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Vélos électriques – effets sur le système de transports

Elektrovelos - Auswirkungen auf das Verkehrssystem

E-bikes - Impacts on the transportation system

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Summary

Research problem and subject

With the rapid development of electrically assisted bicycles (EAB) many conflicts in the use of road space arise, leading to a certain number of accidents implicating EAB. The reasons behind these accidents are can be varied:

- the rise in “EAB45” (with pedalling assistance up to a speed of 45 km/h), whose speed and acceleration potential largely exceed those of conventional bicycles;
- the fact that EAB users are often new to the use of bicycles, thus sometimes overwhelmed by the capacities of their vehicles;
- the other users of public spaces, drivers and pedestrians, who are not familiar with EAB and poorly anticipate their movements;
- the infrastructure dedicated to cycles which seldom takes the presence of EAB into account, whose speeds are greater and therefore generate more overtaking than conventional bicycles;
- conflict situations not foreseen by the legislator, in particular regarding the use by EAB of shared paths or of cycle amenities used by pedestrians – sometimes inadvertently.

Furthermore, the legal framework is barely understandable for the majority of users and planners, particularly concerning rules applying to EAB45. Lastly, the challenges posed by the two EAB types, “slow” (“EAB25”, with pedalling assistance up to a speed of 25 km/h) and “fast” (“EAB45”), are distinct and require suited solutions.

The aim of the present research study was to identify these specific issues, in order to improve the account being taken of EAB in transport planning and enable planners to distinguish the different requirements for the two types of EAB. The objective was to better understand the problems that arise with the development of this transport mode and to suggest potential solutions relating to various fields including infrastructure, legal framework and user behaviour. To this end, the different elements of the “EAB system”, namely the users, the vehicles and their equipment, the infrastructure and finally the legal framework, were each studied separately before being observed and analysed more in detail as interacting parts of the system.

The main research results and challenges identified

Uses and users of EAB

The EAB45 and EAB25 clearly differ, in terms of user types (mainly men and commuters for EAB45, and women and elderly people for EAB25), reasons for use (commuter trips for EAB45), travel distances (much greater for EAB45) and modal shifts (greater portion of previously travelled kilometres with motorised modes for EAB45). Thus, analyses and potential solutions must distinguish the two EAB categories, which are used differently, pose different problems and therefore do not always call for the same solutions.

Accidentology

A large part of EAB users are not (or no longer) used to driving a cycle. The EAB dynamics can sometimes exceed these users, which can explain the largest fraction of loss of control observed in road accidents.

EAB users involved in accidents are much more often subject to severe physical injuries than users of conventional cycles. This can however be explained, at least in part, by the higher age average of EAB users, which makes them more vulnerable.

For collisions related to a right-of-way violation, the antagonist user is in most cases responsible. The fraction of responsible antagonist users is however only slightly greater than for conventional bicycles, which suggests that bicycles are generally only poorly visible and identifiable by other road users, and/or that their approach speed is underestimated.

Infrastructures

Generally speaking, the current traffic norms and regulations in Switzerland do not take the presence of EAB into account. This concerns the following points in particular:

- the clearance gauge recommended by the VSS norm does not take into account larger cycles (for example with trailers and/or transportation of handicapped persons), whose fraction could increase with EAB;
- no extra width is considered for road curves, but this could be corrected with the propositions of the recently published VSS research (see bibliography [58]);
- the width of cycle amenities should in the future depend on the number of potential cases of overtaking between cycles. The criteria proposed in [58] to estimate the cases of overtaking take into account the number of cycles and the slope, but do not consider the fraction of EAB, and in particular that of EAB45;
- the project speeds, curvature radii and visibility distances are to be adapted according to the recommendations of [58];
- at traffic light controlled intersections, the starting speed parameter for cycles (currently set to 5 m/s) must be raised in order to consider the acceleration capacities of EAB45.

Legal framework

The EAB25 form a special “light mopeds” category, for which the cyclist rules apply. The exceptions to this rule are poorly known by users (particularly the prohibition of use by children and the M licence needed for 14 to 16 year olds).

On the contrary to European countries, where EAB45 are considered as light mopeds, they are considered mopeds in Switzerland. This clearly facilitates the accession and appeal of EAB45, and is reflected by a much more significant use.

The EAB45 must obey the regulations relative to mopeds. However, the current signage, according to which the EAB45 are tied to the cycle symbol in the case of obligations (cycle lanes, for example) but to the moped signal in the case of prohibitions or complementary signs, is on the one hand incoherent but more importantly incomprehensible for users, and perhaps even for planners. In practice, this means:

- that the current signage does not correspond to the objectives (for example, cycling against the traffic is prohibited if the complementary sign “cycles allowed” is affixed only);
- consequently, EAB45 users generally do not respect the rules imposed on them (in particular stopping the engine in pedestrian sectors open to bicycles).

The obligation to use cycle lanes raises difficulties, particularly if the width of the cycle lane is insufficient, if the number of cycles is high, if the project speed adopted is insufficient and/or if the amenity in question is shared with pedestrians.

The accelerations enabled by the electrical assistance and the speeds that can be reached can cause additional problems in spaces shared with pedestrians. In particular, shared spaces are often available uphill, when cycling speed is assumed to be low. This premise is yet no longer valid with EAB.

