commission for architecture and the built environment (2008)

looked at what strategies would be necessary in order for UK streets to become 'civilised.' They emphasise that there must be a change of priority such that 'Where the car was king, now people must come first', (Of course it could be noted that car drivers are also people). They support elements of the Shared Space concept including the manner in which it 'removes the presumption that drivers have right of way.' The report suggests that streets no longer ruled by the car could offer 'stronger communities', 'safer communities' and a 'stronger economy'. Stewart (2001) also highlights that part of the motivation to establish walkers and cyclists first in a road hierarchy is that the function of a street is not only to enable the movement of traffic, but is also social and communal. He reiterates the call for the non motorised road users to be given priority and points to the success of this strategy in York, UK where higher levels of walking and cycling have resulted from a city wide hierarchy in which the needs of pedestrians and cyclists are placed above those of car drivers.

There isn't universal recognition that having a road hierarchy which prioritises the needs of non motorised users is important for road safety strategy: Adams (1988) claimed that the idea of such a hierarchy was a 'political question' and not in the realm of road safety. However it is a clearly recurring theme in the literature reviewed.

RDR suggests that walking and cycling should be prioritised and promoted. This is not only because they pose less danger for other road users but also because they carry a wider range of health and social benefits.

Health and social benefits of higher walking and cycling levels

The RDR approach asserts that there are a wide range of health and social benefits attendant on higher levels of walking and cycling that go far beyond road safety impacts.

The health benefits of walking and cycling include preventative impacts on diabetes, stroke and obesity. The particular health benefit of walking and cycling mentioned most often in the literature reviewed is the countering of the obesity epidemic. Hence Pilkington (2009) notes that take up of 20mph limits may have a beneficial effect on the obesity agenda (by encouraging cycling and walking) as well as the obvious safety benefits. In fact it is a possibility raised by Pucher & Dijkstra 2003 that walking and cycling as a means of transport could succeed in tackling obesity where fashions for special diets and going to gyms have failed. They suggest that a self-interest in health may be the 'strongest motivation' to encourage people to walk and cycle. In their report on Vision Zero, Whitelegg and Haq (2006) claim that walking and cycling have great importance for reducing obesity and inequalities in health but also suggest that more work is needed to investigate this importance.

There is the fear, when promoting higher levels of walking and cycling that such a strategy will lead to increased serious injuries on the road. While this will be further examined later in the review, at this point it can be noted that it is possible that within a population the health benefits of extra walking and cycling would outweigh the loss of health and life from collisions. In fact, examining a WHO study, Parker (2001) suggests this can be 'safely assumed.' Pucher et al. (2009) further substantiate this point by quoting 13 documents that support the claim that the 'health benefits of bicycling far exceed the health risks from traffic injuries.' Further to this a survey of 17,000 Harvard alumni found that the added life years from the exercise of regular cycling outweighed life years lost from cycle fatalities by a factor of 20 (Paffenbarger et al. 1986 quoted in Unwin 1995). It could be countered to this last evidence that

those who cycle regularly might also be the personality types to keep themselves in 'good shape' generally. Hence the casual effect between cycling and added life years could be an exaggeration. As well as the health benefit of tackling obesity, walking and cycling can improve mental health by countering conditions such as depression, anxiety and social isolation (Corben & Oxley 2006).

An obvious conclusion to take from the importance of walking and cycling on public health is that the health benefits of increased physical activity should be included in transport appraisals (Jacobsen et al. 2009). Although rare Cavill et al. (2008) found a number of transport schemes and policies that had included the health benefits of walking and cycling in their economic analysis. They found a number of problems with the inclusion of the health benefits: these included a lack of transparency of methods and a lack of consensus on the averted diseases to include. They call for a 'more standardised approach' to be taken. Despite these difficulties they concluded that the Benefit Cost Ratio of transport schemes that included health benefits of walking and cycling tended to be very positive with a median Benefit Cost Ratio of 5:1.

Although it is not the emphasis of this review it is worth mentioning briefly the beneficial effect promoting walking and cycling would also have on the environment. For instance, Parker (2001) raises the idea that outcomes of policies to make walking and cycling safer can be synergetic in terms of jointly benefiting road safety and the environment. The environmental problems that would be lessened by more walking and cycling and less motor traffic obviously include climate change from CO_2 emissions.

Safety in numbers

Perhaps the most glaring intuitive difficulty with the RDR strategy of promoting walking and cycling is that at present a person travelling by foot or cycle in the UK is more likely to be injured than if they had decided to drive. Thus promoting higher levels of walking and cycling may lead in the short term to higher numbers of serious injuries and fatalities on the roads. Clearly this is not a concern to be taken lightly. There are however two themes that argue that promoting the use of those modes is still the correct course of action. One of these themes is the health and wider social benefits of walking and cycling; the other is the 'safety in numbers' theory.

The Safety in numbers theory has been traced back as far as Smeed in 1949 (Robinson 2005). But perhaps the most influential and widely quoted paper concerning safety in numbers is by Jacobsen (2003). This paper reports on data from Californian cities, Danish towns, European countries, bicycling data in the UK and bicycling data in the Netherlands. In all cases it was found that as walking and cycling levels increase the danger of injury *per exposure* to traffic that a pedestrian or cyclist undergoes decreases. That is to say that the more people are walking and cycling, the safer each individual walking or cycling trip becomes. Jacobsen also quotes other papers that had found the same phenomenon. Jacobsen found that 'multiple independent data sets show that the total number of pedestrians or bicyclists struck by motorists varies with the 0.4 power of the amount of walking or bicycling,' That is to say that as numbers of pedestrians and cyclists increase the number injured or killed does not increase at an equivalent rate. Other papers further substantiate Jacobsen's findings of a safety in numbers phenomenon: Robinson (2005) found a safety in numbers effect for cycling in Australia. Geyer et al. (2006) studied 247 intersections in the U.S. and found a safety in numbers effect in operation for pedestrians. Bonham et al. (2006) found the safety in numbers effect in their study of cycling in Australia although questions could be asked about their methodology such as extrapolating general travel patterns from a two day traffic

diary. Vandenbulke et al. (2009) found in their study of bicycle commuting in Belgium that the risk of cyclists becoming casualties of road accidents decreases as the proportion of cyclists increases. Turner et al.2006 used accident prediction models and found that 'crash rate per cyclist and pedestrian reduced with increases in their numbers.' They concluded that 'road controlling authorities should not avoid encouraging cycling walking in the belief that it will increase the overall number of accidents.' This may be contrast with a simplistic intuitive response to casualty rates. Evidence against the safety in numbers was scarce, but Jensen (1999) found that a decline of numbers walking in Denmark didn't lead to the higher injury risk that the safety in numbers theory would expect. On balance then the weight of the evidence does suggest that a safety in numbers effect is a reality.

It is important to question why there is this inverse correlation between the numbers of pedestrians and cyclists and the rate of collision they experience per trip (such that an increase in one leads to a decrease in the other.) An argument against the safety in numbers could be advanced that there are hidden confounding factors in environments that explain both the high levels of walking or cycling and the low injury rates. Such environments could for instance be places where there is widespread 'safe' cycling provision, or social conventions that help protect vulnerable road users or laws which protect them. However Jacobsen (2003) refutes this possibility, pointing to sudden changes in danger per exposure rates that changed quickly and in (inverse) relation to sudden changes in numbers of walkers and cyclists. Jacobsen asserts these changes are too quick to be explained by changes in law, engineering or social conventions. Although this refutation is certainly feasible it is not backed up with much detailed argument in his paper. Jacobsen also points to alternating *up* and *down* trends of cycling numbers being mirrored (inversely) by injury per exposure rates in the UK. It is unlikely that these swift 'about turns' of injury rates, both up and down, were the result of any reversals in policy to walking and cycling or reversals of social attitudes to cycling etc.

Having deduced then that changes of rate of danger per exposure are not caused by policies or engineering factors Jacobsen concludes that the reason for the safety in numbers effect must be behavioural change in either drivers or in cyclists and pedestrians caused by larger numbers of the latter two groups. He concludes that as it is unlikely that walkers and cyclists would become more cautious when in greater numbers it is the drivers who must be adjusting their behaviour. This leads to an important building block in the RDR approach and also in the 'Shared Space' concept that when drivers perceive there are many walkers and cyclists on the roads, they will drive with more hesitation and less speed (Hamilton-Baille 2008b) (CABE 2008).

So far the safety in numbers effect examined has been that if numbers of walkers and cyclists is increased the *risk per unit of exposure to traffic* decreases. But some papers go beyond this claim to suggest that with enough of a modal shift from driving towards non-motorised means, more people walking and cycling could lead to a reduction in actual casualty numbers. This proposition is put forward by Elvik (2009a). He used mathematical models to predict that with enough people changing from driving to walking or cycling the combined effects of safety in numbers and increased safety from less motor vehicles could result in the overall level of traffic casualties decreasing. Hence again like Turner et al. he concludes that encouraging walking or cycling rather than driving will not necessarily lead to more accidents. Thus he suggests his findings are 'Good news to all those who want to encourage walking or cycling…..but who have so far been held back by concerns about the high injury risk of the non motorised modes of travel.'

In conclusion on the safety in numbers and health benefits outweighing traffic trauma arguments: it seems clear that the safety in numbers phenomenon does exist. Therefore if in ten years time due to a RDR policy walking and cycling levels had increased significantly, then a person leaving their house to make a walking or cycling trip would be less likely to be injured then they are at present. It is to be hoped that modal shift towards walking and cycling and away from the motor vehicle will be sufficient to reach a 'critical mass' where the numbers involved render walking and cycling much safer. This will also require motor traffic to be carefully and successfully restrained. However it is the first author's opinion that before such a critical mass was reached, promoting higher levels of walking and cycling could lead in the short term to more people dying on the roads. It is his opinion that there are thus two essential questions: The first is whether at the same time as being made more popular walking and cycling could be made safer, in terms of absolute numbers of casualties. This is in fact is what RDR states *must* happen (Tight 1998). The second question is *if* absolute numbers of casualties did increase, whether the health benefits of more walking and bicycling would save more lives, in hard numbers, than would be lost through the extra fatal collisions. Clearly these questions require careful and exact research. For the second question the WHO has conducted research finding that the health benefits do indeed outweigh the losses of traffic trauma to a dramatic degree. However due to the time limits and scope of the present project it should at least be noted that the decision to encourage more walkers and cyclists to mix with motorised traffic should not be taken lightly. What would seem important is that if this element of RDR is to be implemented it should be comprehensively surrounded and supported by restriction of motor traffic and education, enforcement and social signals such that motorists would take considerably more care in their driving than at present. This would help to ensure that as well as becoming more widely used walking and cycling would simultaneously be made safer.

Decreasing volume and speed of motorised traffic

As described above (see Underlying imperatives informing RDR,) one of RDR's first principles is that road danger should be reduced at source by reducing the volume and speed of motorised traffic. It is self evident that without the presence of motor vehicles travelling at speed many road fatalities and serious injuries wouldn't occur. 'Killed or Seriously injured' statistics can make difficult reading but in fact the harmful effects of fast moving motor vehicles go far beyond these numbers. These effects can be both health effects and social impacts. Busy roads can isolate people from society, pushing them back into their houses through prohibitive fear and difficulty experienced in trying to navigate them. The old and young can be particularly affected by this consequence of road danger. Older people make more trips by foot then any other age group so if their pedestrian activity is inhibited they in particular can become isolated (Stewart 2001). Mullan (2003) further substantiates the idea that heavily trafficked streets can lead to social exclusion. Of course the aggregate effect of individuals being pushed back into their houses and excluded from society is a reduced sense of local community (Manning 1981) and a failing of social support networks. Road danger also has wider negative impacts on health. These include victims of traffic pollution, which Davis (1995) suggests may kill twice as many as are killed in crashes. Other fatal consequences of road danger are the health disbenefits from the inhibition of walking and cycling as daily exercise. Referring to these Davis (1995) asserts that not cycling kills more people then cycling. Tight (1998) quotes Davis (1992) that there is an 'morbidity iceberg' of which the numbers of casualties from collisions are only the tip. Underlying this 'tip' are 'unreported injury accidents, non-injury accidents, near misses, enforced restrictions on independent mobility, fear and worry' and 'noise and air pollution.'

An important concern of RDR relating to motorised traffic is that of fear. A common theme of the literature reviewed is that fear of road danger as well as the danger itself has a significant debilitating presence (Jacobsen et al. 2009). While road collisions may happen sporadically and randomly, the reasonable fear of such danger can be a comprehensive blanket of burden on those seeking to walk or cycle. In this vein Pilkington (2009) suggests that there is a pervasive fear of dangerous traffic which effects the attitudes to walking and cycling of both adults and children. The fear has grown to such an extent that Sherborne et al. (1997) quote Hillman et al. (1990) as finding that while in 1971, 80% of 7-8 year olds were allowed to go to school unsupervised, within two decades this had fallen to 9%. They suggest that increased fear of traffic was the most significant reason for this.

Some groups are more susceptible to fear of traffic. For instance women are more likely to fear dangerous road traffic to the extent that in Australia where there is less provision for cyclists, three times as many men cycle as women (Parker 2001). This is in contrast with the Netherlands where there cycling is safer and there are equal numbers of men and women who cycle.

An idea within RDR is that some of the well meant measures intended to reduce danger for non-motorised road users actually reinforce the fear of traffic that they experience. These measures include promoting cycle helmet use, separating cyclists from motor traffic and road safety education that places emphasises on the threat that motor traffic poses. Although these measures are clearly intended to keep those walking and cycling safe they may deter them from walking and cycling altogether. This in turn leads to lower levels of walking and cycling which as described above leads to worse road danger, health and social problems.
There is much literature about the negative effects of unrestrained car use. In the literature reviewed for instance Hine and Russell (1993) report that busy traffic on a road can cause stress and feelings of fear in pedestrians. CABE (2008) note that ‘traffic centred’ streets have led to ‘dysfunctional places’ in terms of liveability. Adams (1998) notes that the unfettered ease of car transport has curbed the freedom of walkers and cyclists.

The obvious solution to these problems is to restrain car traffic. RDR suggests a raft of strategies for achieving this: From reallocating road space from cars to bicycle use, to having low blanket speed limits, from preventing the arrogance engendered by increasing in-car safety to strict police enforcement of traffic laws and from getting more people to walk and cycle to increased insurance liability for drivers. Internationally, car traffic has been particularly successfully restrained in the Netherlands. Pucher & Dijkstra (2003) note that restrictions on car use in cities has been one of the successful types of safety intervention in the Netherlands. Commenting on the Sustainable Safety vision in the Netherlands Wegman et al (2006) state that the road user is central to road safety and thus must accept restriction of personal freedom in order to ensure safety. It can also be noted that restriction of personal freedom can be necessary to restore equity between different road users. Parker (2001) relates that in the Netherlands road space reallocation is not uncommon in which some of the road space and parking is taken from cars and replaced with ‘bikeways, bicycle parking bays, pedestrian mall and tram and bus lanes.’ In fact the support for restraining car use in the Netherlands has enabled a debate about whether cars should be restricted entirely to a small number of main roads only. This would make residential areas safer but it is argued that main roads would suffer. (Wegman et al. 2006).

