Lessons Learned from Bicycle Traffic Rules in OECD Countries

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Abstract

Cycling holds a key role at urban mobility management schemes, where a number of related treatments and services are continuously receiving growing attention from policymakers. In order to identify the means of incorporating rules to safely manage the steadily growing cycle traffic, a questionnaire based survey was developed and distributed to experts from 16 OECD countries. The survey comprised of questions related to cycling aspects raised from 8 core fields. The assessment of the implementation level on basic cycling rules by the examined countries, provides some important insight not only on the cycling acceptability as a transportation priority, but also on the safety considerations raised. The present study serves as a basis for identifying specific aspects that should be further strengthened in order to advance cycling culture as well as safety. Such aspects consist of recommendations for the cycling network, cycle speeding, basic education programmes as well as cycling equipment.

Keywords: *Cycling rules; safety; questionnaire; cycling culture.*

1. Introduction

Cycling holds a key role at urban mobility management schemes as well as inhabitant areas with sustainable development (Vassi et al., 2014). In such environments, a number of treatments related to cycling, such as policies, infrastructure, education and services are continuously receiving growing attention from urban policymakers. At the same time, bicycle acceptability is warmly embraced and is considered among the main transportation means. Cycling attracts more and more city inhabitants with its charm, sense of pleasure, vitality but mostly freedom.

Moreover, besides the well-known and widely accepted health and social benefits offered by cycling, the bicycle use as a transportation mean offers additional benefits in terms of reducing traffic congestion and improving quality of life in cities, reducing carbon emissions, and lowering costs of transport and parking (Australian Bicycle Council, 2010).

In general, cycling is quite popular in medium sized cities worldwide, where in large cities bicycle use fails to attract large shares of trips on a daily basis. The main reason is that trips in major cities are longer, and eventually, this may partially explain the difference in bicycle acceptability as a transportation mean between US and Canadian cities versus European cities. In the first case 1%-3% of the trips are made via bicycle (Teschke et al., 2012), where in certain European States such as Germany, The Netherlands, Denmark, Finland and Sweden the relevant percentage is estimated between 10%-27% (Parkin, 2003). Moreover, in Europe about

30% of trips with cars cover distances less than 3 km and 50% less than 5 km, a 15minute bicycle ride (European Environment Agency, 2009).

In order to promote cycling a number of considerations should be examined as a component of broader urban and transportation planning policies. Solely the provision of cycling infrastructure is not enough. The cycling network, following the concept of connectivity, should be related with other modes of transport. Coordinating bicycling with public transport is mutually beneficial, enhancing the benefits of both modes and encouraging more bicycling as well as more public transport use (Hegger, 2007).

However, safety considerations consist the major prerequisite. Towards this direction, many European countries, especially in the North, have advanced cycling safety through efficient and continuously improving road safety policies. Such an example of innovative road safety policies is delivered through the Dutch sustainable safety principles of Homogeneity and Functionality (SWOV, 2010), where the road users' travel behaviour and exposure to risk are assessed. Among other initiatives, this approach implies that between various means of transportation, differences in mass and speed should be well-disciplined (Homogeneity), and that road network should be clearly classified and hierarchized (Functionality).

On the other hand, safety concerns are raised as well even for countries where the degree of cycling acceptance in terms of transport mean is relatively low compared to the relevant North European. Such an example is experienced in the city of Athens, Greece, where a recent study among university students (Mavromatis et al., 2015) although revealed a high degree of bicycle acceptability, cycling seems rather confined, mostly due to limited cycling infrastructures.

Nevertheless, for both cases, the design of bicycle infrastructures is slowly entering in the priorities of local Authorities, despite several barriers which are needed to overcome. For example, on one hand, vehicle parking imposes space limitations for new cycle paths, and on the other, road users are not fully familiar with cyclists' behaviour and vulnerability, which are sometimes considered even as intruders in the traffic system (Wegman et al., 2012).

The authors, conceding that the existence of comprehensive planning policies is the core prerequisite to encourage cycling, aim to assess the current practice in terms of the implementation of basic cycling rules to safely manage cycle traffic. On that purpose, a questionnaire based survey was developed and distributed to experts from countries with sufficient cycling background in order to gather information on the applied rules and assess potential differences in terms of their concept. The present paper outlines the results of this survey, where many interesting conclusions are drawn.

2. Survey Structure

The survey was distributed to experts from 16 OECD countries, most of them in Europe. The countries were selected on the basis of thorough cycling policies experience as well as cycling acceptability from the public. An effort was made the questionnaire to be concise, but at the same time address core aspects related to cycling, with special emphasis to those related to safety.

