3. Bauman A, Rissel C, Garrard J, Ker I, Speidel R, Fishman E. Cycling: Getting Australia moving: Barriers, facilitators and interventions to get more Australians physically active through cycling. Melbourne: Cycling Promotion Fund, 2008.

4. Henley G, Harrison, JE. Serious injury due to land transport accidents, Australia 2006-2007. Injury Research and Statistics Series #53. Canberra: Australian Institute of Health and Welfare, 2009.

5. Berry JG, Harrison JE. Serious injury due to land transport accidents, Australia, 2003-2004. Injury Research and Statistics Series #38. Canberra: Australian Institute of Health and Welfare, 2007.

6. Fincham B. Bicycle messengers and the road to freedom. The Sociological Review, 2006; 54(s1): 208-22.

7. Basford L, Reid S, Lester T, Thomson J, Tolmie A. Drivers' perceptions of cyclists. Report No TRL549. Berkshire: Transport Research Laboratory, 2002.

8. Ipsos-Eureka Social Research Institute. The Ipsos-Eureka Road Safety Review. Issue 3, April 2010.

9. Farris C, Spaite DW, Criss EA, Valenzuela TD, Meislin HW. Observational evaluation of compliance with traffic regulations among helmeted and nonhelmeted bicyclists. Annals of Emergency Medicine, 1997; 29: 625-29.

10. Johnson M, Charlton J, Oxley J. Cyclists and red lights – A study of behaviour of commuter cyclists in Melbourne. Australasian Road Safety Research, Policing and Education Conference, Adelaide, 2008.

11. Gilbert K, McCarthy M. Deaths of cyclists in London 1985-92: The hazards of road traffic. British Medical Journal, 1994; 308: 1534-37.

12. Hunter WW, Stutts JC, Pein WE, Cox CL. Pedestrian and bicycle crash types of the early 1990's. In National Cooperative Highway Research Program. Guidance for implementation of the AASHTO strategic highway safety plan. 2008. Volume 18: A guide for reducing collisions involving bicycles. Report #500. Washington DC: Transportation Research Board, 1996.

13. Kirkcaldy BD. Personality profiles at various levels of athletic participation. Personality and Individual Differences, 1982; 3, 321-26.

14. Zuckerman M. Sensation seeking and sports. Personality and Individual Differences, 1983; 4: 285-93.

15. Svebak S, Kerr J. The role of impulsivity in preference for sports. Personality and Individual Differences, 1989; 10: 51-58.

16. Duroy LC. A comparison of sensation seeking and personality measures between road cyclists and mountain bikers. PhD dissertation, Oklahoma State University, 2000.

17. Gat I, McWhirter BT. Personality characteristics of competitive and recreational cyclists. Journal of Sport Behaviour, 1998; 21(4): 408-20.

18. Rothengatter T. Psychological aspects of road user behaviour. Applied Psychology: An International Review, 1997; 46(3): 223-34.

19. Parker D, Manstead ASR, Stradling SG, Reason JT, Baxter JS. Intention to commit driving violations: An application of the theory of planned behaviour. Journal of Applied Psychology, 1992; 77(1): 94-101.

20. Rimmö P-A, Åberg L. On the distinction between violations and errors: Sensation seeking associations. Transportation Research Part F2, 1999; 151-66.

21. Trimpop R, Kirkcaldy B. Personality predictors of driving accidents. Personality and Individual Differences, 1997; 23(1): 147-52.

22. Elvik R, Mysen AB. Incomplete accident reporting: Meta-analysis of studies made in 13 countries. Transportation Research Record, 1999; 1665: 133-40.

23. Stutts JC, Hunter WW. Motor vehicle and roadway factors in pedestrian bicyclist injuries: an examination based on emergency department data, Accident Analysis and Prevention, 1999: 31(5): 505-14.

24. Queensland Transport, Data analysis unit road crash glossary. Data Analysis Unit, Land Transport & Safety, Queensland Transport, 2008.