One of the practical difficulties with RDR that is probably becoming apparent is it may have difficult relations with the car culture and car lobby within the UK, both of which

are influential (Tight 1998). May et al. (2008) note that there is a culture of speed in 'developed' countries that is constantly reinforced by car adverts. This culture, which is 'pro speed' and 'pro car', has meant that the causal link between speed and road danger is often forgotten (Jacobsen et al. 2009). The pro motorist culture is in part maintained by media such as the tabloid papers; the Sun and Daily Mail that present themselves as 'the voice of the motorist' (Stewart 2001). The strength of the forces that would oppose more vigorous car restrain should not be underestimated and Manning (1981) warned that there can be strong opposition to such restraint by the road lobby. However to say that RDR strategies would meet with strong opposition is clearly not to say that they are not the correct course of action and there are many important changes that have taken place in history that happened despite strong opposition: the abolition of the slave trade and the recognition of the harmful effects of smoking are just two.

Speed limits, Traffic calming and reducing speed

It has been stated above that RDR seeks to reduce both the volume and speed of motorised traffic. It could be argued however that with the increasing affordability of cars to the majority of people and with no sign of a diminishing in our addiction to mobility, the most easily of these two to achieve is the reduction of the speed of traffic. Although the currently widely accepted prognosis within the transport world is that reducing the growth of motor traffic would be a huge achievement, (let alone reducing the volume itself of motor traffic,) controlling and reducing the speed of motor traffic may be a more readably achievable and hugely important task.

There are a range of reasons why the reduction of the speed of motor traffic by 20mph/30kph and/or traffic calming is beneficial. Perhaps the most simply justified reason for the reduction of speed is that it leads to a reduction of 'killed or seriously injured' casualties from traffic. There is much evidence about the effect lowering speeds has on casualty rates: Pilkington (2009) reports that the 'Probability of fatal injury for a pedestrian colliding with a vehicle increases dramatically above speeds of 30kph.' A study in Sweden found that streets designed to enforce speeds below 30kph achieved approximately 80% reduction in fatalities (Johansson 2009). Similarly, implementation of 30kph limits in Danish streets led to a reduction of 78% of serious injuries. Reducing the speed of vehicles can reduce serious injuries for two reasons: Part of the explanation for the importance of speed on the severity of accidents is that the human body is able to endure impacts of only up to 20mph (Hamilton-Baille 2008b). Another reason noted by Wegman et al (2008) is that lower speeds lead not only to a reduction of the severity of collisions but also to a reduction in the total number of collisions.

From the above it can be noted that 20mph limits can be justified on the traditional basis of seeking to reduce casualty numbers. The difference between the CR and RDR advocacies of such limits is that the latter would implement the limits more widely on the basis that the danger of fast cars and the other ill effects of fast traffic should be prevented comprehensively rather then *only* in places where there have been previous high, diffuse occurrences of casualties.

A concern might be that although reducing speeds is good for reducing serious collisions, it may still be unpopular with the motoring public. However in the literature reviewed there were indications from focus groups of the general British public that they were aware that controlling speed was vital to reducing fatalities (Whitelegg and Haq 2006). A more mixed indication of the public's support and understanding of speed reduction was found in Australia where although 72% of survey respondents understood that going faster increased risk of collision only 3% felt that 50 kph limits were too high. 27% of drivers did not consider themselves to be speeding unless

they were exceeding the speed limit by more than 10 kmh (May et al. 2008). So then perhaps there remains some effort needed to be spent on winning hearts and minds for public acceptance of speed reducing measures although it can be noted that research has shown speeding to be already the antisocial behaviour to be the largest concern of UK residents.[4]

Perhaps one difficulty in gaining public support is that there may be an exaggerated estimate by drivers of how much time is added to journey times by measures designed to reduce speed. Highlighting the small actual additions of time involved, Corben and Oxley (2006) quote Haworth et al's (2001) calculation that a speed limit reduction that would save 3000 - 4000 casualties throughout Australia would add just 8 to 9 seconds to the average trip time.

Of course there are further reasons for reducing car speeds beyond that of reducing casualties: Hamilton-Baillie (2008b) suggests that 'Reduction in the speed of traffic is the single most important measure to permit the multiple uses of streets and public spaces.' So then streets can become more multi faceted and 'liveable' spaces through the reduction of car speed. As well as becoming more liveable, streets with reduced speed limits can also become less fearful places for walkers and cyclists (Pilkington 2009).

Lower speeds can also lead to less domination of the roads and streets by motor vehicles: at present drivers often have an unfair priority over pedestrians or cyclists because of the threat their high speed poses. Hyden et al. (2007) conducted research into yielding behaviour at intersections in Sweden. They found that despite laws obliging cars to yield to pedestrians at pedestrian crossings, motorists did not do so. What became clear was that the speed of the car was an important factor: When speeds were higher cars yield even less frequently but 'Speeds below 30kmh seem to produce quite favourable conditions for an interaction with a high degree of equity, efficiency and safety.'

Internationally low speed limits have been widely implemented as part of the Sustainable Safety program in the Netherlands. In fact Wegman et al. (2008) posit that 'Setting safe speed limits should be a point of departure for the whole of the Dutch road network.' This setting of safe speeds in the Netherlands involves a principle of homogeneity such that when vehicles are mixed which have significantly different speeds or masses, then the speed of all vehicles should be reduced. (Wegman et al. 2006) Wegman also states that speed should be reduced to such a level that fatal injuries are not inflicted (Wegman et al. 2008).

There are some parameters in which the effect of speed limits is ambiguous. For instance, it might be supposed that slowing down car drivers would lead to an increase in their journey times. However Hamilton-Baillie (2008b) quotes evidence that it can improve journey times 'due to greater efficiencies at intersections.' Another instance of ambiguity is the effect reduced car speeds has on the environment. There is some evidence that cars run less efficiently in terms of fuel consumption at 20mph rather than 30mph. There is also evidence though that speeds of 20mph create less emissions because they promote smoother driving. It is worth noting that not only do lower speeds reduce the risk of serious injury, they also decrease the journey time advantage that car may have over cycle, thus making the latter more popular (Pucher et al. 2009).

[4] Poulter, D. & McKenna, F. (2007) Is speeding a 'real' antisocial behaviour? A comparison with other antisocial behaviours. Accident Analysis & Prevention. 39 (2)

An important type of measure as well as the setting of speed limits in reducing vehicles' speed is traffic calming. Pucher and Dijkstra (2003) say that 'in short traffic calming greatly reduces the danger of traffic deaths and injuries in residential neighbourhoods.' Grundy et al. (2009) looked at 20mph zones with traffic calming over a 20 year period. They found that such zones were associated with a 42% reduction in road casualties and that there was no evidence of accident migration to adjacent roads.

Pilkington (2009) notes that traffic calming has a strong impact on the effectiveness of 20mph zones; without it drivers may not adhere to the limit.
It should be noted that according to RDR traffic calming isn't an unequivocal good. This is because the engineering measures involved may obstruct and impede walking and cycling. However at the same time it should also be noted that traffic calming has been conceived (in the rest of Europe as opposed to the UK) as being part of the 'struggle for the emancipation of the pedestrian' (Tight 1998). This is obviously because it slows motor traffic, making it less dominant.
The main problem that remains with implementing traffic calming measures is the issue of implementation costs.

This review will next look at international road safety visions and strategies that have been implemented extensively. Although by no means identical to RDR they each have important elements in common with it. Hence lessons can be learnt from their implementation and level of success.

Vision Zero
Vision Zero is an approach to road safety that was taken up in Sweden in 1997. It is based on the ethical principle that it is not acceptable for a single life to be lost on the road system and that even if every collision on the road system cannot be avoided then all serious injury can. Hence the vision involved a shift from reducing accidents to eliminating serious injury (Johansson 2009).

Similarities between Vision Zero and Road Danger Reduction
There are significant similarities between Vision Zero and RDR in their conceptual underpinning. Both have moral and ethical standpoints as part of the basis of their approach. Both have a lower tolerance for danger based on a reaffirmation of the value of each human life. Johansson (2009) reports that Vision Zero means that paying attention to human life and health becomes an 'absolute requirement.' It is based on a refusal to trade human life for other objectives. Both also consider the importance of walking and cycling to reducing obesity and reducing inequalities in health (Whitelegg & Haq 2006). (Although as will discussed later this may be undermined by the extensive segregation of modes in Vision Zero.) Vision zero also has some similarities with RDR in the practicalities of implementation. This is partly due to it sharing the starting point that the road system should be on a more human scale and particularly that the momentum inflicted on a human body in the event of crash should never exceed the body's capacity to endure it. In order to limit the momenta involved both approaches advocate widespread 30kmh or 20mph speed limits. A further similarity is that both differ from traditional approaches to road safety such as treating roads on an accident 'hot spot' basis, by being more proactive and geographically comprehensive in their outlook.

Differences between Vision Zero and Road Danger Reduction
As well as similarities there are substantial differences between Vision Zero and RDR. There are important differences in the allocation of responsibility for safety by each approach: Vision Zero starts with the assertion that 95% of the solution to road danger lies in changing the design of roads or vehicles. Hence Johansson (2009)

reports that in Vision zero “Designers of the system….are therefore responsible for the level of safety within the entire system.” There is the idea that danger can be designed out of the system no matter how many errors motorists may make, (although they *are* responsible for following the rules of the road.) In contrast RDR emphasises that road danger is conceived with the road user who decides to use private motor vehicles at speed and hence *they* should be made highly responsible and liable for any collisions that occur.

The biggest practical difference of implementation between Vision Zero and RDR is the issue of whether more and less vulnerable road users should be physically segregated on the roadway. Vision Zero has a strict and thorough pro segregation framework. This states for instance that if speeds are below 30kph then vulnerable and motorised modes may be mixed. However if speeds are above this the vulnerable modes must be separated from the motorised traffic and may only cross at designated points. Separation could involve tunnels, bridges, barriers or separate roads/lanes (Johansson 2009).

How effective has Vision Zero been?
Reports in the literature of how effective Vision Zero has been are mixed. From interviews of those involved with road safety in Sweden, it can be concluded that Vision Zero has reenergised the country’s approach to road safety including that of the road administration, and has established a greater level of coordination and ‘common purpose’ (Whitelegg & Haq 2006)(Elvebakk & Steiro 2009). This is encouraging for RDR, which is a similarly visionary approach. In ‘harder’ quantitative terms, Johansson (2009) reports, “Where large scale attempts have been made to implement these design principles, mainly in built up areas and along major rural roads, fatalities have been reduced to a tenth of the initial risk.” However it is clear that this intense kind of success hasn’t been achieved on a nationwide basis: Andersson and Petersson (2008) suggest that ‘By 2007 it was apparent that the Vision Zero had failed to reach its goals.’ They support their conclusion by pointing out that the 11% reduction of fatalities that was achieved in Sweden between 1997 and 2004 was mirrored by the same percentage reduction in the UK, which didn’t adopt a Vision Zero approach.

Sustainable Safety in the Netherlands
The current Road Safety program in the Netherlands includes the Sustainable Safety Vision. This was initially launched in 1992. It originally consisted of a ‘start up’ program and later was expanded upon with ‘The advanced sustainability safety vision.’ The vision has two basic principles: To ‘prevent human errors as far as possible’ and to ‘ensure that crash conditions are such that human tolerance is not exceeded’ (Wegman et al.2006). Hence instead of trying to manage danger, the Dutch approach seeks ‘inherently safe road traffic’ (Wegman et al. 2006).

The Sustainable Safety approach to road safety is impressive in a number of fields including road engineering, promotion of walking and cycling, education, enforcement, road law and legal system and constraint of car use.

The approach originally had three safety principles. These were: Functionality, which states that each road can only have one function. Homogeneity, that states only vehicles of similar mass and speed should be allowed to share the same space when travelling at high speeds, and Predictability which states that road users should be able to know how to behave in any given type of road.

Under the Sustainable safety program, safety is given a high priority in the Dutch road network. This is shown in the program's assertion that sometimes restricting the road users' personal freedom may be necessary in order to facilitate safer roads.

Similarities between Sustainable Safety and Road Danger Reduction
There are significant similarities between the Sustainable Safety Vision and RDR. Some of these similarities are in the concepts and principles that underpin each approach.

One of the overarching principles in both approaches is that road safety intervention should be preventative rather then curative; that is that the intervention should prevent danger before it comes into existence rather than aiming to manage and reduce it once it is already a present reality. (Wegman et al. 2006).

Another shared principle is that the needs of walkers and cyclists should be prioritised in order to maintain high levels of non-motorised travel (Parker 2001). One way that this is done in the Netherlands is the creation of provision of short cuts for walkers and cyclists. Wegman (2007) reports that through the decades Dutch politicians have realised that excluding certain groups, such as pedestrians and cyclists from participation in traffic is an unpopular way of increasing road 'safety'. The concern that safety shouldn't be achieved by inhibiting walking and cycling is shared by RDR.

Another important principle in both approaches is that there is an overall plan to constrain car use. One of the ways Sustainable Safety does this is by restricting car parking facilities. So Sustainable safety and RDR share the joint aims of making driving less convenient and walking and cycling more convenient (Parker 2001).

In common with both RDR and Vision Zero, Sustainable Safety upholds a principle that the momenta involved in the road network shouldn't exceed the human body's ability to withstand impact (Wegman et al. 2006). Clearly one of the main ways of doing this is to keep vehicle speeds low.

There are also similarities of the specific practical measures that both approaches advocate: Both approaches advocate widespread implementation of low speed limits. In the Netherlands there are 6500 Woonerfs: local streets were cars must travel at 12kph or less. More extensively, all residential precincts have speed limits of 30kph (Parker 2001). Another similarity between both Sustainable Safety and RDR is the idea that driver training should make car drivers more respectful and understanding of the safety needs of cyclists and pedestrians (Parker 2001). Finally on the similarities, Pucher (2003) provides a list of types of specific road safety measures that have been effective in Germany and the Netherlands, all of which would be favoured by RDR. They are; better facilities for walking and cycling, urban design that is sensitive to the needs of non motorists, traffic calming in residential neighbourhoods, restrictions on motor vehicle use in cities, thorough education of motorists and non motorists and strict enforcement of traffic regulations protecting pedestrians and bicyclists.

Differences between Sustainable Safety and Road Danger Reduction
In the literature reviewed, the most substantial difference encountered between Sustainable Safety and RDR is the segregation of motorised traffic and more vulnerable road users. In the Netherlands there are far fewer kilometres of bike lanes on the roads than there are segregated off road bicycle paths (Parker 2001) and in general the separation of vehicles of different speed is considered 'preferable.' For instance, on an 'ideal' 50kmh road 'pedestrians and cyclists are not allowed to use

the road way' (Wegman et al 2006). The weight of the literature would suggest that RDR often seeks to prioritise the concept of cyclists being able to share the road with motorists and the latter adjusting their behaviour to enable the safety of the former. Having said this it should be noted that there is some discussion within RDR about whether segregation or desegregation is preferable. Perhaps another difference between the two approaches is that the Dutch system proceeds on a cost benefit basis whereas RDR may have a more absolute, ethical basis for funding road safety intervention, perhaps more in common with Vision Zero.

It could also be suggested that a difference between the two approaches is that the balance of responsibility allocated, between the responsibility of the road designer and the responsibility of the road user, is slightly different: Although the Sustainable Safety program does emphasise the responsibility of the motorist there may be an even greater emphasis on it in RDR.