The participating countries were Austria, Belgium, Czech Republic, Finland, France, Germany, Hungary, Ireland, Israel, Jamaica, Luxembourg, Netherlands, Poland, Slovenia, Switzerland

and United Kingdom. The survey comprised of questions related to aspects from the following 8 fields:

- Cycling Network
- Shared Infrastructure between Pedestrians – Cyclists
- Legislation
- Speed Limits
- Traffic Education
- Cyclists Age
- Equipment
- Passengers

As already stated above, the surveyed countries have adopted cycling among the main transport modes. Therefore, the fact that for almost all the aspects raised per core field, there seems to be a strong convergence of views, is not at all surprising. The following sections provide an overview and discussion on the results for every examined field.

3. Results

3.1 Cycling network

Cycling infrastructure requires space availability as well as investment. Moreover, an integrated network of seamless cycle routes can greatly improve the attractiveness but also safety of cycling (Vassi et al., 2012). In many urban areas cycling routes begin and end to nowhere. Fragmented and scattered cycle tracks, definitely cannot be described as a network. How are such cases managed?

Half of the questioned countries allow cyclists on the road but only in cases of lacking cycling infrastructure. However, in 4 countries cyclists may use public roads without any limitations. For the remaining 4 countries, the survey revealed that cyclers are allowed to mix with motorized traffic under various limitations (e.g. when indicated by signs, following the traffic rules).

It was interesting to see that cycling on sidewalks was stated to be restricted for almost all counties (15 out of 16). This finding was more evident in North European countries, where such cycling performance is completely forbidden (6 countries). However, for the remaining 9 countries, certain cases were reported where, under certain circumstances, cycling on sidewalks can be allowed. Such cases include mostly the existence of appropriate traffic signs. The same outcomes were more or less reported for pedestrian roads as well where once again 15 out of 16 countries do not allow cycling on such infrastructure.

As far as cycling at shared space areas are concerned (Figure 1), the survey revealed a somehow less restricted approach according to which in 3 countries cycling is allowed without any limitations, in 9 countries under certain limitations (e.g. signalization, speed limit) and in 4 countries completely restricted.

Figure 1: *Cycling at shared space areas.*

Contrary to the sustainable safety approach of Homogeneity, described earlier, for 10 countries cycling was found to be allowed on bus lanes if indicated by traffic signs (Figure 2). However, this is prohibited in 4 countries, where such a behaviour is allowed without any limitations in 2 countries.

Figure 2: *Bus lane layout where cycling is allowed.*

3.2 Shared infrastructure between pedestrians – cyclists

As stated above, cycling on sidewalks, especially unconditional, is forbidden for almost all the examined countries. However, for those countries with mixed pedestrian – cycling traffic, the sidewalk width varies. More specifically the minimum sidewalk width was reported to be between 2.00m (1 country) and 3.00m (5 countries), where for 3 countries no minimum sidewalk width was specified. On the other hand, cases of segregated pedestrian - cycling traffic (Figure 3) were found to be treated with a sidewalk width of at least 2.5m (4 countries), where once again 3 countries do not adopt minimum sidewalk requirements.

However, it should be mentioned that for 2 countries the minimum sidewalk requirements for such mixed traffic is linked to pedestrian – cyclists' flows.

Figure 3: *Segregated pedestrian – cycling traffic.*

3.3 Legislation

Between all the examined countries it is more than evident that legal contexts differ. The bicycle is an important and strategic mean of transport in urban areas mostly. However, it is interesting to see how the examined countries assess cycling in certain road networks, both rural and urban environments, with considerable speed differentials between motorized and cyclist traffic. The present survey aimed at identifying certain road types, from their basic functional classification point of view, where cycling is forbidden.

As a starting point it was reported that in almost all examined countries (15 out of 16), and without any exception, cycling is forbidden in motorways. Moreover, for these countries the survey revealed that besides sidewalks – pedestrian roads, cycling is also forbidden in expressways – express roads as well as tunnels – underpasses (7 countries). The term "expressways – express roads" was clearly defined only by The Netherlands as those roads where the vehicle speed is over 70km/h. Finally, for 3 countries cycling was found to be restricted wherever indicated by traffic signs.

3.4 Speed limits

Cycling speeds, especially high speed values, are directly linked to risk exposure as well as injury severity (Schepers, 2014a). In the literature a number of research studies can be found associating cycling speeds on various infrastructure as well as behavioural aspects (e.g. Woodcock et al., 2014; Summala et al., 1996). In general cycling speeds range between pedestrian and vehicle speed values and are found to be between 18km/h – 26km/h (Parkin et al., 2010). On the other hand, low cycling speeds allow car drivers more time to respond to cyclists at intersection areas (Summala et al., 1996) and at the same time cyclists have greater reaction time to take actions in order to avoid collisions (Schepers, 2014b).

In the context of the present questionnaire, and aiming to perceive the impact of cycle speeding, a number of aspects associated to cycling speed limits were examined.