25. Australian Bureau of Statistics. Bicycle usage: Queensland. Document 9215.3. Canberra: Australian Bureau of Statistics, 2004.

26. Cross DS, Hall MR. Child pedestrian safety: The role of behavioural science. Medical Journal of Australia, 2005; 182(7): 318-19.

27. Ball K, Owsley C, Stalvey B, Roenker DL, Sloane ME, Graves M. Driving avoidance and functional impairment in older drivers. Accident Analysis and Prevention, 1998; 30(3): 313-22.

28. Veisten K, Sælensminde K, Alær K, Bjørnskau T, Elvik R, Schistad T, Ytterstad B. Total costs of bicycle injuries in Norway: Correcting injury figures and indicating data need. Accident Analysis and Prevention, 2007; 39(6): 1162-69.

29. Haworth N. Integrating policy approaches for vulnerable road users. Proceedings, 29th Australian Transport Research Forum, Gold Coast, 2006.

Painting a designated space: Cyclist and driver compliance at cycling infrastructure at intersections

by Marilyn Johnson, Judith Charlton, Stuart Newstead and Jennifer Oxley, Monash University Accident Research Centre, Monash University, Clayton, Victoria

Abstract

This study evaluated cyclist and driver compliance at cycling infrastructure at signalised intersections to determine the effectiveness of the infrastructure in creating a designated space for cyclists. A cross-sectional observational study was conducted during peak travel times at six sites in Melbourne in March 2009. Three types of infrastructure were observed: 1) bicycle storage box in front of left lane, 2) bicycle storage box in front of centre lane and 3) continuous green-painted bicycle lane. Two sites were observed for each infrastructure type, one morning and one early evening. A covert fixed position video camera was used to film all road users, and the behaviour of cyclists and drivers who stopped at the intersection during the red light phase was coded. In total, 2670 cyclists and 1243 vehicles were observed. Compliance was highest at the continuous bicycle lane sites for cyclists (95.4%) and drivers (97.7%). At bicycle storage box sites, cyclists (60.4%) were more compliant than drivers (49.6%). The placement of bicycle storage boxes may contribute to lower rates of driver compliance and cyclists' perceptions of safety and subsequently cyclist compliance. Driver and cyclist education campaigns may increase compliance.

Keywords

Cycling infrastructure, Driver compliance, Cyclist compliance, Bicycle storage box

Introduction

On-road cycling infrastructure is designed to create designated spaces for cyclists. Recent studies suggest that treatments give drivers confidence about interacting with cyclists [1], cyclists prefer routes with cycling infrastructure [2-4] and report feeling safer [5,6]. However, for the infrastructure to be effective, drivers and cyclists need to be compliant, and there has been little research into how cyclists and drivers use these spaces and whether the infrastructure creates a clear space for cyclists on the road.

The number of people cycling in Australia is increasing [7] and so too is the introduction of cycling infrastructure. During the last decade in metropolitan Melbourne, for example, there has been a substantial increase in the installation of cycling facilities in an effort to improve the overall safety of cyclists, increase their visibility and legitimacy, and improve traffic flow [8]. The principal bicycle network currently has 1200km of completed on-road and off-road cycling routes [9]. The most common bicycle infrastructure implemented in Victoria is a bicycle lane, typically a painted white line with a painted bicycle symbol along the left side of the kerbside lane. In some locations across Melbourne, the bicycle lanes are painted green to increase driver and cyclist awareness of the lane particularly, at busy or complex locations [10].

While cycle lanes are effective in providing separation of cyclists and vehicles, one of the major disadvantages is that they inevitably cross roads at various points, and interaction with vehicular traffic at intersections places cyclists at heightened risk. In many cases, bicycle lanes discontinue on approach to intersections. Indeed, along Melbourne's most used on-road commuter cyclist route, St Kilda Road, most mid-block bicycle lanes discontinue on approach to the intersection, and cycling infrastructure is absent from the holding area and through the intersection.