How effective has Sustainable Safety been?
Clearly every country which suffers a single road death could be doing drastically better. Having said this, the Netherlands has a relatively effective approach to road safety. The most comprehensive indicator of the effectiveness of Sustainable Safety is that the Netherlands has one of the lowest road traffic fatality rates in any OECD country whilst, and this is important, having the highest level of walking and cycling amongst those countries (41% of all trips in 2001) (Parker 2001) This is in stark contrast to other countries including the UK which have comparatively low rates of fatalities but also correspondingly low levels of people walking and cycling as well.

Having examined Vision Zero and Sustainable Safety this is a good juncture to look at what lessons those approaches can teach about the benefits and difficulties of adopting a 'vision' based approach into road safety strategy.

Stewart (2001) suggests that in order for people to be able to 'reclaim' the streets a visionary approach is necessary. This approach needs government to take the lead and provide 'inspirational leadership' derived from a strong vision. There is evidence that having a vision-based approach to road safety can have benefits. A common theme in the literature is that having such an approach to road safety can help to motivate those involved (Whitelegg & Haq 2006)(Elvebakk & Steiro 2009). For example Wegman et al. (2008) called Sustainable Safety a 'mobilising and motivating idea.' Road safety officials in Sweden felt that Vision zero had made their work easier and were positive towards it (Forward et al. 2008).

Adopting a 'vision' into road safety policy is not without difficulties however. Problems can include unrealistic goals and political decisions that are impossible to practically implement, insufficient resources and lack of approval from the actors within the sector (Forward et al. 2008)(Andersson and Petersson 2008). Elvebakk & Steiro examined the take up of Vision Zero in Norway. They found that while road safety decisions should in theory be derived from the new overarching vision, in practice they were normally the result of a number of 'conflicting considerations.' Hence in Norway's version of Vision Zero, the specific measures implemented weren't clearly linked to the overall vision. (In Sustainable safety in the Netherlands as well, Wegman et al. (2008) found that compromises were made during the transformation of the vision into practical implementation). The impression of the Norwegian version of the Vision Zero is that it was 'watered down' compared to the Swedish original. Elvebakk & Steiro conclude by saying that despite the uptake of Vision Zero, road safety in Norway had begun again to be measured against other factors such as mobility, thus breaking one of the main tenets of the original vision.

Shared Space
Having looked at Vision Zero and the Sustainable Safety vision it may have been noted that a difference between both programs and RDR is that they are more in favour of separating cyclists and pedestrians from motor traffic then RDR is. Thus they are in many cases more in favour of off road cycle paths and barriers to separate walkers and cyclists from the road then RDR is. There is however a 'tried and tested' approach to road design that advocates, like RDR, the desegregation of motor and more vulnerable modes of traffic. It is the Shared Space concept.

Shared Space advocates removing many of the signs, road markings and barriers that have traditionally 'organised' and separated users of different modes of traffic. Shared Space is very clear about this desegregation: Hamilton-Baillie (2008b) says the approach requires the 'formal abandonment of the principle of segregation in urban traffic engineering.' The reasoning behind this strategy is that when such markings etc are removed drivers feel less assured of themselves, have a greater perception of possible danger to themselves and others and hence drive more slowly and carefully. Thus the slower speeds and greater care lead actually to less collisions rather then more. They also enable a greater equity of different road users, particularly empowering walkers and cyclists to reclaim their use of the streets (Hamilton-Baillie 2008b). There is also the assertion that Shared space increases safety because drivers feel more integrated into their environment (Hamilton-Baille 2008a). There is substantial evidence of the success in terms of safety of Shared Space schemes (Hamilton-Baillie 2008a).

The issue of whether segregation or desegregation of different mode users is preferable has evidence on both sides. As previously mentioned Vision Zero and Sustainable Safety are often in favour of segregation. However Pucher et al. (2009) reports studies that have found that experienced cyclists may prefer on road lanes to off-road paths. Evidence on whether women also prefer on road lanes is mixed. Some suggests they do due to personal safety concerns on off- road paths. However women also report a fear of traffic as a major reason for not cycling and another study reported by Pucher et al. found that women prefer off road paths to bike lanes. Of course a strong argument against segregation is that in effect it can make walking and cycling less convenient because of having to negotiate underpasses bridges and barriers etc. This in turn can lead to people using these more benign modes less.

It is important to note that while both approaches are intended to improve safety, in one aspect Shared Space is opposite to Vision Zero: While the latter seeks to 'design out' any possible danger from the road network by engineering measures, the former seeks to make the dangers more obvious and present in the minds of road users so that they slow down and navigate more carefully. RDR would fit more closely with the Shared Space approach in this respect. It could be argued that the Shared Space approach is subtler in its psychological approach to road safety then Vision Zero. It raises the interesting possibility that road users respond more to social 'signs' about behaviour then they do to formal rules and regulations (Clark 2006). It also enables drivers to increase a human involvement with the surroundings through which they drive. This is in contrast to the detachment between motorists and other users that is more often the norm in the UK at present. This detachment and danger occurs most when motorists perceive that pedestrians have retreated from the roads (Hamilton-baillie 2008b)

Potential difficulties with Road Danger Reduction
No system of thinking and acting is perfect and there are a number of potential difficulties with RDR. Some of these have already been discussed: for instance there is the worry that promoting higher levels of use for the more vulnerable modes may

lead to an increase in casualties –'at least in the short term' (Tight et al 1998). See the discussion above for an examination of this concern. Also already discussed are the difficult relations RDR would likely have with car manufacturers and oil companies and the opposition it may face from the car lobby and motorist rights groups in general which may become manifest as political opposition.

It may be remembered that RDR can be contrasted with the CR approach traditional to the UK. Tight et al. suggest that RDR is more complex then the traditional approach to road safety. In particular reducing danger and monitoring the progress towards this aim might be more difficult and expensive than simply seeking to reduce casualty rates. Hence getting relevant actors to become involved in the approach may be difficult.

An objection that could be raised to RDR is that it is 'untried.' However as discussed above many of the measures RDR would approve of have been implemented as part of other international schemes. In addition York, UK could be pointed to as implementing a strategy near to a RDR strategy. In that city use of vulnerable modes was encouraged simultaneously with the achievement of a reduction in casualty numbers. The city implemented a hierarchy of road user prioritised by mode. In this hierarchy pedestrians and cyclists had priority over motorised traffic. Specific schemes York implemented included traffic calming and facilities for cyclists and pedestrians (Tight et al. 1998) York's strategy then was similar to a RDR approach in action.

An aspect of RDR that the first author thinks may be problematic is the tendency to demonise or simplify 'the car driver' and not take full account of their circumstances. For instance RDR advocates more severe punishment for those that cause the death of a pedestrian or cyclist. But it could be questioned how severe the punishments handed out to people who didn't intend to cause the injury or death which they did should be. There may often be everyday and non malicious factors that cause fatal collisions.
Another instance where car use may be being oversimplified is the case of disabled people who cannot walk or cycle. Perhaps in conclusion it is important to remember that pedestrians and cyclists are human beings but that car drivers are also human beings who drive for a whole myriad of reasons.
Another issue that needs further investigation is the economic effect of reducing or slowing car traffic.

Support for Road Danger Reduction
There are, in the literature reviewed, encouraging themes that elements of RDR would meet with public support. Such support is clearly necessary for successful road safety strategies (Wegman 2007). Whitelegg and Haq (2006) conducted focus groups to investigate whether the British public would support a strategy like Vision Zero in Britain. The focus group participants raised the ideas that drivers need to be more aware of the real costs of driving and the real impacts of driving and speed on injury severity. They also raised the idea that drivers should become more aware of inter-modal considerations, in particular 'what it's like to cycle.' These ideas raised by the public then are in tune with a RDR approach. The focus groups were mixed however in their support for 20mph zones. (Whitelegg and Haq 2006) (May et al. 2008). There was support for a number of strategies that would be part of RDR. These included better provision for cyclists and pedestrians, taking away the traffic in order to 'reduce risk', reducing the car dominance in streets and the reallocation of road space towards walking and cycling. In general there was some dissatisfaction with 'antiquated' British road safety policy. The paper also drew on interviews and questionnaire responses. The interviewees felt that 'the benefits of a clear paradigm

shift in road safety were real'. However it should be noted that many of the questionnaire respondents felt negatively about Vision Zero being taken up in the UK, so there were mixed views.

There was some evidence in the literature that public apathy may be an issue that RDR will need to deal with. For instance Hine and Russell (1993) found that pedestrians were indifferent to pedestrian conditions in Edinburgh in general in spite of commonly reporting feeling unsafe, feeling medium high levels of traffic related stress and feeling a medium high level of risk when negotiating streets.

Perhaps then RDR needs to provide a vision of how much better our experience of the roads could be, in order to galvanise the take up of the approach.
Strong evidence for support of RDR priorities is provided by Hokstad & Vatn (2008). They conducted a survey in Norway which grouped road users in various ways such as grouping 'those who aren't traffic offenders' 'children' and 'those using public transport' etc. However the grouping that was most popularly selected as a priority for a hypothetical increase in money to protect their safety was 'Those groups heavily exposed to danger'. Pedestrians and cyclists would clearly come under this rationale so the result shows latent support for many elements of RDR.
In conclusion, Tight et al (1998) suggest that RDR is 'manifestly more in tune with the public's perceptions of what road safety should be about.' They further suggest that the approach has the merit of being perceived by the public as being 'intrinsically fairer' then a simple CR approach.

Further elements of Road Danger
Having investigated the underlying imperatives of RDR and similarities and differences to international approaches to road safety, some further elements of RDR will be discussed.

Risk Compensation
Risk compensation otherwise known as risk homeostasis is the theory that 'people modify their behaviour in response to perceived changes in risks to their personal safety.' This is to say that if a person feels a driving task has been made easier or safer in one area they will drive more dangerously and 'push the limits' more in a compensatory reaction, in order to reassert the original level of risk and driving difficulty.

Risk compensation provides the motivation for taking a RDR approach rather than a CR approach in a number of areas. One area is 'in car' safety. The theory suggests that as cars feel safer and safer on the inside, due to seat belts, airbags, advanced braking system etc drivers react to the increased safety by increasingly driving in a more and more casual manner. This clearly has dangerous implications for the walkers and cyclists outside of the car as well as for the drivers themselves and for this reason RDR would reduce the present emphasis on in car safety (Tight et al.1998). The specific example of the implementation of seat belt legislation was examined by Adams (1994). He found that comparing countries which passed seat belt laws before 1978 and those that didn't, showed that those that didn't actually experienced a greater decrease of road deaths during that time. He states that there 'were no directly measurable reductions in fatalities that could be attributed to seat belt laws.' He also specifically comments that with the Seat belt law danger was redistributed from car occupants to walkers and cyclists. (It should be noted that Adams' views are contested in some quarters.) Similarly, Davis (1995) suggests that in the UK after the seat belt law was introduced the class of vehicles that it applied to caused a rise of pedestrian and cyclist casualties compared to the classes of vehicle that it didn't apply to. Some factors that are introduced to benefit safety, such as

better braking systems etc, due to motorists' risk compensation are quickly converted into 'performance benefits' and the tendency to drive faster (Adam 1988).

Another area in which risk compensation motivates RDR is the use of cycle helmets. It has been suggested that motorists react to the increased protection they perceive these helmets provide their wearers with by driving nearer to the cyclist and showing less respect in terms of road space.

An additional implication of risk compensation is that drivers may react to a hot spot that has been intensively treated under CR by speeding up and driving in a worse manner in the area and streets following it (Adams 1988). In this way collisions can migrate from a treated hot spot to the untreated streets adjacent. In the literature reviewed Smith and Lovegove (1983) found some evidence on this in their examination of motorists' subsequent reactions to a new stop sign; they concluded that infrequent commuters did seem to react according to risk compensation theory but that an alternative explanation was needed for the behaviour of more regular commuters. Evidence against the risk compensation theory was that in their study of 20mph zones in London, Grundy et al (2009) found 'no evidence of casualty migration to areas adjacent to 20mph zones.' In terms of the implications that risk compensation may have for a hot spot approach to road safety Adams (1988) suggests 'a systematic removal of accident blackspots may simply produce a more diffuse and dispersed pattern of accidents without reducing their total number.'

Another issue where risk compensation plays a role is that of whether pedestrians and cyclists should be segregated or desegregated from motor traffic. It can be suggested that if walkers and cyclists are only a sparse presence on roads, motorists will drive faster and more carelessly due to the perceived lack of risk of meeting a vulnerable road user. Of course this can be immensely dangerous when they do meet one. In the opposite case when there are a lot of vulnerable road users on the roads, motorists will respond to the increased cognitive load and the risk of hitting one (Hamilton- Baille 2008b). In this vein, Hamilton-Baillie (2008b) suggests that spaces should 'feel risky' in order to become safer. This is an important point and is a pertinent one to those who may feel that encouraging desegregation of more and less vulnerable road users does indeed 'feel risky.'

It could be suggested that like the tide leaving no pebble on the beach unmoved, risk compensation effects may have implications for the outcome of nearly every road safety measure: Nearly every measure that makes people 'feel' safer could lead to a risk taking reaction, and nearly every measure that makes people 'feel' more at risk could lead to 'safer' behaviour. The implications may be endlessly complex. However there does seem to be one obvious exception to this kind of cause and effect and that is low speed: If a car driver is persuaded or forced to drive at say 15mph, they are much less likely to kill anyone no matter how many risks they try to take at that speed. Hence RDR's support of lower speed limits and their enforcement is of great importance.

Present statistics inadequate or misleading

One of the major criticisms that RDR aims at the present CR approach is that currently road casualty statistics are inadequate and misleading. One of the misleading aspects of the present statistics is that they may show low numbers of casualties in the UK but this is because the roads are too terrifying to navigate on foot or by cycle (CABE 2008) (Stewart 2001). Hence in relation to young people (relatively) low casualty figures may mask an 'invisible, unofficial problem of increased fear and worry, journeys foregone, restricted independent mobility and reduced social and play activities' (Mullan 2003).

As discussed above, RDR is radically different to CR in that it focuses on reducing danger at source rather then on reducing casualty numbers. In light of this for a RDR approach monitoring casualty figures is not as important as monitoring the danger levels and as Adams (1988) states: 'If danger is defined as the potential of some thing or activity to cause harm, then accident statistics are a worthless measure of it.' This is because collisions may be the sporadic, almost random manifestation of a more constant danger. Obviously it should be noted that RDR focuses on danger rather then casualties in order, ultimately to reduce casualties to a far greater extent.

Tight (1998) lists a number of ways in which RDR would expand and correct ways of monitoring road safety progress. He reports that as well as looking at casualty numbers RDR would monitor modal split, the behaviour of motor vehicle drivers, the speed and volume of traffic, casualty rates (i.e. danger per exposure or per mile) and would also facilitate community assessments of the transport conditions in their neighbourhood.

Education

One of the main problems with a traditional approach to road safety education has been that it has tended to be aimed at groups which are the victims of road danger such as pedestrians and cyclists rather then groups who are the cause of road danger (Sherbourne et al. 1997). Hence Davis (1995) says that traditionally 'Victims are made to believe that they are the problem.'

