

## **Road Safety 2.0: Insights and Implications for Government**

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### **Abstract**

*This research provides insights to government into the potential of web 2.0 as a mechanism to engage with the public on issues concerning road safety. It uses the Transtheoretical Model of Change (TTM) to bring about citizen engagement. An important first step in TTM was to establish young people's 'contemplation' of engaging with government via web 2.0 by determining their abilities and expectations. Reasonably high levels of abilities with web 2.0 tools as well as expectations for Road Safety 2.0 applications were found, thus encouraging government to pursue the potential of web 2.0. Expectations were highest for information management followed by data management and citizen engagement. The next stage of TTM will see the public becoming 'active' in their engagement with government. This imposes significant challenges for Road Safety 2.0. Externally, government has to adapt to the attention economy by acquiring 'eye-ball time' for road safety and an increasingly reflexive society that reacts to events on the basis of their own choosing. Internally, government systems have to be transformed to reflect an organisational architecture of participation to enable open and transparent collaboration with citizens.*

**Keywords:** Road Safety, Web 2.0, Transtheoretical Model of Change, Citizen Engagement

## **1 Introduction**

Deteriorating road toll numbers continue to attract a high level of public attention which is reflected in prominent newspaper headlines. The following are just two such examples. On July 17, 2009 the headline in the daily West Australian (WA) newspaper was "Road deaths, injuries costing State billions" in which the "social cost of deaths and injuries" was estimated at \$Australian 2.4 billion. A possible remedy was identified in the same newspaper on July 24, 2009 under the title "Money can halve road toll in WA, says expert". The expert quoted in the article advocated safety measures such as big roundabouts to slow vehicles, incorporating electronic stability controls into cars, fixed speed cameras at known blackspots and reducing speed limits.

However, the expert quoted in the article speculated that motorists would “laugh at” any moves that would drop regional speed limits below the current 110 kmh. This points to the need to better understand the acceptance or non-acceptance of traffic rule changes by road users before they are implemented. The emergence of web 2.0, or so-called social software, offers an opportunity to better understand what the community is willing to accept in respect of road safety for them and to electronically collaborate with government in developing road safety strategies and policies.

The objective of this research is to evaluate the attitude of citizens, especially young people as explained later, to electronically engage with government on matters of road safety. To guide the process of achieving “Road Safety 2.0”, a well known model, the Transtheoretical Model of Change, was used in which the progress towards adopting web 2.0 can be observed through a sequence of stages. In this paper, the early stage of this model is being investigated, namely to what extent does the public ‘contemplate’ adopting web 2.0 approaches in order to engage with road safety issues.

## 2 Web 2.0 and Behaviour Change

A good overview of different perspectives of web 2.0 is provided by Dearstone (2007) who identified leading web 2.0 researchers and their particular emphasis. Even a cursory review of literature reveals a richness of principles and practices. Trends that can be observed are succinctly captured in the following statement.

“Today the Net is evolving from a network of Web sites that enable firms to present information into a computing platform in its own right. Elements of a computer – and elements of a computer program – can be spread out across the Internet and seamlessly combined as necessary. The Internet is becoming a giant computer that everyone can program, providing a global infrastructure for creativity, participation, sharing, and self-organization.” (Tapscott and Williams, 2006, p. 37)

Essentially, web 2.0 can be viewed as a combination of underlying technologies (e.g. Ajax), tools (e.g. wiki) and applications. For this research the scope was narrowed to the latter two with a focus on web 2.0 applications of citizen engagement, data management and information management. The first application, citizen engagement, is defined by Smith et al (2005) as “activities by which people participate in civic, community and political life and by doing so express their commitment to community” (p. 6). The explicit commitment to the community is an important aspect since road safety should be seen as a mutual government-public responsibility. Smith et al (2005) identified ‘meta categories’ that describe online civic engagement.