In some locations a bicycle storage box (see description in next paragraph) is provided at the intersection bar. According to the Australian and Victorian traffic engineering guidelines, at points where the road narrows, cyclists are expected to defend their space among moving vehicular traffic by positioning themselves in the centre of the lane [11] as the priority for space allocation on the roads is to vehicles [12]. However, where there are feeder lanes into the bicycle storage box, cyclist behaviour has been found to be more predictable than when the bicycle lane discontinues [13].

Bicycle storage boxes have been widely installed in Melbourne. Also called advanced stop lines or head start areas, bicycle boxes originated in the Netherlands. They are painted on the road at the front of the vehicular traffic lane at intersections and aim to create a separate space for cyclists to wait during the red light phase. The position increases driver awareness of the cyclist, thus increasing cyclist safety [6, 14].

Cycling infrastructure research in New Zealand identified the primary objectives of the boxes were to improve cyclists'

physical safety and reduce cyclists' perceived risk at intersections. The study found a reduction in driver-cyclist collisions after the installation of the box, and cyclists reported feeling safer. However, the authors reported that drivers did not like cyclists 'stacking' ahead of them and felt unsure or non-committal about the purpose and function of the box [15].

In Victoria, an additional intention of the boxes was to formalise, and in doing so legitimise, the informal behaviour of cyclists of rolling through to the front of traffic during the red light phase [16]. In addition, the boxes have the advantage of locating cyclists away from vehicle exhausts while waiting in traffic, and provide an opportunity for them to leave from the traffic lights first, ahead of vehicular traffic [12, 17].

For the bicycle storage box to be effective, the space must be kept clear for cyclists. Several studies have found that vehicle encroachment during the red light phase has created concern for cyclists. Newman found that driver intrusion did influence cyclist confidence and their position at the intersection. In video observations, cyclists were likely to use the box, whereas drivers were the least compliant and intruded on or obscured the cycling infrastructure [15]. A before-and-after observational study of bike storage box installations in the United States found that slightly more than half the vehicles observed (51.9%) encroached into the box [17]. In the United Kingdom, of 5114 cyclists observed, 36% experienced a vehicle encroaching into the bike storage box [13].

Driver and cyclist education about how to interact with the cycling infrastructure also influence compliance [13, 15, 17]. In Victoria, the current graduated licensing system is underpinned by the Victoria drivers licence handbook Road to Solo Driving. There are numerous references to bicycle lanes and appropriate driving behaviour when sharing the road with cyclists. However, there is limited information on broader cycling infrastructure, with only one reference made to bicycle storage boxes, referred to as 'head start' areas, with no information about appropriate driver behaviour at a bicycle storage box [18].

More extensive information about driver and cyclist behaviour, including an increase of penalties for encroaching into a bicycle storage box, has been available on the VicRoads website since changes to the Victorian road rules in November 2009. Drivers may be fined up to 10 penalty points (currently $1168.20) [19, 20]. There are detailed instructions about the correct positioning of drivers and cyclists on the road with a clear, instructive animated graphic. However, this information is located on a cyclist-specific road rule site, and it is not known how many non-cycling drivers view this page.

The aim of this study was to evaluate cyclist and driver compliance at different cycling infrastructure treatments at signalised intersections. Given the increasing number of cyclists in Australia and the lack of research focused on the safety implications of cycling infrastructure, it was anticipated that the findings would contribute to knowledge about infrastructure use and highlight potential solutions to improve cyclist safety.

Methods

This study was designed to assess the compliance of cyclists and drivers at signalled intersections with varied cycling infrastructure. The observation sites included three types of cycling infrastructure that have been implemented along the most frequently used on-road cyclist commuter routes in metropolitan Melbourne. A novel covert position was used to record the behaviours of all cyclists and drivers who entered the sites.

Research design

This was a cross-sectional observational study of on-road commuter cyclists. The study was conducted in March 2009 at six sites along popular on-road commuter cyclist routes on St Kilda Road and Swanston Street [21]. All sites were within five kilometres of the central business district (CBD), as measured from the Melbourne Town Hall. Each observation was a three-hour recording repeated over six non-consecutive days either at 7-10am or 4-7pm, resulting in 18 hours of recordings per site. Given the time of the observations, it was assumed that most cyclists and drivers were commuting to or from work. It was not necessary to observe multiple approaches, as the peak flow of commuter cyclists travelled in one direction at all observed sites.