Posted cycling speed per road type (e.g. regional, local, etc.) has not been determined for all the participating countries. The same finding can be seen when classifying roads per area (urban

– rural), where either speed limits do not exist (10 countries), or bicycles must comply to the same speed limit as the adjacent road.

Following the above concept more or less, speed limit on cycle lanes has not been defined or is the same with the motorized vehicles for 13 countries. Only 2 countries adopt 30km/h and only in one country bicycles must approach cycle crossings with a speed of no more than 10km/h.

In cases where specific posted cycling speed on sidewalks and pedestrian roads is adopted, a speed value equivalent to the walking pace is usually applied the upper limit of which is 10km/h. Such treatment was reported in 5 countries, where for one country 20km/h applies.

Slightly different are the findings for shared space areas where either no rules apply (8 countries), or the speed limit is usually set to 20km/h (4 countries).

Finally, speed limits for different cycle types, especially e-bikes, are not adopted for the majority of the questioned countries. However, for 2 countries electric assistance must be switched off when cycle speed exceeds 25km/h.

3.5 Traffic education

Traffic education is vital, especially for countries with limited experience on cycling (Schepers, 2014b). Road safety education programmes focusing on children during their primary school instruction are in place for 10 of the questioned countries. However, such programmes are mostly informational and for less than half of these countries there is no formal education or assessment. Thus, knowledge on traffic rules is not ensured.

On the other hand, many governments of these countries support campaigns of private bicycle organizations in order to sensitize cyclists for the dangers in road traffic and to teach them the most important traffic rules.

3.6 Cyclists age

It is generally appreciated that children familiarized with cycling at a young age, around 12 years old, are enough experienced and capable in order to cycle independently (Reurings et al. 2012). In the present survey, 5 countries adopt the concept of an adult companion not being compulsory for children of at least 10 years old, where more than half (9 countries) apply no limitations.

Since children are likely to ride bicycles to school even in cases of inappropriate cycling infrastructure, cycling on roads was another issue raised through the questionnaire. It was found that for half of the questioned countries no limitations apply regarding the minimum age a child can cycle on the road. For those countries requiring a minimum child's age, in general 10 years old is adopted (4 countries).

3.7 Equipment

Among the most important cycling equipment, bicycle helmet is considered as the primary safety device. Bicycle helmets have shown to be effective at reducing the severity of injury, particularly brain injury, in the event of a crash (Attewell et al., 2012). Bicycle helmet usage rates differ across ages, and between countries. However, the findings of a relevant research revealed that there is a significant positive correlation between the amount of cycling and

frequency of wearing bicycle helmets among riders (Haworth et al. 2014). The majority of research has examined helmet use by children mostly because of the introduction of mandatory helmet legislation for children only (Klein et al., 2005; Rogers, 2002).

In the present questionnaire helmet usage was not a compulsory device for adults over all the examined countries, although in general it is highly recommended in the interest of road safety. As far as children are concerned, helmet wearing was found to be mandatory for 3 countries covering young cyclists up to 12 years old, 15 years old and 18 years old respectively.

Besides helmets, the utilization of additional safety equipment – devices were examined as well. Among them, it was found that reflecting clothes are recommended for 13 of the examined countries. For the remaining 3 countries reflecting clothes are considered compulsory either outside urban areas and under demanding conditions in terms of visibility (2 countries), or if pedals cannot be equipped with reflecting devices (1 country).

As expected, bicycles equipped with lights is a mandatory requirement for all the examined countries, where in certain more detailed specifications apply.

Reflecting devices are considered a compulsory equipment for the vast majority of all the examined countries and are usually positioned in the front, back and pedals of the bicycle. However only in 2 countries such equipment is required solely on an advisory basis.

Bicycles must be equipped with bells. Such a device was found to be enforced to 13 of the examined countries. Contrary to this requirement, mirror devices were found not to be obligatory for the questioned countries, excluding the case where a trailer is attached (1 country).

3.8 Passengers

Bicycles in general are oriented in carrying one passenger. However, in all the questioned countries bicycles may carry passengers in designated or specially adapted seats. For many counties additional requirements apply; such as the specifications of the additional seat and footrest as well as the age of the main rider (usually over 16 years old).

4. Conclusions

The assessment of the implementation level on basic cycling rules by countries with advanced cycling culture, provides some important insight not only on the cycling acceptability as a transportation priority, but also on the safety considerations raised. Toward this direction, a questionnaire based survey was developed and distributed to experts from 16 OECD countries. The main findings of this survey are summarized through the questions presented in Table 1.