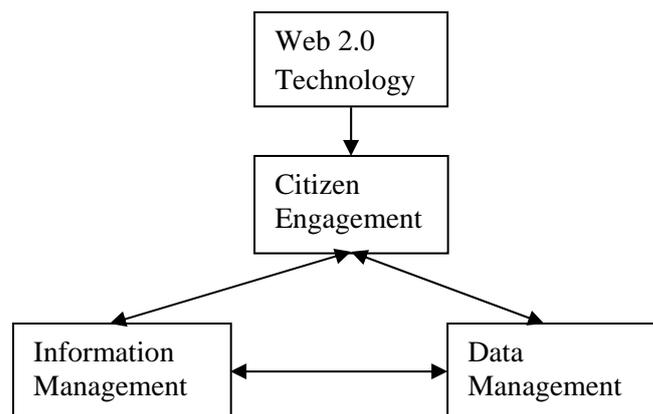
- Collaboration: many people working together on a single activity, effort or project through wikis and discussion boards. For example, road safety strategies can be developed jointly by government and the public.
- Communications: talking with and among constituents through email, chat rooms, listservs, text messaging and instant messaging. Road safety could be improved by, for example, using these tools to alert the motoring public about road hazards.
- Content development: generating and disseminating original news through websites, web logs (weblogs), newsletters, RSS (Really Simple Syndication) and

podcasting. New developments affecting road safety, for example improved car designs, are made available to the public.

Linked with citizen engagement is the ability to provide information in the form desired by the citizen. Web 2.0 provides a potential solution to effective information presentation in that it should be thought of as filling the “gap between a web browser and desktop application.” (Cong and Du, 2007, p. 6) In other words, the technology enables the user to format information closer to what he/she is used to from a desktop application rather than that found on current static web pages. This relies, of course, on the existence of suitable documents and data. The importance of data is recognised by O’Reilly (2005) who stresses that “Data is the next Intel inside”. In other words, the success of an organisation in future will depend on its database management competency. According to O’Reilly (2005) database management is becoming a core competence requirement for organisations in the web 2.0 era.

To provide citizens with the ability to manage data in the way it sees fit differs from the traditional approach of information management. Under the latter, government decides the content, format and retrieval mechanism of information it displays on its website. This approach suits the typical information seeker rather than one that wants to discover new and innovative forms of information. The difference can be illustrated as follows. In the case of road safety, information about safe car design can be made available by government in generic form covering the basic models of cars. However, by providing a portal for the collective work on the topic that uses hyper-linking as the foundation, the user can now assemble sources of data in novel or effective ways and search for data by not only the characteristics of the document but also link structures. In this way, car owners can modify the data to suit their particular circumstances, i.e. the configuration of the car they drive.

The relationships between the research constructs are shown in Figure 1. Web 2.0 technology enables citizen to engage with government and hence its data and information.



**Figure 1:** Overview of Research Constructs

With web 2.0, the challenge government face is to change the motoring public’s behaviour from being disengaged to being engaged with them in improving road safety. Behaviour change has been examined in previous research by applying the

Transtheoretical Model of Change (TTM). This looks at the psychological aspects of physical and cognitive characteristics of individuals and provides stages and processes to achieve change behaviour, i.e. to modify problem behaviour or acquire positive behaviour. It is a model of intentional change and focuses on decision making of the individual (Velicer et al, nd). Initial studies have used it in health related areas (e.g. Prochaska et al, 1994; Prochaska and Velicer, 1997) but more recently in diverse settings such as encouraging behaviour to increase savings for retirement (Xiao et al, 2004) and to seek protection against fires (Martin et al, 2007).

TTM has relevance for Road Safety 2.0 in that seeks to develop a positive attitude among the public to engaging with government on road safety. Of interest to this research is the application of TTM in conjunction with the opportunities offered by web 2.0. In other words, the research is not about changing the public's behaviour when using roads per se (e.g. driving at low speeds) but about changing their attitudes to road safety by engaging with the topic via the use of web 2.0 (e.g. in developing strategies and policies). The model has six distinct decision-making stages that individuals face when considering behavioural change: precontemplation, contemplation, preparation, action, maintenance, and termination (Martin et al, 2007).

During the precontemplation stage, the theoretical foundations of encouraging citizens to engage with government are evaluated. In other words, the opportunities and attractiveness of web 2.0 as means of engaging with government are determined and if assessed as being substantial, the next stage of behaviour change can commence. Based on the theoretical discussions above it was determined that there exists sufficient merit for the public in the web 2.0 approach to road safety. For a more comprehensive analysis see Fink (2007). Hence, the current research takes place in the 'contemplation' stage of TTM in that it seeks to establish whether or not the public is prepared to change (i.e. considers to actively engage with road safety issues via web 2.0) based on their assessment of the approach. For this research this was examined along the constructs of their web 2.0 ability and reaction to web 2.0 applications that constitute Road Safety 2.0.