Observation sites

Three types of cycling infrastructure at intersections were observed: a bicycle storage box in front of the left lane, a bicycle storage box in front of the centre lane and continuous green-painted bike lane. As the majority of the cyclist traffic flow is one way during peak hour travel times, only one approach was observed at each site. The three treatment types are illustrated in Figure 1.

Bicycle storage box in front of the left lane

Intersections with bicycle storage boxes in front of the left lane (Figure 1, diagram 1) were observed at two intersections on the most used on-road cycling commuter route in Melbourne, along St Kilda Road from the south-eastern suburbs of Melbourne [21]. Two sites were observed, one in the morning (in-bound) and one in the afternoon (out-bound). The signals at this intersection did not have a left-turn filter light. This is

the most common bicycle storage box position along the selected route.

Bicycle storage box in front of the centre lane

The second type of bicycle storage box (Figure 1, diagram 2) was also observed along St Kilda Road, and at these sites the bicycle storage box was located in front of the centre vehicular lane. The intersections with this infrastructure had a dedicated left-turn vehicle lane with a left turn filter light. The position of the centre storage box placed cyclists ahead of drivers who were continuing straight through the intersection.

For all bicycle storage box sites observed, there was no bike lane on the approach to the intersection. The mid-block bike lane discontinued prior to each observed site.

Continuous bicycle lane

The third type was green-painted bicycle lanes that continued from midblock to the intersection; the lane did not continue through the intersection, as shown in Figure 1 (diagram 3). These sites were located along Swanston Street to the north of the CBD. The lanes were located kerbside, parallel to the vehicular traffic, and were continuous with the mid-block Copenhagen-style bike lane. These sites did not have a bicycle storage box at the intersections.

Procedures

A Sony DCR-SR62 video camera was positioned inside a small grey box and attached to a roadside sign post that gazetted parking time details. The camera position recorded the behaviours of all road users who entered the space, and continuous recording allowed detailed analysis of cyclist and driver behaviours. The covert positioning of the camera eliminated potential behavioural bias, as cyclists and drivers were unaware they were being filmed.

There were weather-related restrictions to the observations to minimise potential bias. Observations were not conducted on days over 35°C or when it rained during the morning observation period, as on these days there were lower numbers of cyclists and fewer female cyclists. Observations continued on the next suitable day.
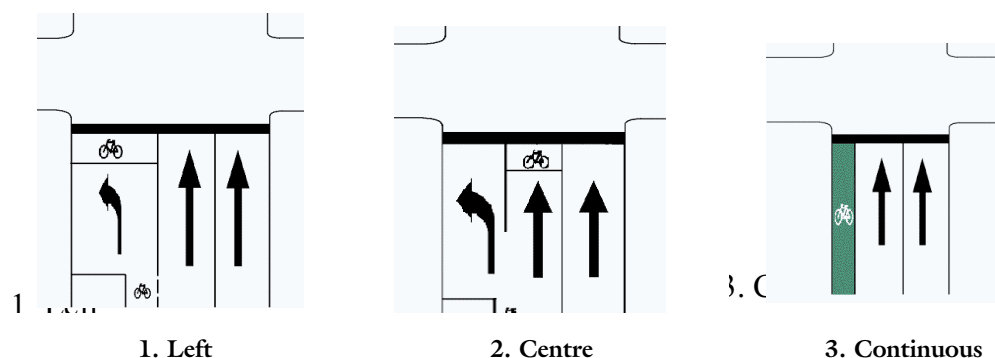

1. Left   **2. Centre**   **3. Continuous**

Figure 1. Cycling infrastructure observed

Definitions of cyclist and driver compliance

Of interest was cyclist and driver compliance at the cycling infrastructure types when approaching a red light. At the bicycle storage boxes, cyclist compliance was defined as entering the bike storage box with at least one wheel in the box. For drivers, compliance was defined as stopping before the bicycle storage box, defined as the front wheels of the vehicle stopping before the white line of the box. It was possible that there may still be vehicle encroachment, with the bonnet of the vehicle entering the bicycle storage box; however, given the perspective recorded by the camera, the wheel-based classification was the only objective classification possible across all the sites. Only the first vehicle to approach the intersection was coded at all sites. Non-compliance was recorded when the wheels encroached into the box.