Many of the references to road safety education and publicity in the literature reviewed were in relation to the Netherlands' approach to education. In a number of respects this approach is in harmony with the educational aims that RDR would advocate. As a starting point, in his paper on road safety in the Netherlands, Wegman (2007) comments that as human action is a contributory factor in 90% of road crashes, addressing this behaviour is very important and hence so also is the informing and training that can modify the behaviour. He suggests though that education is not a 'panacea' but can be an essential compliment to other interventions. (Similarly Davis (1995) suggests that advertising campaigns aimed at making people drive more safely need to be accompanied by serious enforcement campaigns.) Wegman's thoughts on road safety education are that it should 'encourage the making of conscious strategic choices' (these would include choice of mode) and that it should educate people about the necessity of having their freedom restricted to a degree in order to achieve better safety. Commenting on road safety education in the Netherlands, Parker (2001) suggests that it is 'more relevant to the safety needs of cyclists and pedestrians' than in countries like Australia. Pucher & Dijkstra (2003) also point to 'Rigorous traffic education of both motorists and non motorists' as one of the building blocks of the relatively good road safety strategy in the Netherlands.

An experiment into new approaches to road safety education was conducted in selected schools in Leeds, UK by Sherborne et al. (1997). Their approach, in line with RDR was to encourage children to think about everyone's responsibility for road safety and how they might, in the future, effect the safety of their environment. It was hoped that consideration of this would filter up to parents and then out to the wider community. The approach included examining the car as a source of danger and achieving a more balanced view of it. However the results of the experiment seemed to be somewhat disappointing with little participation in it by parents and the local community.

One of RDR's focuses within education is the idea that motorists should be made aware of their responsibilities to others because of the dangers they pose, (Tight et al 1998.) Similarly, Stewart (2001) suggests that the driving test should include a grounding in 'understanding social and environmental responsibilities of motorists.' Tight et al. also raise the idea that traditional road safety education campaigns, through making children and parents scared of roads, have further restricted children's' mobility through recent decades.

Of course an important part of driver training in the UK is the driving test. Radical revisions of the test procedure have been offered. In Sweden for instance, an investigation of 'graduated driver education' suggested that traffic education could begin in nursery and continue throughout the entire school period (Swedish National Road Authority 2000). Davis (1995) states that the driving test is 'pitched at a very low level of achievement.' He suggests driver training should be much more demanding and should require an advanced level of skill.

Conclusion

This review has looked at themes coming from a small number of documents explicitly about RDR and a larger number of papers that contain cover elements that are a part of RDR. There is much evidence that many of the building blocks of a RDR approach are successful. These include many of the elements included in the Vision zero, Sustainable safety approach and the Shared Space concept, particularly the latter two. As well as exploring the possible success of a RDR approach the review has also examined some of its motivations. Some of the challenges facing the approach have been highlighted as well as the concepts central to it, including safety in numbers theory and risk compensation theory.

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Appendix 2 – Expert interviews

Methodology

Interviewees were chosen due to a high level of expertise on road safety in general and/or RDR in particular. They were also chosen as there was expected to be amongst them a broad spectrum of opinions on RDR and mainstream road safety. They were all interviewed in London. The interviewees (with the initials used to denote them in this report) were:

John Adams (JA) is an Emeritus Professor at University College London. He has written extensively about risk compensation theory and was joint author of 'One false move'; a book examining declines in child mobility. He was also a member of the original board of directors of Friends of the Earth.

Amy Aeron Thomas (AAT) is the Executive Director of RoadPeace, the national charity for road crash victims in the UK

Richard Allsop (RA) is an Emeritus Professor at University College London. He has been head of transport studies at UCL and is an internationally recognised road safety specialist.

Bob Davis (BD) is the primary formulator of Road Danger Reduction he is the chair of the Road Danger Reduction Forum. He is author of 'Death on the streets', which offered an extensive critique of mainstream road safety and of other publications setting out the principles of RDR.

Norma Fender (NF) is the world's only RDR officer working for a local authority. She is employed by Lambeth Borough Council.

Robert Gifford (RG) is Executive director of Parliamentary Advisory Council for Transport Safety (PACTS). The aim of PACTS is to advise and inform members of the House of Commons and of the House of Lords on air, rail and road safety issues.

Deirdre O'Reilly (DOR) works for DfT as the Deputy head safety research and statistics team leader road user safety research. However for this interview she was answering questions in a personal capacity and was not necessarily representing the views of her organisation.

Interviews were recorded. They were not fully transcribed but the recordings were consulted closely when writing up. The interviewees were sent this write up of the interviews so they could check that their comments were recorded accurately.
The interviews averaged about an hour in length. They took the form of 7 main questions that were asked of each interviewee. For each of the 7 main questions further sub questions were prepared beforehand or during the interview. This is important to note as some of the elements that interviewees 'raised' were responses to or agreement with these prepared questions. Other elements covered in the interviews were raised by the interviewees themselves as being important. It is also important to note that the interviewees were not aware of other interviewees'

comments when responding themselves and so links between them are only inferred by the interviewer.

Note
AAT, BD and NF differentiated between road safety and RDR and took the term 'road safety' to represent the traditional establishment approach. While this is noted the term 'road safety' will be taken to refer to traditional Casualty Reduction and /or RDR efforts because that is how some of the other interviewees understood the term. The terms 'mainstream road safety' or 'traditional road safety' will denote the traditional, establishment of road safety only, as distinct from RDR.

1) What is the core or essence of 'road safety'
Interviewees were asked what they thought the central core or essence of road safety is.
RG thought that road safety is about 'reducing the number of people who are killed or injured on our roads.' RA also thought that road safety is about the reduction of risk of death and injury. RG added there should be an ethical dimension as well such that one group's risk shouldn't be exported to another group.

BD thought that road safety should be about 'reducing danger at source.' This 'source' is the driver of the motor vehicle. Expanding on this, NF thought that 'it is the behaviour of drivers that is the most important thing' and that getting people to drive or ride responsibly and with respect and attention for others on the road was paramount.

BD's view of road casualties was clearly more concerned with issues of who was killing who on the roads rather than total numbers of those killed or injured. He contended that such totals could go up and down in relation to GDP and could also reflect people being too scared to walk and cycle on the roads. He suggested that in moral terms, the number of people who kill themselves by poor driving or motorcycle riding is less important. The real moral concern should be for those who are 'hurt or killed by others…*that* is dreadful.' So he thought the whole moral basis of the issue is sorting out 'the difference between endangering other people (whether or not you hurt or kill them) and being endangered by others (whether or not you are hurt or killed.) 'Until you make that explicit you are nowhere.'

DOR thought that the core of road safety includes the agenda of increasing and maintaining levels of mobility. When asked why mobility was important she answered, 'It's important for well being, quality of life, the economy…. at all sorts of levels; individual, national, social, economic and cultural levels.' RG also thought that we do have to think about 'safety vs. mobility and competitiveness.' Although critical of the linkage between the two, BD also saw traditional road safety as being part of a wider transport policy, as organised by the DfT (which has motor vehicle usage as part of its policy) and that road safety is derived from 'what government does.' Thus he seemed to imply that there is a link between the wider transport policy of car mobility and the specific area of mainstream road safety.

As well as links (approved or not) with wider transport considerations, links were also drawn between road safety and environmental considerations by several interviewees. DOR considered that road safety does have implications for the environment and carbon emissions etc. BD also thought that road safety has implications for local and global environmental considerations. JA highlighted a potential synergy between road safety efforts and environmental considerations and felt that because of climate change reasons among others he was 'essentially in

favour of all measures that increase the status of pedestrians relative to that of people in motor vehicles.'

As well as with environmental considerations, several interviewees considered that road safety should be integrated with public health issues. These included DOR, AAT, BD and RG. DOR commented that health has an increasing importance in the DfT. RG felt that if reducing speeds led to more walking and cycling then there would be health benefits as well as road safety benefits so that would be the 'holy grail': 'That's what we want, we want people safer, and with a better quality of life.' BD pointed to the numbers of people who die from not getting the exercise benefits of cycling or from noxious emissions or who will die from global climate change: 'All these deaths are much greater numbers then the numbers of people actually killed on the roads in terms of collisions.'

Some of the interviewees were asked whether they thought road safety should have responsibilities to modal shift. Several did, including DOR, AAT and BD. AAT considered a positive and negative approach is necessary to road safety which would consist of tackling dangerous driving on the one hand but also promoting safer streets through active travel.

BD suggested that mainstream road safety already has responsibilities towards modal shift 'except in the wrong way.' He pointed to growth of motor traffic in recent years and that this was not due to 'some immutable fact of nature.' He suggested it had happened because of 'the way we operate with regard to ownership and use of motor vehicles.' He commented that road safety should have responsibilities to modal shift away from the car 'for reasons which are not directly to do with safety on the road.' These included the loss of local community, dependency on oil and health disbenefits of mass car use. He thought that RDR is 'the only approach which is really going to have a proper modal shift to more benign modes.' He also thought that when talking about reducing danger on the road, 'you are automatically talking about reduction of car use to start off.' This was because 5-10% of drivers are 'flagrant law breakers' and 'a good 10% of motorists are not registered, they don't have third party insurance' etc. So if law were enforced more strictly, that on its own would lead to a shift away from motor vehicle use.

Interviewees were asked whether perceived fear is an issue that road safety should address. RG thought that fear of danger is hard to measure and pin down statistically. He wouldn't however want to suggest it doesn't exist. Having said that he recognised an inverse relation between heaviness of traffic and numbers of people walking and cycling and engaging with their society. JA also highlighted Appleyard and Lintell's study that showed an inverse correlation between heaviness of traffic in a given street and the number of neighbours the streets' residents were on friendly terms with. DOR was clear about the existence of perceived risk and thought for instance that both the actual risk of cycling and perceived risk are important. She suggested the latter relates to modal choice and behaviour and needs to be addressed along with actual risk.

RG implied that traffic should be managed better in order to create environments that inspired less fear and that this was an area where RDR philosophy is now beginning to merge with the traditional road safety philosophy.

RA thought that road safety consideration should extend to fear of the roads. But that the aim shouldn't be for people to feel utterly care free. 'One of the ways of reducing danger is for there to be a proper awareness of risk.'

Some interviewees were asked if they thought road safety should be preventative or curative. RG felt it should be both. AAT saw mainstream road safety as being 'reactive because it just measures failures.' So it seems she would consider it less preventative the RG. She felt that curative approaches only looked at 'hot spots'. AAT felt it was a sea change to realise what you could do to 'not even have the problems in the first place.'

RG felt the progress made in casualty number reduction was positive, 'But we are now getting to a point when we can say 'Ok there are a certain amount of things we can do to prevent those deaths occurring but there are other measures that will begin to reduce the risk overall, to all. 'Such measures can be put in place after a number of deaths that 'had to be dealt with first.'

2) Do you think that the UK road safety strategy at present is socially just?
JA thought that the traffic system (as distinct from the policy that may have created it) is not just. (The distinction was also important to RA who referred to enduring inequities that exist in road safety but which might not be due to current policies.)

AAT thought that the strategy was not just, 'Not at all.' She felt the clearest example of this injustice was the 30mph speed limit and the lack of its proper enforcement. She observed that although we are trying to get people to walk and cycle more, this speed would kill pedestrians and further added it is only enforced at 35mph. 'So I don't think its socially just at all.'

BD also thought that the strategy is 'Not socially just…it's fundamentally immoral.' The main basis for this was the endangering of one group of people (cyclists and pedestrians) by another group (motorised vehicle users.)

NF thought that the strategy was 'trying to be just' but that motorists are 'given a lot of leeway considering that they are driving a vehicle that can cause great danger to others'. She commented that the strategy recognises the importance of reducing speeds on the road for reducing injuries but tends to focus on the minority of motorists who drive recklessly rather than the fact that almost half of all drivers break the 30mph speed limit. She added that in order to be a just road system, there needs to be an element of positive discrimination in favour of those who are most at risk on the road.

Both DOR and RG referred to some difficulty in linking social justice and road safety strategy. DOR was not clear about the link the interviewer was drawing between the two and RG didn't think that anybody 'thought about that' when it was drafted in 2000. He did go on to say however that the question reflected 'that there is a wider responsibility for transport now. It's the kind of thing people do talk about now.'
RA didn't perceive the road safety strategy to be unjust. He didn't feel any 'discomfort from the social equity point of view about the existing policy.' He did think that there is inequity 'present in the (road) system because it's a product of the whole process of motorisation and we haven't finished learning yet to live with the car.' He concluded that 'You might argue that (the road safety strategy) could have done more to counter some of the inbuilt inequalities but in itself I would see it as an attempt at an even handed addressing of risk and danger to all kinds of road users.'

In retrospect it could be that it would have been better to ask interviewees if they thought the road system was equitable rather than the road safety strategy; both RA and JA made a distinction between the two. It could be argued though that you can 'tell a tree by its fruit' and that Bristol City Council will need to take account of the

social equity and social justice ‘fruits’ of its road safety strategy ‘tree’ should it wish to take up an RDR approach.

JA raised the idea that the present road safety system is not a fair one because at present ‘the bigger your vehicle, the safer you are and everyone else has to get out of the way.’

He pointed to the approach of separating modes by using ‘barriers, underpasses, footbridges, traffic lights and all sorts of controls as essentially ‘requiring the least dangerous to defer to the most dangerous.’ He thought ‘Pedestrians and cyclists are very much second class citizens.’

RA considered that the perception that freedom of walkers and cyclists being hampered by the freedom of car drivers ‘*is* quite an important perception.’ ‘It's part of the deep-rooted inequities that have come about through motorisation that we haven’t sorted out fully yet. RA also thought ‘it is true that there has been a presumption from the really quite early days of motor traffic that it was up to the pedestrians to get out of the way of the motorist. Very gradually we have worked at (this presumption) to reduce it, but we haven’t finished the job yet. But I think it’s a legitimate part of the danger reduction agenda to get that balance further adjusted in various ways.’

With regard to non-motorised road users having to defer to motorised users, DOR considered that fast moving traffic can form a barrier for those wishing to walk or cycle. She said there was evidence that different road schemes and road systems could create community severance and thought that it would be good to reduce speeds and to reduce traffic volumes. She thought there would be safety benefits of doing those things but she came back to the point that the mobility needs of the whole community need to be addressed. In contrast to AAT, DOR didn’t necessarily agree that someone seeking to travel by foot or cycle rather than car would be in more danger. She suggested that there are different ways of looking at the risks and that there are issues around actual and perceived risks.

RA thought that the themes of ‘tomorrows roads safer for everyone’ ‘do consider every kind of road user and I don’t think they prioritise one over another.’ Similarly RG thought that strategy was socially just in that it identified that there were certain groups who were more likely to be at risk, including pedestrians and cyclists, and it decided that what should be done is to ‘put your efforts into reducing the risk for those people who are most at risk.’

An important element in RDR is that drivers should take on higher levels of liability and legal responsibility when deciding to get into a car. In response to this idea DOR thought that people do take responsibility: ‘I think all road users have responsibility, and I think their responsibilities are quite clear. I think all road users have a responsibility to behave in accordance with social norms, and the rules of the road generally.’

RG conceded that by driving, people are imposing their risk on other people but felt we should be careful not to suggest that ‘the driver is always at fault in the accident.’ Both DOR and RG pointed to the fundamental approach of innocent until proven guilty in British law and that this shouldn’t be changed in the case of the motorist. RG qualified this by saying this would be in the case of criminal cases, but that there may be a case for an assumption that the driver is liable, in terms of insurance, in civil cases. RG did fundamentally agree with ‘the notion that drivers should take more care and have more responsibility and that we need to think about the risk that is

imposed on those least able to look after them. I don't think you can divorce a road safety policy from questions of equity.'