The willingness of citizens to engage with government has been researched in various endeavours. For example, Sommer and Cullen (2009) used a wiki to encourage citizens to engage with New Zealand agencies (bioethics, policing) and observed engagement but this has not yet been fully achieved. Research by Tan et al (2008) found that technology alone was not sufficient to encourage engagement; websites need "human-like traits" to convey service competency, benevolence and integrity. This was endorsed by Barnes and Vidgen (2007) who found that "interactors" (as opposed to information seekers) rated website quality much lower for the UK Inland Revenue because they expected empathy and personalisation for their individual needs.

### **3 Research Design and Conduct**

To represent the public, young people were selected since it is generally acknowledged that this group is over-represented in road accident statistics. For convenience, the researcher selected the sample from students at his university and, furthermore, invited those who were studying Business Information Technology (BIT) related courses. It was assumed that they would be the most familiar with web 2.0 tools and applications among the student cohort.

A quantitative approach was adopted in that a questionnaire was administered to students at both under- and post-graduate levels. The questionnaire contained the research constructs discussed earlier, namely web 2.0 tools and web 2.0 applications of citizen engagement, data management and information management. Each of them was operationalised into six variables as shown in the following tables. The instrument was peer-reviewed by an expert working for the WA government road safety authority as to its wording and intentions. Being part of a university, the questionnaire was approved by its ethics committee for such issues as confidentiality and voluntary participation.

#### 4 Participants’ Backgrounds and Abilities

The study surveyed 108 students from whom 103 satisfactorily completed questionnaires were obtained. Forty-seven were completed by undergraduate students and fifty-six by postgraduate students. Table 1 provides demographic background data.

	N	%
<b>Age (in years)</b>		
Below 18	6	5.8
18-21	25	24.3
22-25	27	26.2
Above 25	45	43.7
Total	103	100.0
<b>Number of years in possession of a driver’s licence</b>		
No licence	11	10.7
Less than 1 year	15	14.6
1 – 4 years	47	45.6
5 – 8 years	10	9.7
More than 8 years	20	19.4
Total	103	100.0
<b>Type of vehicle mostly used</b>		
None	15	14.6
Motorcycle	7	6.8
Motor car	81	78.6
Total	103	100.0

**Table 1:** Demographic Data of Participants

Table 1 indicates that 57% of students were under 25 years of age, most of them possessed a driver’s licence between 1 and 4 years (45%) and used a motor car most often (78%).

Before asking specific questions about abilities, expectations and experiences with web 2.0, general questions were asked to capture the overall ‘feeling’ towards the research topic. Replies indicated that participants had strong empathy with road safety (4.27 on a 5-point scale) and the role of WA government in ensuring road safety (4.16). While still above the midpoint of the scale, the feeling for applying web 2.0 to road safety was slightly less pronounced (3.58).

Participants were asked general as well as specific questions about their web 2.0 ability. When asked generally they indicated that their understanding of web 2.0 was 3.30 and using web 2.0 was 3.51, both on a 5-point scale where 1=very poor and 5=very high. The following table shows their abilities with particular web 2.0 tools.

<b>I am able</b> to engage with a website on road safety issues through being familiar with	Mean	St dev
1. sending text messages through email	3.60	1.32
2. engaging with others on electronic forums	3.57	1.14
3. generating content material through weblogs	3.33	1.15
4. generating content material through wikis	3.21	1.10
5. controlling how data is displayed	3.32	1.13
6. RSS that feed information to me	3.21	1.15

**Table 2:** Ability with Web 2.0 Tools  
(1=strongly disagree 5=strongly agree, N=101)

The ratings are all above the scale midpoint and indicate an even spread across all 6 items; no one item stands out. However, variations in ratings for each item are reasonably high as shown by the standard deviations.

## 5 Expectations for Road Safety 2.0

What can be regarded as the core of the questionnaire concerned the expectation of participants to engage with road safety as a citizen and with data and information about road safety via a website. This implied that a road safety website was based on web 2.0 approaches as discussed earlier. The following sections provide tables that reflect their opinions.