At the continuous bicycle lane, cyclist compliance was defined as staying within the bicycle lane. Cyclists who stopped in front of the continuous bicycle lane (i.e., in the pedestrian crossing or in the parallel vehicle lane) were coded as non-compliant. For drivers, compliance was defined as stopping parallel, with all wheels outside the bicycle lane. Drivers whose vehicle wheels encroached into the bicycle lane were coded non-compliant. It is possible that vehicle protrusions or mirrors may have entered the bicycle lane.

There is potential for coding bias in observational studies, particularly with a single researcher coding the data. In this study, compliance for both cyclists and drivers was coded separately by an independent research assistant for 6 hours (11.1%) of footage and analysed using the Kappa statistic. The inter-rater reliability was Kappa = 0.673 (p<0.001), 95% CI (0.585-0.761). This measurement of agreement is statistically significant and can be interpreted as substantial [22].

Results

Nine hours of footage was analysed for each of the six sites, for a total of 54 hours. A total of 2670 cyclists (including 1878 males and 792 females) and 1243 vehicles stopped at the intersection at the observation sites during the red light phase.

Descriptive statistics

Cyclist and driver compliance rates were cross-tabulated with the three cycling infrastructure types as summarised in Table 1.

Compliance was greatest at the continuous lane location, with a high level of compliance by drivers and cyclists. In comparison, cyclists were more compliant than drivers at the bicycle storage box sites, regardless of the positioning of the box. Across the infrastructure types, the relative compliance was different for cyclists and drivers ($x_2^2 = 16.217$, p<0.001).

Binary logistic regression – cyclists

Site infrastructure type, time of day and cyclist gender were included in a binary logistic regression with compliance (yes/no) as the outcome variable (see Table 2). A cut-off for predicted probability of compliance of 0.07 was used in the classification tables for the fitted model. The overall correct predictive percentage of the model was 67.4%, with sensitivity 63.8% and specificity 78.1%.

Infrastructure type had the strongest association with cyclist compliance. In particular, the compliance odds at the continuous bicycle lane was 12.4 times the compliance odds at the left bicycle storage box infrastructure. There was also an association with time of day and compliance odds, with the compliance odds 39.3% less in the afternoon compared with the morning. There was no statistically significant association between compliance and gender.

Table 1. Descriptive statistics of cyclist and driver compliance at three cycling infrastructure types

	Cyclists		Drivers	
	% compliant	Observed	% compliant	Observed
Infrastructure				
Left bicycle storage box	64.9%	1005	49.8%	275
Centre bicycle storage box	53.0%	614	49.6%	516
Continuous bicycle lane (green)	95.4%	1051	97.7%	452

Table 2. Relative odds of compliance-related factors in the model – Cyclists

		Relative odds of compliance	Statistical significance	95% C.I. for odds	
Infrastructure			0.000		
Infrastructure	**Centre vs left**	0.686	0.000	0.556	0.848
Infrastructure	**Continuous vs left**	12.494	0.000	9.059	17.230
Time	**pm vs am**	0.607	0.005	0.496	0.744
Gender	**Female vs male**	0.926	0.478	0.749	1.145

Binary logistic regression – drivers

A second binary logistic regression was constructed for drivers, including infrastructure and time of day, with compliance as the outcome variable (see Table 3). A cut-off for predicted probability of compliance of 0.07 was used in the classification tables for the fitted model. The overall correct predictive percentage of the model was 67.6%, with sensitivity 52.9% and specificity 97.5%.