In contrast to DOR and RG, BD thought that when a motorist got into a crash with a non-motorised road user the former should have to prove it wasn't their fault in terms of both insurance and criminal law repercussions.' He thought that danger would never be entirely eliminated but that 'you can make those responsible accountable for danger and that could be the highway authority, motor vehicles manufacturers or it could be the individual road user.' He thought that when approaching road safety 'We are primarily talking about what motor vehicle drivers get up to and how they are supported in what they do by highway authorities, motor vehicle manufacturers and government transport policy as well.'

BD pointed to a strength of RDR being that 'It deals with the fact that we've never dealt with at all, that people are able to go out using motor vehicles, endanger other people and more or less get away with it.'
AAT highlighted the importance of victims of road traffic collisions being properly counted by the legal system. She reported that 'we are not counting the number of victims of law breaking drivers. And I think that's really telling. If we were counting the number of victims it would put them higher up the priority for the justice sector.' On a similar topic, RA noted that police forces are not rewarded with extra funding for convicting a drink driver the way they are for convicting a murderer etc and that this was a 'Serious omission.'

Asked about the sometimes light punishments given to those drivers killing or injuring people on the roads RA pointed to an attempt to strengthen road offence charges in a 1991 act but which resulted in an effect on rates of prosecution and conviction that was negligible and which was 'very disappointing.' He felt there was a very deeply ingrained 'there but for the grace of God go I' feeling in the whole system.

3) What do you think of the Road danger reduction approach?

BD thought that the strength of RDR is that 'It's about your responsibility to other road users as being the most important thing.' In relation to this he suggested that RDR is 'more morally responsible, it's more honest, that's its central strength'. He also asserted that it is the only approach which would succeed in promoting more non-motorised and less motorised mode use.

BD proposed that the difficulty with RDR is that it is up against a traditional road safety ideology that is 'incredibly powerful.' He suggested that such a road safety ideology is part of car culture in general and that we live in a 'car obsessed society.' He further thought that 'the powers that be aren't prepared to challenge car culture.'

BD was asked about the economic effects of promoting walking and cycling on the one hand and discouraging driving on the other, crucial elements of RDR. He pointed to work done by people like John Roberts in the 70's and 80's (Director of TEST) who studied Germany and other northern European countries. They found that taking out car provision and supporting alternative modes in the city centres made them more economically viable. 'So walking and cycling has a good record of success in city centres.' On a neighbourhood scale he implied that higher levels of walking and cycling could improve access to local shopping areas on the outskirts of a city like Bristol, thus benefiting local economies. In general he highlighted the costs of congestion which are caused by there being too many cars on the roads. The last point was echoed by RG who although not having visited Bristol recently remembered that its layout was 'not built for the motor car' 'and therefore probably

highly congested.' 'So it's not working economically at the moment, if you think about overall congestion costs.' 'What road users want is reliability'. 'So Bristol transport isn't working economically at the moment, and it might be the case that better traffic management would get it to work more effectively but that does require persuading people that they have to get out of their car.'

Some interviewees raised concerns about elements of RDR. Both RG and RA commented on the tone of RDR's presentation deterring potential support. RG said that what 'bothered' him about RDR is that the 'moment you stand on a high horse and say 'this must not be allowed to happen, this is a disgrace,' you may be alienating potential supporters.' With some of the things that RDR has said although he had agreed with the substance of what was said he had found the tone in which it had been voiced difficult. So he felt RDR's presentation style an issue, in particular he felt its 'hard line' tone was a problem.

Also concerned with the tone of RDR, RA thought there had been 'a certain zeal' in RDR which has been counter productive. He implied that RDR could think a little more about how to win hearts and minds with its arguments. He thought 'if there were a bit more feeling of getting alongside rather than the 'over against' feel (then RDR might be more effective.)' He felt that RDR could allow for sensitivities more within the road safety community in order to win hearts and minds. It could do better in minimising the sensitivities in order to get past them. He also considered that RDR was overly critical of the approach of treating 'high risk sites' and traditional road safety approaches and that such approaches were not as different to RDR as RDR had proposed. He added that it had been realised since 1970's that the process of treating high risk sites was producing an inequity in that it was benefiting car occupants more than non-motorised road users (as collisions were more scattered with the latter) and that this had brought 'the priority that was needed for looking at urban road safety in a way that addressed the thinly scattered accidents as well as dealing with the high risk sites. Now of course we hardly have any high risk sites left. I hope that no RDR enthusiast would say it was wrong to have (treated high risk sites.)'

In relation to the feeling that RDR is overly negative in tone towards traditional road safety, BD commented that RDR is 'not just bellyaching about how dreadful the road safety lobby is…its actually pointing the way forward.' Here there is no denial however that RDR does see traditional road safety as largely negative.
When asked about RDR's vision of car use being further restrained, RG said PACTS are not pro or anti any mode. They wouldn't argue for constraint of usage, they would argue for constraint of speed though.

4) In terms of road safety what is your view of promoting higher levels of walking and cycling?

RA would be reluctant to 'promote' or 'persuade' people to walk and cycle but was more in favour of providing infrastructure and then pointing it out to people. He cited the possibility of persuading a person to cycle who then had a serious accident as deterring such promotion or persuasion. He found the Safety in numbers theory very plausible and so although shy of promoting and persuading 'certainly it justifies encouragement (of walking and cycling) JA Adams also implied that the numbers of cyclists and pedestrians have a large effect on their safety. AAT and BD also raised and agreed with the safety in numbers theory.

In contrast to RA, AAT considered an important part of road safety is promoting safer streets through active travel. JA also thought that promoting walking and cycling was

highly desirable as it promotes a sense of community which in turns combats 'stranger danger' and prevents paranoia. BD also thought it was very important to promote higher levels of walking and cycling. Promoting the latter was particularly important where there were some cyclists already. NF was also in favour of promoting walking and cycling. She thought that it can go 'hand in hand' with reducing road danger, as increases in these modes tend to mean a reduction in private car use. She added that an increase in the number of cyclists can give a critical mass where cycles are more prominent and visible, and so tend to be safer as drivers become more aware of their presence. AAT thought it very necessary that walking and cycling should be made safer at the same time as promoting them. This is because otherwise women and old people wouldn't take it up. AAT also highlighted the important differences between promoting cycling and promoting walking, questioning the interviewer's lumping of the two groups together.

One of the reasons RDR promotes walking and cycling is for the health benefits of those activities. Some of the interviewees commented on these benefits. DOR thought that 'When looking at any policy you have to look at all the costs and benefits, and the wider context and in doing so you will find that there are some costs in terms of casualty reduction and there may be some benefits in terms of longer term health benefits. But I think those two need to be weighed up against each other and against all the other costs and benefits. I draw those two out but they are certainly not the only issues involved and I think you need to look at all of those issues.' She also stressed that car use ought not to be discounted.
RA thought the argument that health benefits from walking and cycling may outweigh possible extra road deaths was a strong one. He said data about this should be monitored. RG said that PACTS accept that 'as a society there are bigger trade offs then just 'we want fewer people killed.' So society would have to think through whether it should accept a trade off where a rise in road casualties would be more than offset by increased life expectancies from healthier lifestyles of cycling,'

5) What top 3 road safety measures would you put in place if you had responsibility for a city? These could be engineering, education, enforcement measures etc.

Speed measures

The most popular type of measures reported were those to restrain speed. RG, AAT, NF and RA would all consider introducing 20mph limits. BD and JA didn't think 20mph measures should be over emphasised. Looking to the future AAT, NF and RG all chose Intelligent speed adaptation (an in car system that can either inform drivers when they are breaking the speed limit or physically prevent them from breaking it.)

Enforcement and law measures

RG would ensure further enforcement of traffic law violations and high risk behaviours including, using mobile phones while driving, drink driving, not wearing a seatbelt etc. AAT also choose a measure that would increase driver accountability but which was not traditional to the UK, this was the use of in car 'black boxes'.

Other measures

Other measures that were chosen by just one interviewee included improving the surface of the public realm, quadrupling the price of petrol, ensuring careful monitoring of accident maps, horizontal traffic calming measures, having more cycles available for hire and use of shared space. RA thought increasing trained staff would

be important because ‘there is a national shortage.’ BD suggested a raft of measures that would reduce the danger coming from motorised users and others that would promote walking and cycling.

In conclusion, on this question there was quite a consensus on favourite measures between interviewees that had different views on the other questions. There was a particular consensus on the importance of restraining speed and the deterrent potential of enforcement and law.

6) What is your opinion on city-wide 20mph limits being put in place in residential streets?

RA, RG, BD, NF and AAT all broadly approved of 20mph limits.
AAT was in favour of very widespread implementation of 20mph including main roads: She thought the default should be 20 so that a case would have to be made to raise a 20 to 30 rather than vice versa. I.e. ‘It should have to be argued why a road should be more dangerous, not argued why it should be more safe.’ In terms of difficulties of implementing 20mph limits, AAT pointed to European cities ‘that have managed it for so long.’ She said a difficulty is that so many people think that a 20mph limit would have to be enforced which Roadpeace doesn’t agree with. A difficulty is that people think that 20mph will mean humps which are costly and contribute to emissions. She thought that local newspapers are very supportive of 20mph speed limits in the same way that they were supportive of speed cameras. It is just the national papers that may rely on motor advertising that may not favour the limits. So not monitoring local papers for support is a missed opportunity. AAT thought that 20mph is a ‘win win win’ for road traffic injuries, for public health and for the environment.

RG thought that it was desirable to have much more widespread 20’s. He suggested that the community in Bristol might ‘buy in’ to the idea because it has a culture of place, a history and an environmental strand to its thinking. So cultural attitudes may be important for the success of 20mph implementation. NF also felt that peoples’ attitudes would be vital to the success of 20mph, and to be successful they would need to be enforced. DOR raised a possibility that we are not at a stage socially and culturally and in terms of infrastructure where signage only would be effective.

On the other hand she pointed to preliminary evidence from Portsmouth that suggests that there may be some positive benefit from 20mph limits. As a researcher she would argue that there should be more evaluation of the impact of 20mph limits on all road users, (in general she thought that there needs to be more evaluation of the impact (costs and benefits) of safety interventions and sharing of evidence and good practice effectively.) She agreed with the idea that cultural attitudes would be important for 20 limits on their own to work and also highlighted that enforcement would be important. She thought that doing limits across a whole area might in some respects make it easier than doing it in small little clusters. Then people would know what to expect more, as in the Dutch sustainable safety principle of predictability. RG added that ‘many of the areas where people are most at risk are on through routes, where there may be shopping, leisure centres or schools, ‘so its not just about residential roads. In some cases its actually on commercial or through routes as well.’

JA was not opposed to 20mph but was less enthusiastic about them. He pointed to the early 1920’s when there was a national 20 limit, hardly any traffic but 3 times as many children killed as today; ‘So a speed limit on its own is not the answer.’ He thought that if they were properly enforced they ‘can’t do any harm’ but was sceptical

about the effectiveness of 20 limits. BD also thought that 20mph measures shouldn't be considered the 'be all and end all'. He suggested 20mph would mainly be implemented on side roads and that 'its mainly on main roads that a lot of people want to ride bicycles and there's going to be a lot of pedestrians crossing. He thought proper enforcement of 30mph might be more important. He suggested that speed in itself is only part of the answer. One of the things we (find) when we look at cyclists being knocked over in London is that actually speed Is very often not a factor', its people coming out of T junctions without looking where they are going. Also being crushed by lorries didn't require speed. 'So I wouldn't push speed too much, I would push it as a general thing.'

7) Any further comments on what you think would be the opportunities and difficulties for RDR being taken up by a local authority? Or by central government?

JA suggested that RDR has 'ready made allies in the form of people who are concerned about peak oil, people who are concerned about CO_2 emissions and all of those who point to the desirability of reducing dependence on motor vehicles.' Similarly NF suggested that RDR and the sustainable transport agenda go 'hand in hand'. Thus she reported that as an RDR officer in a council her relationships with sustainability colleagues is good but that working with engineering colleagues could be more challenging, for example around the area of exploring how to measure safety on the road. BD also thought there might be resistance from traditional highway engineers.

RA thought the winning hearts and minds and collaborating would be important. He considered that 'There would be quite a lot of scope for working on the elected members.' He also thought there could be coalition between RDR and living streets and CTC. Relations with motorist groups would have to be handled carefully and the message sent that RDR was 'not out to 'clobber' the motorist. In general, 'I'd be wanting to try to bring people together, that seems to me the key thing.'
RG also highlighted that 'The challenge for the local authority is ensuring that whatever policy its pushing forward it doesn't appear to be favouring one group as opposed another group...whichever those groups are. And that is about, I think, choice of words.' Asked if the public would have a problem with the content or the communication style of RDR, RG thought it might not be the content because a lot of local people are worried about speeding cars. 'So there is a genuine public concern that says we don't like cars coming too fast past our doors … So if you communicate that this is about quality of life, its about improving the environment, its about improving the lives of the majority of people in a community, then I think you will get support. He added though that as soon as people were told 'we want you to drive your car less,' support would diminish. 'So its about turning it into a positive message rather than a negative one. So it is primarily about communication and the tone of the people who stand up to do the communicating.'

BD felt that the communication about RDR is 'both easy and difficult'. It is easy in that the general public can understand the main motives and ideas behind RDR, but on the other hand it involves road traffic reduction and so has to confront the 'car culture.'

RA highlighted problems with scare resources as a difficulty for RDR. This could raise the issue that RDR in Bristol will need to make a strong case for investment in it. RA considered that a difficulty may be that 'if we can't allocate resources even to treat the places where people *are* being hurt then its hard to argue for doing things ahead of people being hurt'. AAT also raised budget restrictions as a possible

obstacle. She also thought that the health sector had a role in promoting evidence based interventions.

RG also thought that in the current economic climate there would be real pressures on local authorities. He thought the clever thing would be about 'joining up the dots': Where a local authority can work is through local strategic partnerships 'bringing together primary care trusts, police, fire and rescue and local authority.' 'So that you can look at 'If we are putting some money in here, then that's actually meeting a road safety objective or that's meeting a public health objective' so we can get better usage of the money we've got.' Equally local authorities could look at what the different activities are of all their partners. Local authorities could also be 'cleverer in terms of other sources of funding.' This could include getting the safety benefits out of major redevelopments. He concluded: 'But if money is not forthcoming from central government as well it will be difficult.' In terms of funding AAT thought that better monitoring and more realistic estimates of numbers of road casualties should effect cost benefit analysis and allow better decisions to be made (in strategy.)

In relation to persuading people to get out of their cars (part of RDR strategy) RG quoted the idea that the 'automobile is a very clever combination of two different ideas 'autonomy and mobility' and you tackle either of those at your peril. People don't like either of these being taken away from them. But that is what we all have to accept has to happen if we are going to make the traffic system work better.' Echoing these ideas NF thought that 'there's always an element of people who think that we're just trying to penalise car drivers.' Efforts to get them out of the cars might be seen as an attempt to take away their freedom. A response to this would be to point to how a reduction in the number of motorised vehicles and an increase in walking and cycling makes the urban environment more pleasant for all of us by reducing congestion, improving traffic flow as well as providing safer, cleaner and quieter streets.

BD thought that in order for a local authority to take up RDR, 'You have to make the commitment and once you make the commitment everything else flows.' He also suggested that the Council would need an RDR officer and support from one senior councillor and also from senior officers. NF also thought that the support of an executive member and public support are both important to implementing RDR.