The use of a road safety website <b>should enable me</b>	Mean	St dev
1. to be engaged with developing road safety policy	3.91	0.97
2. to share opinions with the broader community on road safety	4.00	1.01
3. to contribute to my community on road safety	3.98	1.00
4. to edit road safety information provided on the website	3.21	1.25
5. to be treated as a co-developer of road safety information	3.44	1.18
6. to be part of the collective intelligence of the public on road safety	3.82	1.04

**Table 3:** Expectations for Citizen Engagement  
(1=strongly disagree 5=strongly agree, N=102)

Responses were evenly spread, ranging from 3.21 (edit road safety information) to 4.00 (share opinions with the community). It is noted that only one item rated 4.00 or above.

For me, data on a road safety website <b>should</b>	Mean	St dev
1. be easy to use	4.50	0.93
2. be easy to navigate	4.45	0.92
3. integrate with other government data	4.20	1.02
4. notify me every time data changes	3.79	1.16
5. offer data variety formats	3.94	1.03
6. offer searching facilities	4.35	1.02

**Table 4:** Expectations for Data Management  
(1=strongly disagree 5=strongly agree, N=103)

Ratings were evenly spread across items but higher than for citizen engagement reported in Table 3 above. Only 2 items were rated below 4.00 with ratings ranging from 3.79 (notify when data changes) to 4.50 (ease of use).

For me, a road safety website <b>should</b>	Mean	St dev
1. provide information about government policy	4.23	0.93
2. link road safety information to other government information on policing, road construction, etc	4.05	0.98
3. link with other information such as vehicle safety	4.28	0.89
4. provide information on road safety products and services	4.15	0.91
5. provide information that reflects expert opinions	4.12	0.97
6. provide information that is up-to-date	4.53	0.88

**Table 5:** Expectations for Information Management (1=strongly disagree 5=strongly agree, N= 103)

Among all the ‘expectation’ constructs, information management was rated highest; all items were above 4.00. The spread was even ranging from 4.05 (link road safety information) to 4.53 (provide up-to-date information).

## 6 Perceptions of Current Websites

To obtain feedback on current experiences dealing online with government, participants were asked their opinions on generic aspects of a website. This was done for government websites and the road safety website. Of the 103 participants, 76 indicated that they had experience with government websites (Table 6) while 26 indicated their experience with the WA road safety website (Table 7).

To me, government websites, should be/are	Expectation		Experience	
	Mean	St dev	Mean	St Dev
1. Easy to access	4.49	0.94	3.54	1.03
2. Easy to use	4.56	0.91	3.18	1.02
3. Quick to respond	4.39	0.94	2.88	1.11
4. Provide effective information	4.54	0.90	3.41	0.98
5. Encourage my feedback	3.92	1.07	2.80	1.21

**Table 6:** Expectations of and Experiences with Government Websites (1=strongly disagree 5=strongly agree, Expectations N=103, Experiences N=76)

Statistical analysis revealed that for all 5 variables above, expectations exceed experiences in a significant way (Sig.=.000). Somewhat surprising is the low expectation to encourage feedback, both as an expectation and as an experience. This could have a link with the experience in getting a response quickly which was rated lowly at 2.88 on the 5-point scale.

To me, the government road safety website, should/does	Expectation		Experience	
	Mean	St dev	Mean	St Dev
1. Emphasise road safety as an important issue	4.34	0.97	3.92	1.12
2. Demonstrate that knowledge exists to make roads safer	4.26	0.95	3.50	1.03
3. Raise the public's awareness about road safety	4.31	0.99	3.58	0.98
4. Engage the public on road safety	4.25	1.02	3.31	1.01
5. Be a major information source on road safety	4.15	1.12	3.35	1.09

**Table 7:** Expectations of and Experience with Road Safety Website

(1=strongly disagree 5=strongly agree, Expectations N=102, Experiences N=26)

Statistical analysis revealed that for 4 of the variables above, expectations exceed experiences in a significant way (Sig.<.001). The exception was 'emphasis on road safety' for which expectations and experiences with the website were not significantly different ( $t=.207$ ,  $df=24$ , Sig.=.207). All expectations were rated high (all over 4.00) while all experiences were rated low (all under 3.00).