Again, infrastructure type had the strongest association with driver compliance. In particular, the compliance odds at the continuous bicycle lane were 43.9 times the compliance odds at the left bicycle storage box infrastructure. The time of day and compliance association was similar to the cyclist rate, with drivers having an odds of compliance 32.0% lower in the afternoon compared with the morning.

Discussion

Common cycling facilities such as bicycle lanes and bicycle storage boxes aim to separate cyclists and vehicles along mid-block and at critical locations; however, such infrastructure treatments are only effective if they result in appropriate behaviour. While there are some noted benefits of these treatments, little is known about their effect on behaviour. This study examined cyclist and driver compliance behaviour at three types of cycling infrastructure at signalled intersections.

Infrastructure type was the greatest predictor of compliance. Specifically, the continuous, green bicycle lane was associated with the highest levels of compliance by both groups of road users. A key point to note is that compliance creates different demands depending on the infrastructure type. The continuous bicycle lane was a continuation of the mid-block infrastructure, so drivers and cyclists continued to travel parallel with each other to the intersection. The only compliance requirements were that drivers did not encroach on the green lane when they turned left and cyclists maintained their position within the lane.

However, at the bicycle storage box sites, compliance does require a variation in travel behaviour between mid-block and intersection. Firstly, while drivers and cyclists travel in parallel when mid-block, compliance at the bicycle storage box requires drivers to stop behind the box, short of their 'usual' position at the intersection. Secondly, cyclists are required to move from travelling in parallel to the drivers to stop in front of the vehicle. This need for variation in behaviour may have contributed to

non-compliance, and it may be that cyclist infrastructure is perceived as less legitimate when it displaces drivers.

The continuous bike lane was painted green at both observed sites, so it is not possible to determine whether it was the continuous path or the painted colour or a combination of both elements that contributed more directly to higher compliance. The importance of colour to distinguish cycling infrastructure and discourage vehicle encroachment has also been identified at bicycle storage boxes [11,17]. Further research is needed to determine the role of coloured surface treatments for cyclist infrastructure and both cyclist and driver compliance.

At all bicycle storage box sites, the level of compliance of cyclists was higher than drivers. This may suggest that a high proportion of compliant cyclists perceived the boxes to provide a safe space to wait during the red light phase. It is not known why approximately half of drivers were non-compliant. Possible reasons may be lack of knowledge of the purpose of the boxes, disregard for the space if no cyclists are already present, failure to notice the infrastructure or acknowledge the space as legitimate, or failure to accept cyclists as legitimate road users. Further research is needed to determine the reasons for driver non-compliance. Time of day was a significant factor for both cyclists and drivers, as groups were more compliant in the mornings than the afternoons.

At the centre bicycle storage box sites, some cyclists were coded as non-compliant because they stopped behind the bicycle storage box in single file along the left side of the waiting vehicle, rather than in front, essentially creating an informal left-side bike lane. Further research is needed to determine cyclists' motivations for this behaviour; possible motivations may include perception of safety, habit, lack of awareness of the function of the box or reluctance to impede drivers. Further research is also needed to determine the role of vehicle positioning on cyclists' non-compliance.

In order to improve compliance we need a better understanding of the influencing factors. Recent changes to Victorian road rules increased the penalty for non-compliant drivers at bicycle storage boxes; however, there have been limited education and awareness campaigns about the changes, and to date the impact of the road rule changes on compliance is not known. It is likely that education and awareness programs that inform all road users of the function of the space will improve compliance.

Table 3. Relative odds of compliance related factors in the model – Drivers

		Relative odds of compliance	Statistical significance	95% C.I. for odds	
Infrastructure			0.000		
Infrastructure	Centre vs left	0.956	0.767	0.712	1.285
Infrastructure	Continuous vs left	43.866	0.000	22.436	85.766
Time	pm vs am	0.680	0.006	0.517	0.895

Compliance may be affected by additional factors such as vehicle type or the presence of other road users, and therefore available space, on arrival. This could be addressed with further analysis of the video observations. It is also possible that non-observable factors may also contribute to compliance, such as socio-economic status of the cyclist or driver, or perceptions of safety. Survey research is planned to explore these factors further.