Discussion of interviews

It is simplistic but maybe helpful to compartmentalise the experts interviewed into those inside the institutions of mainstream road safety and those outside of those institutions. It is also interesting to consider the priorities that informed the opinions of those interviewed. When framed in this way it could be posited that those inside mainstream road safety saw road safety as being a priority amongst other priorities that have to be taken account of. Examples of this could be the mobility that DOR highlighted and the competing worthy priorities for scarce resources that RA mentioned. Those on the outside of mainstream road safety were freer to think about road safety in purer terms and put greater emphasis on ethical imperatives such as justice and equity etc. This raises the interesting and difficult question of if those 'outside' say that road safety 'must be this way' and those on the 'inside' say that 'practically speaking it can only be this other way', then what progress can be made and which option taken? How can a satisfactory synergetic outcome be achieved? This may be an important question for a Bristol Council RDR policy: Should it maintain a strong, radical and critical tone which would enable it to be true to the aim of making radical changes but which may alienate support from inside and outside the Council? Alternatively should it temper its tone in order to increase support but risk become 'watered down' and less true to its aims in the process? Perhaps one

thing to consider in addressing this question is that RDR thought could be divided into on the one hand 'what is wrong with present road safety strategy' and on the other 'what an alternative approach could consist of'. Perhaps the latter could be concentrated on rather than the former.

Interviewees on the 'inside' of the mainstream road safety tended to be critical of the tone of communication that RDR adopts. It is undeniable that RDR is abrasive towards the mainstream of road safety. It could be argued though that a radical critique of present approaches underpins RDR and is necessary to inform a future alternative strategy for action. It could be that key to addressing the questions above is creativity: In particular the creativity to find synergistic outcomes of radically safer roads and improved economy. (Note as an example RG's comment that the road system in Bristol at present isn't 'working' economically. Additionally in the literature CABE (2008) referred to economic benefits to more 'liveable streets' including increased footfalls in retail areas.) Creativity may also be required to ally RDR and political support perhaps by 'painting a picture' of how much more just and attractive Bristol could be with radically safer streets. The good thing about interviewing BD is that he has an almost tangible vision of the way the road system should be. There is a sense with him that the vision is possible.

Appendix 3 – Marksbury Road Scheme description

An engineering road safety officer was interviewed in relation to this scheme, which he managed. He will be referred to as 'the scheme manager.' As can be seen in Appendix 4, this scheme involves 7 interventions along or near to Marksbury Road. (Please see the diagram to understand the lettering (A) etc in the following discussion.) Four of these interventions are islands at the side of the road in order to narrow the road, one is a section for red surface treatment, and another is a speed table at a junction with proposed high friction surfacing on approach. Elements at either end of Martock Road/Parson street were added to the scheme following the original internal consultation. These are proposed build-outs making the road narrower at junctions.

What stage is the scheme at?

The scheme at time of interviewing was at the stage where it was being built.

What was the purpose of doing the scheme? Why was it prioritised and was there more than one reason?

The principle reason for doing this scheme started with an accident cluster at the junction between Littleton Road and Marksbury road (G). There have been a total of 13 recorded personal injury accidents in the past 3 years on the site and 6 of the accidents occurred at the junction of Marksbury Road with LittletonRoad/Lyton road, mostly involving turning movements.

Were there any issues of accessibility of walking and cycling that occurred in the scheme?

At C there is a walking and cycling route called Malago walkway which meets Marksbury Road, goes along a short length of it and then turns off the other side. 'Although there weren't that many accidents at this point, the road had previously been narrowed.' But this narrowing wasn't very obvious or clear. Nothing warned the driver that they were coming to a hazard. There is a point there where cyclists cross over Marksbury road. The scheme manager and his colleague thought that some colouration of the road might help draw attention to the narrowing. The red hatching gives a visual clue that there is some kind of obstacle ahead.

The scheme manager spoke to walking and cycling officers who confirmed that they wanted to enhance the area. So he proposed that if there was anything they wanted to do there that they were willing to pay for, he would manage those interventions as part of the overall scheme. So walking and cycling teams gave a contribution towards that part of the scheme. Between the red lines is a crossing point for cyclists and pedestrians with drop kerbs and tactile paving. So safer and more accessible navigation of that stretch of Marksbury Road by cyclists following the Malago walkway route is facilitated. Additionally some of the cycleway alongside Marksbury Road is being re-laid and tidied up to improve the Malago route.

Pedestrian crossing facilities (drop kerbs, tactile paving etc) were improved at the buildouts on both ends of Martock Road ((A) and (B)). The buildouts there mean there is a shorter distance for pedestrians to cross. Similarly the buildouts in B, D, E and F aid pedestrians crossing the road. Tactile paving etc was also added at the Littleton Road junction (G)

The scheme manager thought that the buildouts at B, D, E and F were Ok from a cyclist perspective. He consulted with cycling engineers who didn't voice any complaints about them. The 4m width should be adequate for a car to pass a cyclist.

Why did you put in the high friction surfacing?
The scheme manager suggested 'We know from a road safety point of view that putting high friction surfacing in advance of junctions or crossings where we have problems with loss of control accidents or nose to tail accidents can have an incredibly good effect. The value for money in those kind of circumstances is astonishing.' He said that in the last three or four years, the worst accident saving that had been achieved was 700%. This can be put in context that an accident saving of 250% or 300% would be considered a success.

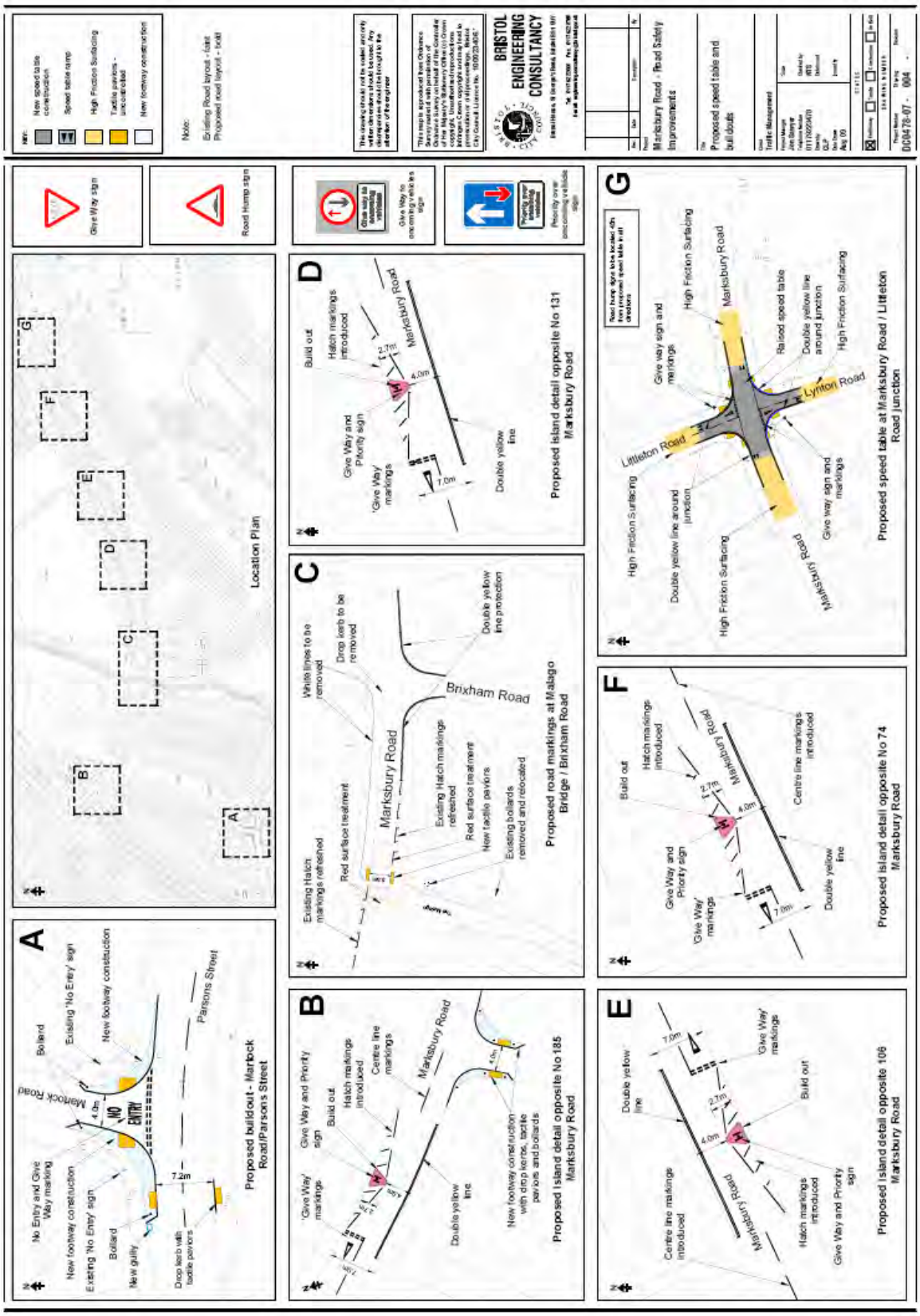
In the case of the Littleton road crossing (G) the high friction surfacing was put in for both visual and safety reasons as a kind of 'belt and braces' approach to a junction that had seen so many accidents.

Looking at the Marksbury Road Scheme through the eyes of RDR
The scheme shows good awareness of the local important cycleway (Malago route) and improves the safety and accessibility of that route even though there wasn't a history of accidents at that spot. This shows that the team isn't only looking at accidents when designing the interventions although accidents were the primary reason for deciding to treat the area. Additionally most of the different sections of the scheme include details that aid pedestrian accessibility.

RDR would probably be critical of addressing the high risk site in the first instance and particularly of using high friction surfacing. It would be critical because of risk compensation theory which would suggest motorists will respond to the junction's treatment by braking later and driving worse, in reaction, on subsequent junctions and surrounding areas. To counter this though the scheme manager can point to the specific nature of the road conditions that cause the danger and accidents at the junction in question. Presumably these conditions aren't replicated at other nearby junctions

The idea that high friction surfacing will lead to some drivers braking later seems plausible. However the scheme leader would point to research he has done into the past success of high friction surfacing.

Appendix 4 – Marksbury Road Scheme diagram



Appendix 5 – Bishopsworth Road Scheme description
An officer was interviewed regarding this scheme, which he managed.
This scheme can be seen in Appendix 6. It included improvements to a zebra crossing with high friction surfacing added. Two traffic islands have also been introduced which are also pedestrian crossing points. These two traffic islands were partly put in for safety reasons. The scheme manager suggested they give the impression of a 'competent,' consistently designed highway along Bishopsworth Road. By narrowing the road they bring down speeds. There was also a danger reduction intervention on St Peter's Rise near to the entrance of Manor Woods.

What was the reason for doing the scheme?
Accident reduction was a prime concern. There were also elements of danger reduction. There were a number of collisions, mostly including cyclists but some including pedestrians as well. The latter included an elderly pedestrian who was seriously injured on the pedestrian crossing. The route is an important one with lots of bus use etc.

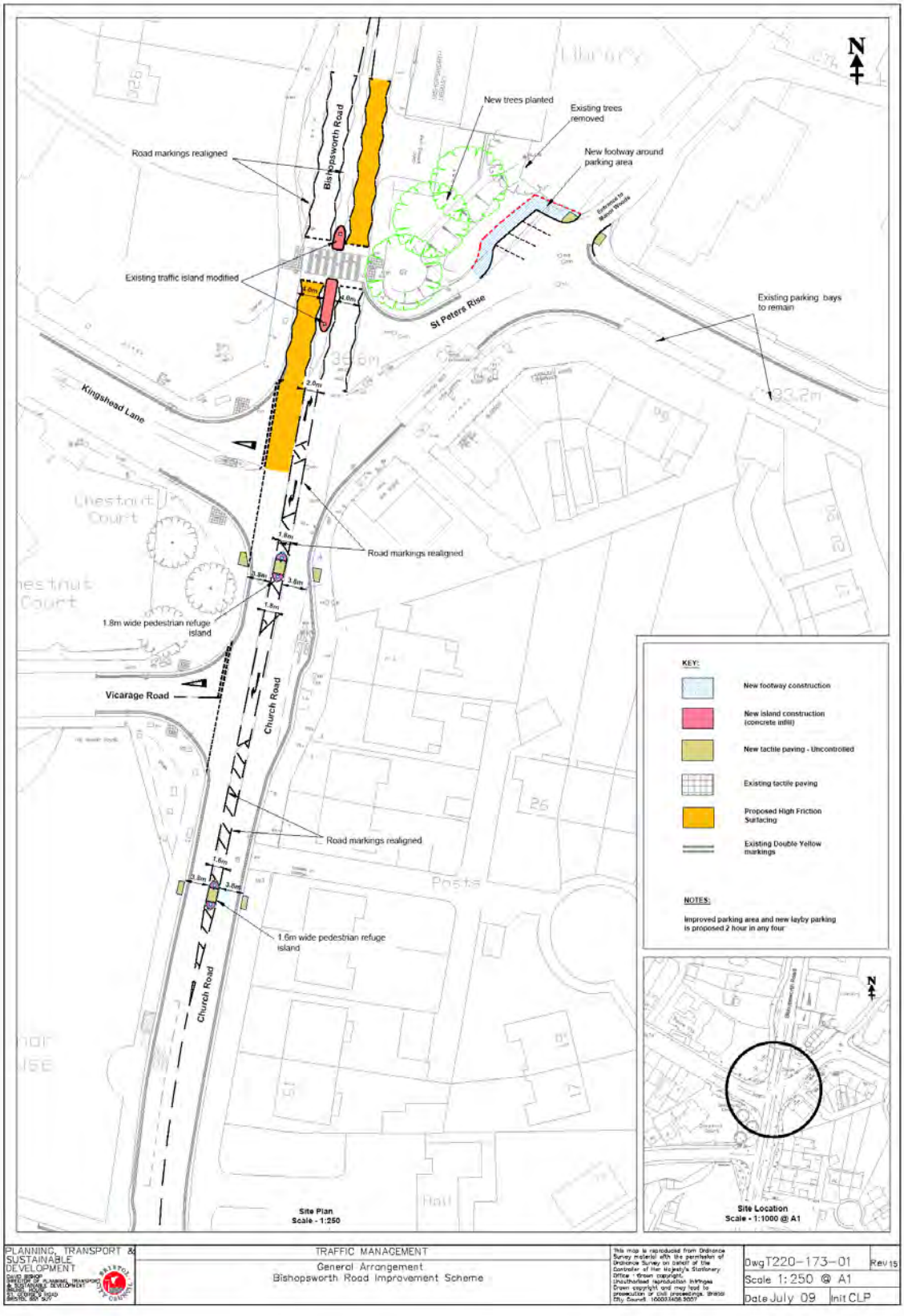
Did any issues relating to pedestrian and cycling arise along the way, either in terms of safety or in terms of accessibility?
'Yes.' The scheme manager referred to the area of St Peter's rise adjacent to the entrance to Manor Woods. This area had been an 'eyesore' of rough land. People used it for parking. Before the scheme crossing St Peter's rise had been very difficult for pedestrians so they couldn't get to the zebra crossing in order to cross Bishopsworth Road. The scheme's new footway facilitated easier access for children pedestrians travelling from a residential area to the local secondary school. The scheme manager thought that the pedestrian crossing points added etc had led to a reduction in community severance by Bishopsworth Road and St Peter's Rise.
The new pedestrian refuge islands leave road widths of 3.8m on either side, which isn't ideal for cyclists but cycling teams were happy with it as it is almost the usual 4m.