## 7 Insights into Findings

Findings indicated a strong empathy among participating young people towards making WA's roads safer and their conviction of the role of government in this. This provides a solid base from which to explore the potential of government using web 2.0 approaches in achieving better road safety; an objective which participants broadly agreed with. Further support for pursuing this objective was reflected in the response that indicated general high abilities with web 2.0 tools, both with their understanding as well as using them, among participants. Web 2.0 abilities were rated evenly across tools identified as email, electronic forums, weblogs, wikis, data display and RSS.

Based on the above findings, the following potential opportunities therefore become available. To open engagement with the public, weblogs could raise issues and receive opinions on road safety issues. They would replace the static nature of websites leading to a dynamic exchange of ideas and result in rapidly growing content. Content development produces draft road safety strategies and policies which can be made available on electronic forums, especially wikis, useful for inviting the public to edit content and offer comments. The refined documents can then be communicated to a broad range of subscribers through RSS. This offers a low-cost, low-resource push technology and can be also be used to notify the public about road safety promotions, events, important dates, etc.

When asked about their expectations from a website that supports web 2.0 based applications of citizen engagement, data and information management, expectations for information management were rated highest, followed by data management and citizen engagement. This finding is both understandable as well as surprising. Being BIT students, it was reasonable to expect participants rating information management practices (e.g. currency of information, the relationship between information) very highly. What was surprising is that expectations for data management and citizen

engagement were rated lower because of their increased relevance to web 2.0 as discussed earlier and re-iterated below.

The success of the organisation in future will depend on its database management competency (O'Reilly, 2005), i.e. providing extensive data to the public. The public in turn is able to control how data is displayed within web 2.0 approaches. By gaining access to government data, the public is able to improve their contextual understanding of road safety since they can, by themselves, display an overlay of one data set on top of another data set (also referred to as mashing together). In this way they become their own managers of road safety information. The relative low rating for the variable titled 'data variety formats' indicated that participants most likely have not yet grasped the significance of data management under the web 2.0 approach.

Least rated was the research construct of citizen engagement. This may indicate the unfamiliarity of young drivers engaging with government. As indicated earlier, citizen engagement is in its early stages of adoption in WA and at present in a static form, i.e. inviting the public's input through email responses. Web 2.0 will change this dramatically since emphasis is placed on interactive collaboration with government. Rated relatively highly by participants, and therefore a promising sign, were sharing opinions with the broader community (akin to the 'wisdom of the crowd'), and making a contribution to the community (i.e. taking personal responsibility for road safety).

The above finding of low expectation for citizen engagement overall may also be due to the finding of a significant gap between what was currently expected of government website features and what experience provided. Statistical analysis revealed that for government websites, the expectations for ease of access and use, responsiveness, information effectiveness and feedback exceeded experiences in a significant way. Most noticeable was the low rating for encouraging feedback, both as an expectation and as an experience. This is an important aspect of engagement between government and its citizens and has so far, according to the participants, not been effective.

Similar findings were established for the WA road safety website. While only 26 had experiences with this website, their expectations significantly exceeded experiences with the exception of the website placing 'emphasis on road safety' for which expectations and experiences were not significantly different. All expectations (emphasising road safety, demonstrating road safety knowledge, raising public's awareness, engaging the public, being the major information source) were rated highly (all over 4.00) while all experiences were rated lowly (all under 3.00). By improving these website features, the gap between expectations and actual website experience on road safety would be narrowed.

While the survey achieved a satisfactory number of responses, the following limitations should be acknowledged. The sample of 103 students was selected because of the convenient access to them by the researcher. Furthermore, they were undertaking BIT related units which could have given them better ability and understanding of web 2.0 approaches than other groups of young drivers.

## **8 Implications for Government**

Following the above findings, this section outlines the proposed next stage of Road Safety 2.0. It follows the sequence of activities of the Transtheoretical Model of Change that was discussed in an earlier section. The next stages of change, therefore, are

'preparation' and 'action' when the public begins to actively engage with road safety topics through web 2.0 applications outlined earlier. However, this will not materialise unless government is Road Safety 2.0 ready. It is therefore recommended that it proceeds along two fronts, an outward-facing as well as an inward-facing one.