Conclusion

This study has provided a baseline measure of cyclist and driver compliance for three commonly used cycling infrastructure treatments. Highest compliance rates for both cyclists and drivers were observed for continuous bike lanes and during morning observation times. It is recommended that future research be conducted to identify reasons for non-compliance and to explore potential treatments to enhance compliance, including coloured bicycle storage boxes and continuous bicycle lanes.

Acknowledgements and declaration

References

1. Basford L et al. Drivers' perceptions of cyclists. Department for Transport, 2002; 42.

2. Garrard J, Crawford S, Hakman N. Revolutions for women: Increasing women's participation in cycling for recreation and transport. Burwood: Deakin University, 2006.

3. Krizek KJ, Roland RW. What is at the end of the road? Understanding discontinuities of on-street bicycle lanes in urban settings. Transportation Research Part D, 2005; 10: 55-68.

4. Dill J, Carr T. Bicycle commuting and facilities in major U.S. cities: If you build them, commuters will use them. Transportation Research Record, 2003; 1828: 116-23.

5. Davies D. et al. Attitudes to cycling: A qualitative study and conceptual framework. Transport Research Laboratory, 1997.

6. McClintock H, Cleary J. Cycle facilities and cyclists' safety: Experience from Greater Nottingham and lessons for future cycling provision. Transport Policy, 1996; 3(1-2): 67-77.

7. Department of Communications, Information Technology and the Arts. Participation in exercise, recreation and sport annual report 2007. DCITA, 2008.

8. VicRoads. Creating on-road space for cyclists. Cycle Notes No. 9, 2001.

9. VicRoads. Principal Bicycle Network (PBN). 2010. http://www.vicroads.vic.gov.au/Home/Moreinfoandservices/Bicycles/StrategicDirectionsForCycling/BicycleNetworkPlanning/PrincipalBicycleNetwork.htm. (Accessed 10 March 2010).

10. VicRoads. Coloured surface treatments for bicycle lanes. Cycle Notes No. 14, 2005.

11. Austroads. Guide to traffic engineering practice: Bicycles. Part 14. Sydney: Austroads, 1999.

12. VicRoads. 'Head start' storage areas at intersections. Cycle Notes No. 5, 2000.

13. Allen D, Bygrave S, Harper H. Behaviour at cycle advanced stop lines. Transport Research Laboratory, 2005.

14. Pucher J, Dill J, Handy S. Infrastructure, programs, and policies to increase bicycling: An international review. Preventive Medicine, 2010; 50(Supplement 1): S106-S125.

15. Newman A. The marking of advanced cycle lanes and advanced stop boxes at signalised intersections. Christchurch: 2002.

16. Daff M, Barton T. Marking Melbourne's arterial roads to assist cyclists. 2005. http://209.85.173.104/search?q=cache:OxpPBB8gK4AJ:www.ite.org/Conference/SamplePaper.pdf+%22Advanced+stop+lines+for+cyclists%22&hl=en&ct=clnk&cd=7&gl=us&client=firefox-a.

17. Hunter WW. Evaluation of a combined bicycle lane/right turn lane in Eugene, Oregon. University of North Carolina, Chapel Hill, Federal Highway Administration, 2000; 19.

18. VicRoads. Road to solo driving: Learning to drive, driving to learn. Kew, Victoria: Roads Corporation Victoria, 2007.

19. Victoria Legal Aid. Stopping at traffic lights where there are bicycle boxes. 2009. http://www.legalaid.vic.gov.au/2642.htm. (Accessed 17 February 2010).

20. Victoria Legal Aid. Penalty and fee units. 2009. http://www.legalaid.vic.gov.au/1700.htm, (Accessed 17 February 2010).

21. City of Melbourne. Melbourne bicycle account – A cycling census 2008. Melbourne: City of Melbourne, 2008.

22. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics, 1977; 33: 159-74.