Looking at the Bishopsworth Road Scheme through the eyes of RDR
The scheme was prioritised on the basis of collisions, many of which involved cyclists and pedestrians. Thus the scheme is clearly aimed at making walking and cycling in the area safer. It also improves cycling and pedestrian accessibility in the area with the pedestrian refuge islands and the new footway element, which was not added for direct casualty reduction reasons and which facilitates walks to school. Basically then this seems a very RDR friendly scheme even though done primarily for Casualty reduction reasons. It shows that in engineering practice RDR and CR can seek the same measures to achieve their ends. Perhaps though again RDR would question the high friction surfacing and might take a stricter view on the 3.8 metre width to the side of the refuge islands, although as previously mentioned the council cycling experts were happy with this.

Once you have prioritised a certain area for intervention due to accident rates, why do you include other design elements in the nearby vicinity that may not have accident-based justification?
The manager of the schemes above said he takes the view as a public servant 'that it's a bit churlish to do the one job that you've got to do without being open to at least the suggestion that (there might be) other things that can be tidied up in the area at the same time that should have been done in the past.' This lets the public know 'that we're not just there to do road safety, there's a little bit more thinking going into it.' 'You don't have to do lots more to make people feel that they have been thought about in their community and that their concerns have been listened to.' So when starting to look at a scheme, he will look at correspondence files to see what other

things people have said in the area in the past. He said though a line does have to be drawn: a scheme can't cover every possible element in too wide an area.

Appendix 6 – Bishopsworth Road Scheme diagram



Appendix 7 – St Augustine's Parade Scheme description
This intervention on a very busy street outside the hippodrome in the centre of Bristol has been built. The scheme plan can be seen at Appendix 8.
A document for public consultation states that between July 2006 and June 2008 there were 17 reported pedestrians being injured at the site, 8 of them seriously. There are many drunk people on the pavements by the road in question in the evenings (due to kebab shops at the site and taxis) and half of the collisions involved drunken pedestrians although the other half were during the daytime. An additional problem at night was that the taxis parked illegally in a bus stop area making things more dangerous.

Observations showed that a lot of pedestrians were crossing the road at the point in question because there was a desire line there. As Appendix 8 shows the scheme then provided a new refuge island in the middle of the road. There were concerns about the crossing point because of the A roads merging at the location, and the fast traffic. The scheme manager acknowledged it wasn't an ideal point for people to cross but that pedestrians would continue to cross there even if no crossing was put in.

Railings
New pedestrian railings were put in to the north and south of the new crossing point on the west side of the road. Before the guard rails, drunk people were running across the road to the north of the new crossing and stumbling into the road in general. Police were finding it difficult to manage the taxi ranks and the fights that were breaking out in the evenings. The railings weren't part of the original design, they were requested by Safer Bristol. Railings were not put on the other side of the road as it was felt this could impede cyclists. The scheme manager commented 'We don't usually put in railings, but because of the problems we considered in this case it was beneficial.' She related that she had been in two minds about putting the railings in. They also built out the footway so that there was more space for holding pedestrians.

Were there any issues of accessibility of walking and cycling that occurred in the scheme?
The scheme manager said she worked in conjunction with the cycling team. There was a worry about the 3.4m width of the road at the crossing point on the east side. They were worried that drivers might try to overtake cyclists there and that there would be a pinch point. She thought though that the width has worked OK. A consultation comment was that people wanted railings on the East edge of the road as well. But this idea was rejected as the scheme manager thought it would cause a conflict with cyclists and there wouldn't be enough space to put them in.

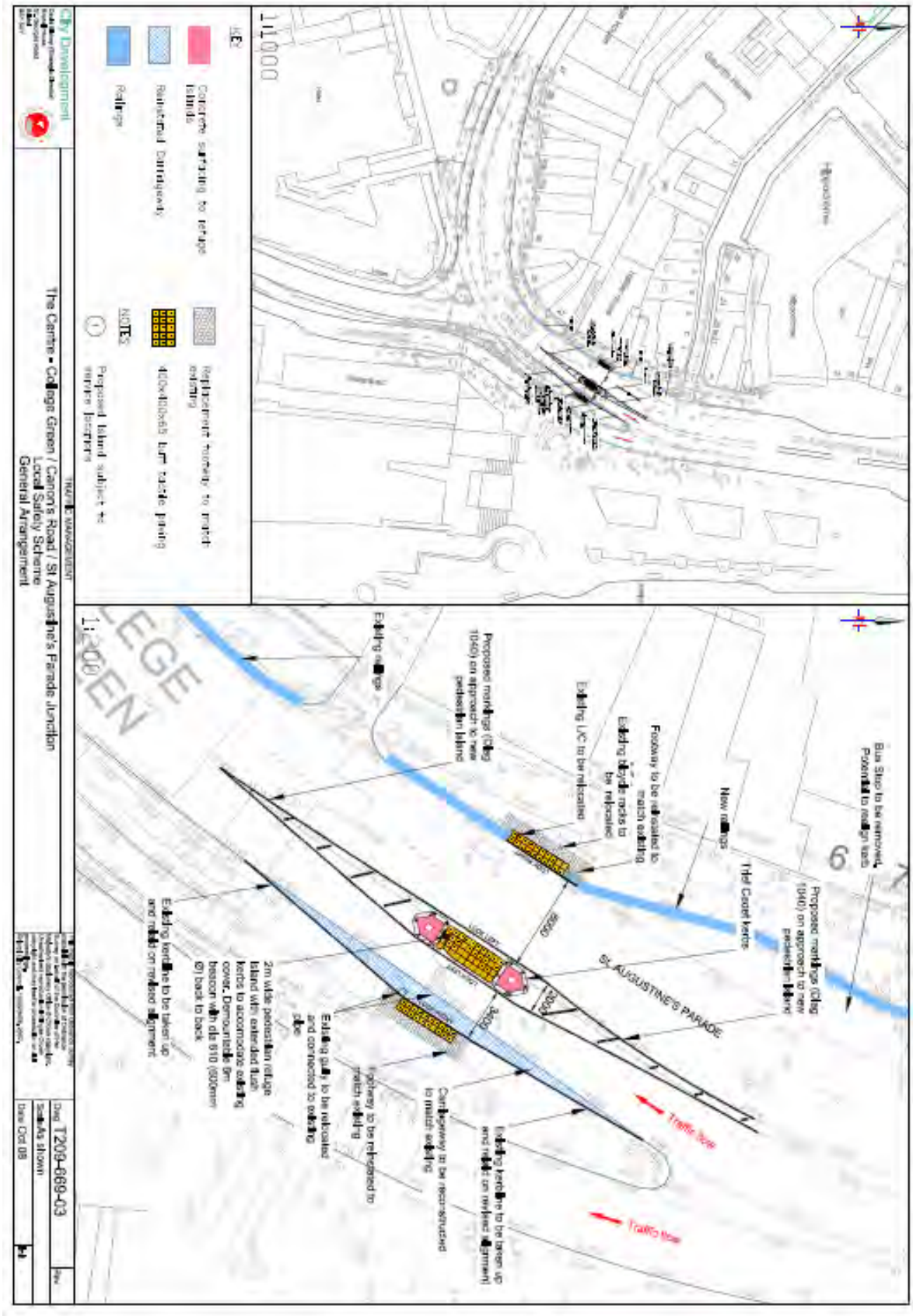
Success of the scheme
The scheme manager said there had been a reduction in casualties since the scheme although she hasn't yet got a full year's data about it yet in order to report on it fully. Recently police have reported that since the railings were installed the crime figures have dropped dramatically. The number of officers required in the area has also gone down. ABH and common assault incidents in the area have gone down by 40%.

Looking at the St Augustine's Parade Scheme through the eyes of RDR
The scheme manager can point to a decrease of antisocial behaviour at the site as well as what will probably be a decrease of casualties at the site, as measures of its success. RDR would approve of the installation of a central pedestrian refuge with a

straight across crossing point for pedestrians which improves accessibility and safety for pedestrians along a desire line. Also there has clearly been consultation with walking and cycling engineers. Having said that it is likely that RDR would have a mixed view of the scheme, mainly because of the railings. RDR would probably suggest that the pedestrians are not the problem, to be penned in, even if they are drunk, it is the fast cars on the road that are posing the danger and so, to be just, it is the cars' access that should be adjusted or restricted rather than that of the pedestrians. Thus RDR would probably advocate wider, more radical measures such as pedestrianisation, etc.

However, it is likely that such solutions are practically too difficult and expensive in this prime site in the city centre with the pressures and practical considerations that are attendant on it. In fact it is an interesting question of what RDR would advocate in such a location where there is a whole 'pressure cooker' of competing practical considerations to be taken into account. It seems likely that RDR would require a very strong mandate to override such considerations for more radical solutions. However, the fact remains that by separating pedestrians from the road by railings, in this area of the city centre the dominance of the car has overridden pedestrian accessibility.

Appendix 8 – St Augustine's Parade Scheme diagram



Appendix 9 – Portway crossing description
This scheme was at the design stage at time of interview. It had been out for TAA once. The option for the scheme that the scheme manager thought would be decided upon is shown in Appendix 10.

Previous to the scheme there had been one fatal collision in the vicinity of the crossing and another fatal collision south of the crossing. One of the fatalities was a cyclist who was trying to cross the road. It was the severity of the injuries at the site that partly led to the scheme's prioritisation. There have also been a number of loss of control accidents. So the reason for the scheme is to provide a formal crossing point across the 'Portway' road.

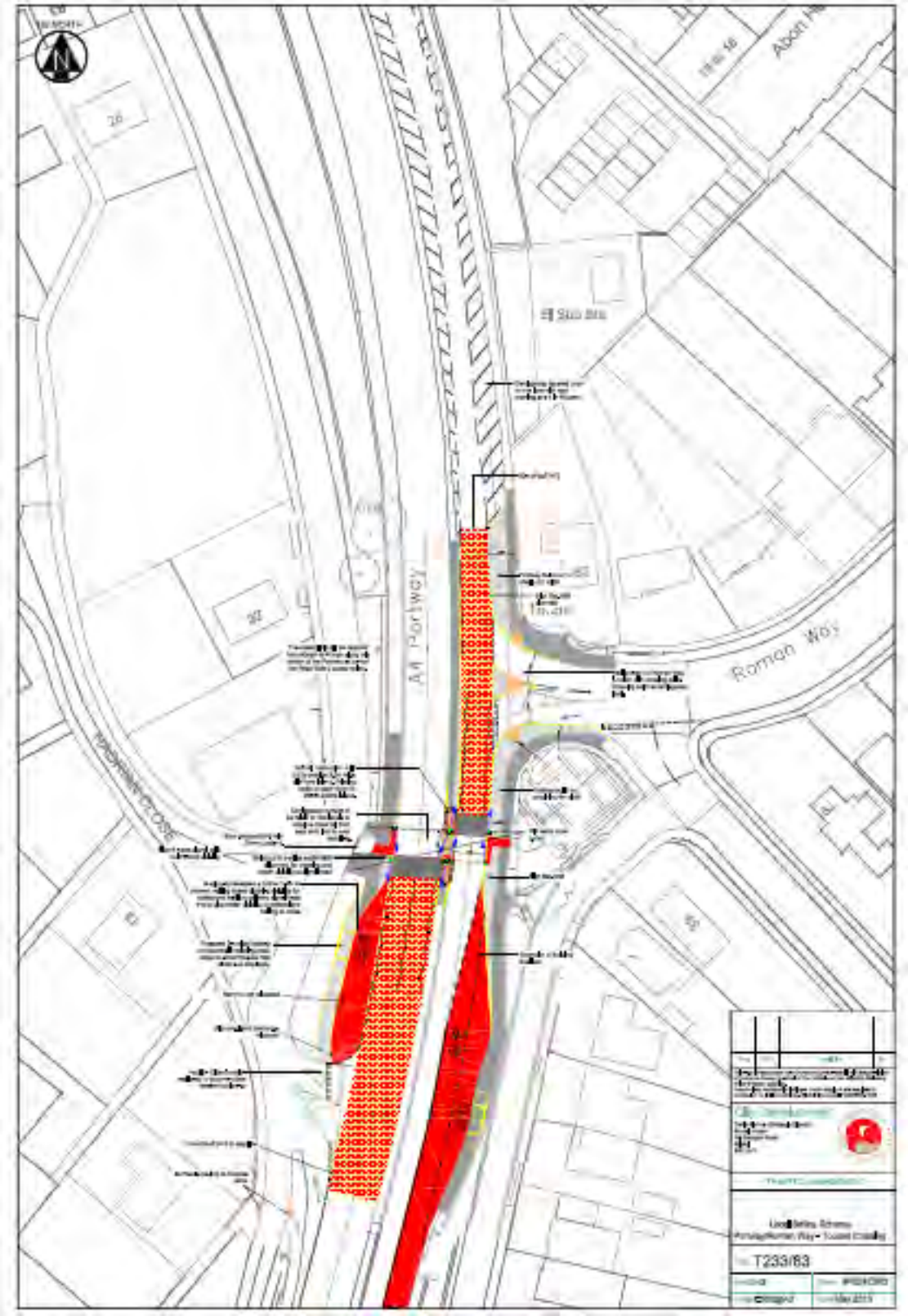
Scheme design
An original design for the scheme had kept the road lanes unchanged in terms of width. This meant that the proposed crossing had to be a two-stage crossing. However at a TAA meeting somebody had the idea that the two lanes could be reduced to one on the southbound side of the road. So the current scheme design extends the bus lane and importantly narrows the road southbound for cars to one lane on approach to the crossing point. Because the southbound is restricted to one lane at this point the crossing can now be a straight through design that is easier and quicker for pedestrians and cyclists to cross.

The crossing will be a formal crossing (I.e. with red and green indicators showing when to cross) Originally a puffin crossing was intended but having talked to the cycling and walking team a wider a Toucan was chosen that will cater for cyclists as well as pedestrians. So the crossing should improve cycling accessibility.
The pavement beside the southbound lane of Portway has been widened so that pedestrians and cyclists can both fit on the footway. Comments about whether walking and cycling are happy with this haven't yet been received through the TAA process.

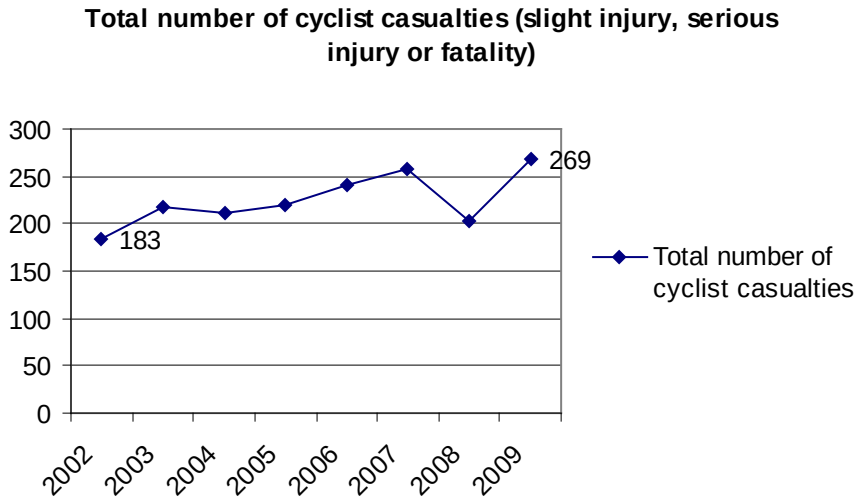
So the scheme was originally a two stage crossing but the new design is a straight through, one stage crossing and at time of interview the scheme manager thought the straight through option would be the favoured one.
The scheme includes reducing the speed of traffic to 40mph. The Council isn't allowed to put in speed cameras unless all other options have been tried and so instead watchman cameras have been put in.