From that external perspective, it is suggested that the road safety authority, as the first step, raises the public's awareness of, and encourages it to give attention to, the topic of road safety. As observed by Marche and McNiven (2003) "in terms of the 'attention economy', the expansion of media, especially in terms of television and the Internet, means that government will have to work harder to acquire 'eyeball time' or 'mind sharing'." (p. 80) Road safety is only one among many government activities competing for the public's attention. Furthermore, citizens may not be satisfied with the information provided by what they perceive to be functional, insular departments structured as silos or stove-pipes. Marche and McNiven (2003) refer to an increasingly "reflexive society", defined as "the tendency of citizens and customers to react concretely to events on a basis of their own choosing, rather than just accept the explanation of authorities." (p. 77) In the case of road safety, citizens may, for example, want to access information on road safety related topics such as health, policing, road construction, etc. to form their own opinion on the topic rather than accepting what is currently provided.

With increasing electronic citizen engagement, the impact of this on internal systems and processes should be evaluated. An analysis of the success or otherwise of web 2.0 technologies led Short (2008) to conclude "Regardless of which specific technologies are used, it is how web 2.0 is implemented and how the associated risk are managed that will be most important" (p. 30). The interactive nature of applications requires new and immediate organisational responses. For example, technological security measures have to be implemented to overcome new vulnerabilities (e.g. hacker attacks) and social risks (e.g. an employees response is taken to imply formal policy) have to be identified and ameliorated.

In addition, the overarching 'disruptive' impact of web 2.0 (increased collaboration, communication, etc) requires a broad organisational response. Mintz (2008) refers to this as "turning inside out the classical approach to organizational structures and business relationships" (p. 24). More specifically, Garnett and Ecclesfield (2008) termed the new environment, where the technology-enhanced organisation and public value are aligned, an "organisational architecture of participation". They identified the key requirements for this structure as the ethos and values of the public organisation and the creation of public value in the form of better outcomes, services and trust. They can only be realised by transparency in the work being undertaken and forming partnerships with stakeholders (i.e. the public) in the form of collaborative networks. Similarly, Barbagallo et al (2010) identified the need for government to develop eGovernment ontologies for participative, social processes; in their case the Social Ontology Building and Evolution (SOBE) methodology.

The road to fully exploit the opportunities offered by web 2.0 is an uncertain one and the conclusion formed by Mintz (2008) appears to capture the current state of development very well.

"By its varied nature, these new Internet-enabled technologies allow unpredictable interactions between unexpected stakeholders producing unplanned results, none

of which offer comfort to the typical government agency. To participate, government agencies will need to define small pilot projects and give staff flexibility to experiment. In our current ‘blame first, ask questions later’ environment, it will take strong leadership for this to occur.” (p. 24)

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Road Safety Matters Company-wide Road crashes have massive financial, legal, reputational, and social implications for companies. Investing in safer transportation programs can benefit business by improving employee health and safety, protecting assets, reducing productivity losses and healthcare costs, and by enhancing the efficiency and effectiveness of supply chains. Legal implications are another key area to consider, with the total cost of a fleet insurance claim being estimated up to 36 times higher than just the cost of repairing a vehicle.<sup>9</sup> Not only does investing in road safety make sound financial, legal, and business sense, developing a corporate road safety program can have a positive impact on a company's public. Provide frameworks to governments and other parties involved in road safety to develop strategies intended to improve road safety and reduce road traffic fatalities. Illustrate key evidence from countries that adopted successful road safety strategies that effectively reduced road fatalities. Support the delivery of the United Nations General Resolution adopted in 2010 which calls upon member states to take the necessary steps to make their roads safer. Moreover, they can have negative social implications for the families of those involved as well as on local communities. According to the World Health Organisation (WHO), road traffic accidents can cause a loss of up to 3% of the global GDP, and up to 5% of GDP for low and middle-income countries.

Redesign Roads with Safety Edges – Installing a roadway safety is an effective paving design that is constructed with a 35-degree slope along the outer edge of the road. The addition of the safety edge reduces the potential of the wheel inadvertently falling over the edge of the road which can cause the motorist to lose control of the vehicle and cause a rollover crash.

Readjusting the length of time yellow light remains lit by one more second before it changes to red can significantly reduce numbers of red light violation by half and save lives.

Install Refuge Areas in Crosswalks – The installation of pedestrian refuge areas (islands) away from the sidewalk and along with raised medians can reduce the number of pedestrian-related vehicle accidents.