From the cycling network point of view, it was found that cyclists are strongly restricted when cycling outside cycle paths. More specifically it was found that for half of the questioned countries, cycling on the road is allowed only in cases of missing cycling infrastructure and/or when indicated by signs. Only in 4 countries no limitations apply. Cycling on sidewalks, pedestrian roads and shared space areas is either totally restricted or allowed under certain limitations (e.g. existence of appropriate traffic signs, children cycling). However, it was surprising to see cycling to be allowed on bus lanes for 10 countries although such performance should be indicated by traffic signs.

Regarding shared infrastructure between pedestrians and cyclists, cases with no limitations in terms of width for 3 countries were reported. For the remaining cases of minimum sidewalk width requirements, the interaction between pedestrians and cyclists was addressed with sidewalks width between 2.0m – 3.0m and at least 2.5m for non-segregated and segregated traffic respectively.

Regarding current legislation, cycling is forbidden on motorways and express roads for almost all examined countries.

In most countries no rules apply regarding speed limits by road type/area or on cycle lanes excluding sidewalk/pedestrian or shared space areas where a 10km/h and 20km/m speed limit respectively usually applies.

Traffic education in the context of road safety education programmes are in place for 10 of the questioned countries and focus on children during their primary school instruction. However, knowledge on traffic rules is not ensured.

As far as cycling on roads is concerned, for half of the questioned countries no limitations apply regarding the age of a child. For those countries requiring a minimum child's age, in general 10 years old is adopted. Moreover, 5 countries adopt the concept of an adult companion not being compulsory for children of at least 10 years old, where in more than half (9 countries) once again no limitations apply.

Helmet, mirrors and reflecting clothes are not considered compulsory for the majority of the countries. However, for helmet usage, some countries adopt restrictions for young cyclists. All the examined countries consider bicycles equipped with light mandatory, where almost all enforce bicycle bell and reflecting devices on the cycle.

Bicycles may carry passengers in designated or specially adapted seats, although for a number of counties additional requirements apply.

Table 1: *Main findings of the questionnaire*

	Concerns Raised	Replies		
		Yes	Partially Yes	No
Cycling Network	Cycling allowed on roads	4	12 (no cycling paths, follow rules)	
	Cycling allowed on sidewalks	1	9 (comply to signs, road rules)	6
	Cycling allowed on at shared space areas	3	9 (comply to signs, speed limit)	4
	Cycling allowed on bus lanes	2	10 (comply to signs)	4
Legislation	Cycling allowed on motorways	1		15
Speed Limits	Posted cycling speed per road type (regional, local, etc.)			16
	Posted cycling speed per area (urban, rural)		6 (speed limit of adjacent road)	10
	Posted cycling speed on cycle lanes		16 (same as motorized vehicles, <30km/h)	
	Posted cycling speed on sidewalks		6 (<10km/h,<20km/h)	4
	Posted cycling speed on shared space areas		4 (<20km/h)	8
	Speed limit for e-bikes		2 (<25km/h)	14
Traffic Education	Road safety education programmes for children	6	4 (no formal education - assessment)	6
Cyclists Age	Adult companion compulsory for children below 10years old	5	2 (below 12years old)	9
	Minimum age for children to cycle on roads		8 (>10years old, >12 years old)	8
Equipment	Helmet compulsory		3 (children)	13
	Reflecting clothes compulsory		16 (recommended, rural areas)	
	Lights compulsory	16		
	Reflecting devices compulsory	14	2 (recommended)	
	Cycling bells compulsory	13		3
Passengers	Passengers in designated seats only	16		

Countries with advanced cycling background were examined and despite their numerous differences in culture, a strong convergence of views in terms of cycling policies seems to exist, which partially explains their high road safety performance levels. Despite this noticeable convergence, there are also reported cases where different policies are adopted.

The present study serves as a basis for identifying specific aspects that should be further strengthened in order to advance cycling culture as well as safety. Based on the survey results, the following are proposed:

As far as the cycling network is concerned, cycling should not be allowed to mix with motorized traffic on public roads unconditionally. The same applies for cycling on bus lanes, where in 2 countries such mixing is allowed without any limitations.

Moreover, cycling in core road networks with considerable speed differentials between motorized and cyclist traffic should be strictly restricted. Fortunately, in almost all the examined countries such practice is in law.

In general cycling speeding, although crucial, is underestimated. The introduction of cycling speed limits (<20km/h), especially in areas of mixed pedestrian and cyclist traffic, may serve as a starting point.

Traffic education programmes in primary school instruction should be compulsory and respected as a basic component of the National Education Plan for each country. Campaigns targeted on safe cycling may be proved valuable as well.

Finally, basic components of cycling such as helmets, reflecting devices – clothes and lights should be set as compulsory equipment.

However, further methodical actions from broader involved authorities seem necessary in order to promote cycling. Such actions include, the redesign of many urban areas, talking under consideration general traffic calming measures, assessment of shared space areas and 30 km/h zones. Further education and enforcement seem also necessary as to familiarize other transport system users with cyclists in terms of safety.

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