Looking at the Portway scheme through the eyes of RDR
RDR probably wouldn't approve of the high friction surfacing as this might lead to risk compensation (although as previously discussed in relation to the Marksbury scheme the team can point to research that supports the effectiveness of such treatment.) In general RDR would probably approve of the scheme because it is improving accessibility for pedestrians and cyclists, particularly it would approve of the straight through crossing.

Appendix 10 – Portway crossing diagram

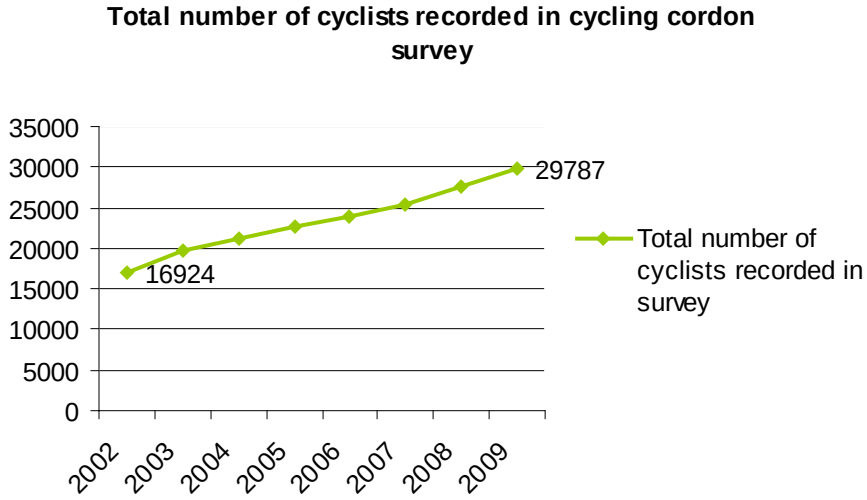


Appendix 11 - Bristol cyclist casualties adjusted for the numbers cycling.
An informal indicator of a casualty rate for cyclists in Bristol was produced. It should be noted this is an informal indicator only and isn't formally endorsed by the Council:



This graph shows the *total* number of recorded cyclist casualties of all severities from 2002 to 2009. As can be seen in general the trend has been upwards.

However information was found about numbers cycling, gathered for JLTP purposes during the same years. The information was gained by cycling cordon counts. There were cordon counts on 43 roads or paths in Bristol. The cordons counted numbers of cyclists travelling in both directions. The cordons covered central and wider areas of Bristol. The numbers recorded cycling are shown below:

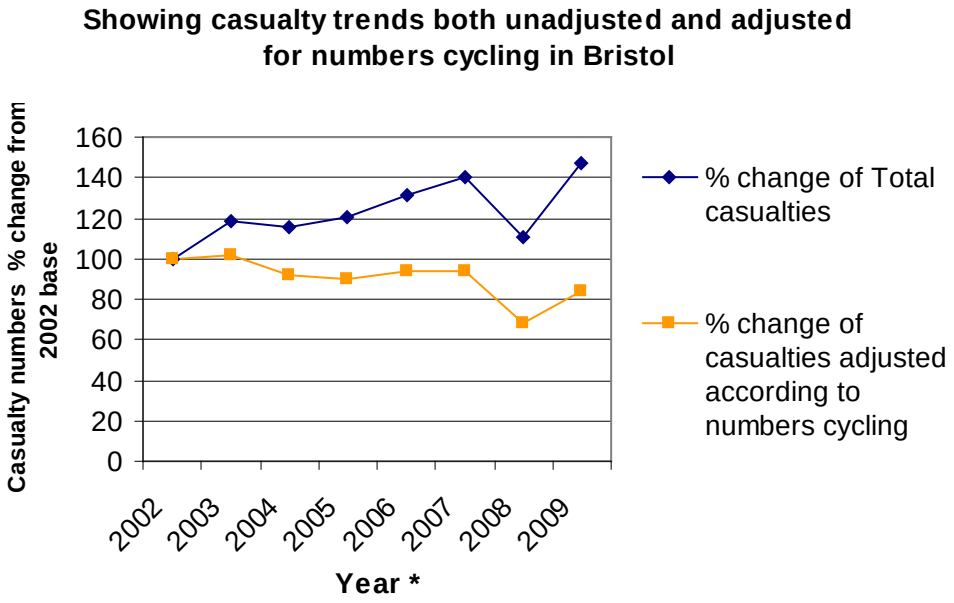


As can be seen the trend of numbers cycling is steadily upwards and the size of the cordon survey is impressive.

A calculation was applied to give an indication of whether cycling casualty rate is going up or down in relation to a 2002 base rate:

If a0 is the total number of casualties in 2002 and a1 is the total number of casualties in a subsequent year and b0 is the number of cyclists recorded in the 2002 survey and b1 the number of cyclists in the subsequent year,

Then, the percentage change in rate compared to 2002 was calculated by a1/a0 X 100 X b0/b1 = % change in casualty rate.



* It should be noted that the 'years' for total casualty numbers ran January to December, whereas the year for the cycle cordon count maybe did not – this doesn't effect the overall trend

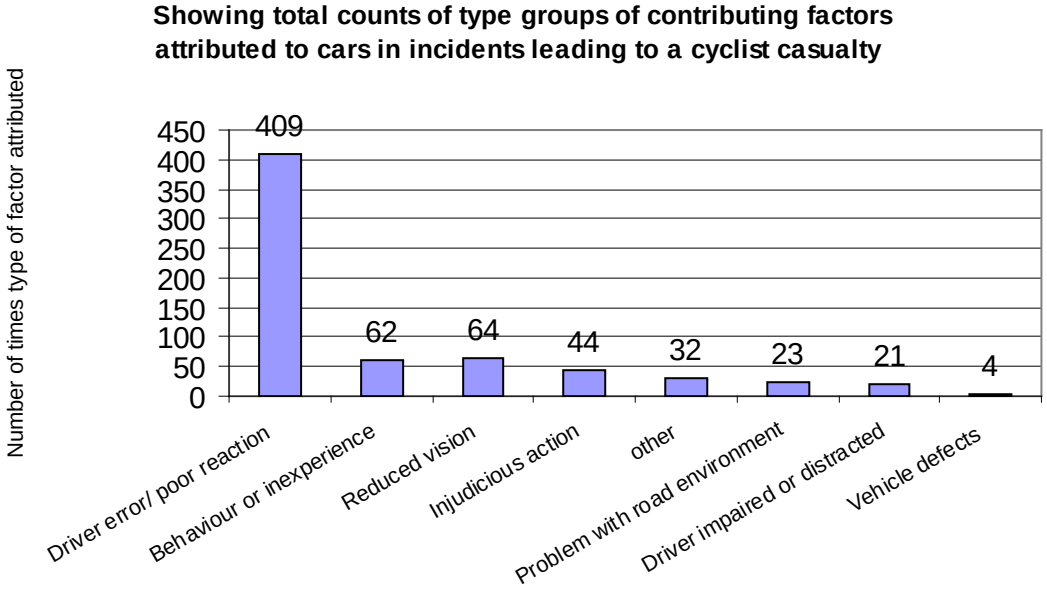
So it can be seen that when adjusted by numbers cycling, the casualty rate has been going down over recent years.

One caveat should be applied that it is possible that although cycling seems to be getting safer as a rate it is still possible that compared to other modes it is becoming relatively more dangerous. Further analysis would have to be done to examine this possibility.

It could be concluded from the above graph that if numbers of cyclists had not been increasing during the past years then casualty trends would have been downwards instead of upwards but remember that a safety in numbers may be in effect – so it could partly be that because there are more people cycling that the 'casualty rate indicator' has a downward trend (as well as engineering interventions, cycling training etc.)

Appendix 12 – Analysis of contributory factors leading to cyclist casualties
It was decided to analyse what contributory factors had been attributed to car drivers in incidents that resulted in cyclist casualties. These contributory factors were recorded in the Police Statistics 19 forms. Caveats should be applied to the accuracy of the data. The main caveat is that the judgment of what contributed to the accident is made by the police person attending at the scene of the collision. As such it may have elements of subjectivity. Also it may be that the car cited may not be the

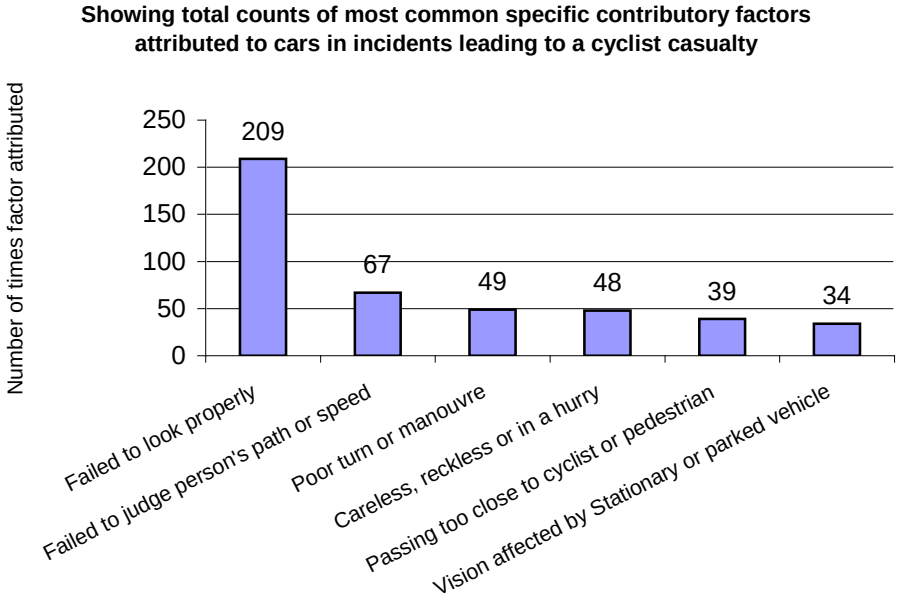
vehicle that collided with the cyclist, however the designation ‘contributory factors’ suggests that the actions recorded played some part in the injury/fatality caused. More than one contributory factor can be applied to one car involved in an incident.



The above graph is very interesting in that it shows by far the most common type of contributory factors that car drivers made were ‘Driver error/ poor reaction errors.’ This is telling, as most of these factors would not usually be considered as ‘illegal’ activity. They include for instance, ‘Poor turn or manoeuvre’, ‘Failed to look properly’, and ‘failed to judge other person’s path or speed.’ These then are mistakes that ‘normal’ drivers might make. This leads to the conclusion that these statistics highlight that it is ‘normal’ driving that contributes to most cyclist casualties, not what most would consider to be ‘illegal driving’. Some specific factors can be given to emphasise this:

‘Failing to look properly’ was a contributory factor attributed in 209 cases.
‘Failing to judge person’s path or speed’ was attributed in 67 cases.
‘Poor turn or manoeuvre’ was attributed in 49 cases.
In contrast
‘Impairment by alcohol’ was attribute in only 5 cases
‘Aggressive driving’ was attributed in only 3 cases
‘Stolen vehicle’ was attributed in only 1 case.

The following graph shows the most commonly attributed specific factors. It shows that one factor stands out in regularity of occurrence as contributing in incidents leading to cyclist casualties. This is ‘failed to look properly.’

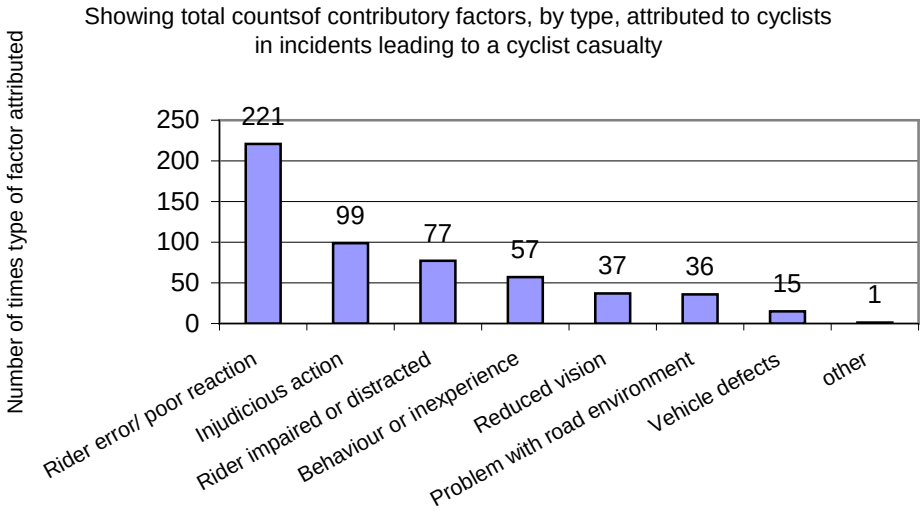


This graph shows the most common specific contributory factors. As can be seen 'failing to look properly' was much more commonly attributed then the other factors.

In conclusion then these statistics suggest that the road safety message should be given out that in total 'normal' driving is responsible for many more casualties then 'illegal' driving. They suggest that the ETP team could do something to address these drivers. In general normal drivers need to be encouraged to be more careful beyond simply avoiding illegal driving behaviours. Clearly national legislation increasing liability and prosecution for careless driving leading to harm could address this, although it is beyond the power of local authorities to achieve this except through lobbying. One caveat about the above conclusions is that perhaps it is 'easier' for police to record factors such as 'Failing to look properly' as being a contributory factor in incidents then other types of factors.

The contributory factors by cyclists in incidents that resulted in cyclist casualties were also examined. The graph below shows that as for cars, 'Rider error/poor reaction' were most often recorded as a contributory factor. It could be suggested that 'injudicious action' such as disobeying highway law and 'Rider impaired or distracted' were more common amongst the cyclists then amongst the car drivers involved in these incidents.

In relation to this analysis RDR would likely come back to the argument that human mistakes will happen, but it is the presence of motor vehicles travelling at high speed that is the controllable factor that at present leads to severe injuries.



Appendix 13 – Further analysis of incidents leading to pedestrian casualties
Bristol statistics were further analysed to find information about what motor vehicles were doing in incidents in which there was a pedestrian casualty. The following are some figures from the statistics:

123 of 1402 (9%) of the pedestrians injured were on the 'footway or verge.'
20 of the 387 (5%) of the child pedestrians were on the footway or verge.
225 of the 1402 (16%) of the pedestrians were crossing on a pedestrian crossing.
45 of the 387 (12%) of the child pedestrians were crossing on a pedestrian crossing.
Incidents causing pedestrian injuries involved 13 cycles, 21 mopeds, 39 motorcycles but 1174 cars.

These statistics should be treated with caution as the forms are filled at the scene of the incident by police officers and may contain elements of subjectivity. However they seem to indicate that it is cars that are involved in many more incidents leading to cyclist/pedestrian casualties then other forms of transport. The pedestrian statistics show that many pedestrians are injured when on footway or verge or when crossing at a pedestrian crossing. This is obviously concerning and suggests that it is not only the carriageway where drivers are endangering non-motorised users. The above statistics give a small indication of what could be undertaken further in terms of analysing those who inflict danger rather than those who suffer it