EAB are not perceived as such by other road users, due to the absence of distinctive signs (with the exception of the yellow plate for EAB45, visible only from the back), which most likely explains the lack of respect of the right-of-way granted to EAB in roundabouts and non-regulated intersections.

The impossibility of speed control raises problems mainly for EAB45, particularly in speed-restricted areas (30 km/h zones and pedestrian-prioritised zones).

Finally, the requirement to cycle on the right, compulsory for all cycles, is even more difficult to respect when the speed is high (“buffer” zone on the side of the road).

Ground surveys: occurrence and number of EAB in traffic

Ground surveys were conducted in Geneva in September 2015 and in Bern in November 2015. All together 850 EAB were observed over eight observation posts during the 4 days of the survey.

The number of respondents is slightly greater in Geneva (around 500, i.e. 33 per hour of survey) than in Bern (around 350, i.e. 28 per hour of survey).

Distribution between the different types of bicycle is very different from one city to the other. The total share of EAB in Geneva reaches 18%, but only 11% in Bern (as a reminder, 18% of bicycles sold in 2014 were EAB). On the other hand, the fraction of EAB25 is crushing in Geneva (80% of EAB), while the EAB25/EAB45 distribution in Bern is almost balanced.

Ground surveys: driving speeds

The average speeds of EAB45 are between 26 and 35 km/h in all situations, regardless of the slope. Very high speeds are therefore never reached. It should however be noted that the surveys are conducted in urban areas.

The average speeds of EAB25, between 20 and 27 km/h, are hardly influenced by the slope. They are very similar to the speeds of conventional bicycles and only slightly greater (+4 to 6 km/h) uphill.

Bicycle speeds vary significantly with the slope: from 12-13 km/h uphill to 25-27km/h on flat ground or downhill.

Thus, on flat ground or downhill, EAB25 speeds are close to those of bicycles, while EAB45 speeds are on average 6 to 8 km/h faster. Uphill, the differences between EAB25 and bicycles are more significant.

Ground surveys: overtaking

The average speed differences between the overtaking EAB and the EAB/bicycle being overtaken are usually quite high, ranging from 6 to 12 km/h.

In 25 to 50% of the observed situations, depending on the survey station, overtaking cannot take place or takes place in difficult conditions (insufficient space between vehicles, crossing of tram rails required …).

Overtaking ratios per hour and per 100 m of homogenous section were also calculated for the different bicycles types (conventional bicycle, EAB25 and EAB45). In all circumstances, EAB45 generate a large number of overtaking situations. In the EAB25 case, the table of results is more varied: on flat ground, EAB25 overtake barely more than conventional bicycles. Uphill, however, the ratio is much higher. Hence, the fraction of EAB, and specially EAB45, must be included in the determination of the widths of bicycle dedicated surfaces, so as to enable the safe overtaking between bicycles.

Ground surveys: choosing amenities

When bicycles have the choice between two amenities (bicycle lanes or sidewalks open to bicycles, for example), EAB45 systematically favour the faster amenities, particularly when those amenities are better (for example the existence of a bicycle lane of sufficient width on the individual motorised transport lane). As a result, banning EAB45 from shared amenities could be compatible with the interest of EAB45, so long as a realistic alternative is available.

Main conclusions of the research

Validity of the research hypotheses

The hypotheses and sub-hypotheses were for the most part confirmed, in particular:

- the differences in the use of EAB45 and EAB25 were clearly identified, in terms of user types, degree of use, speeds, behaviour, etc.;
- some needs of EAB45 and EAB25 are indeed alike, particularly in terms of parking;
- the problems relative to EAB25 appear in particular situations: uphill, shared spaces with pedestrians, when used by elderly persons;
- the problems relative to EAB45 are plentiful and occur in a large number of situations: unclear legal framework, regulations concerning vehicle equipment are out of date (speed control), review needed of the norms relating to bicycle infrastructure and rules for shared spaces.

Various subtleties were however highlighted with respect to the original hypotheses:

- the surveys were unable to identify a greater lack of respect of the right-of-way towards EAB than towards conventional cyclists;
- the specific road training is linked more to the driver's condition (for example elderly or inexperienced persons) than to the type of bicycle used;
- the survey samples are insufficient to prove an increase in heavy loads carried by EAB;
- vehicle regulations must be adapted, but a categorisation of EAB45 as mopeds is appropriate;
- very constraining rules concerning driving licenses (specific permit) would have a significantly negative impact on the development of this transport mode.

Main findings

The greatest EAB development potential today clearly concerns commuting over distances from 5 to 15 km. That is also where the most important impact on the transportation system lies, as even the transfer of a small number of trips from car to bicycle allows for a more rational use of the infrastructure. By enabling the modal transfer of motorised traffic at rush hour, the development of EAB clearly contributes to relieving today's overloaded infrastructure and should in that sense be promoted.

The increase in EAB numbers, but also of bicycles in general, requires the planning of more generous cycling amenities; only thus can the trend observed in the recent years continue and the safety conditions be improved. In particular, overtaking in complete safety should be made possible on roads with large EAB and bicycle traffic without the need to overstep on motorised traffic surfaces.

Quantification of EAB fluxes, which is almost nonexistent today and must be developed, is required in the establishing of appropriate infrastructure, both on national and local scales.

The existing legal framework poses many enforcement problems and is understandable neither by users nor by planners, particularly concerning EAB45. The clarification of this legal system is essential, especially concerning the following points:

- updating of the “moped” category, to which EAB45 are tied;
- reviewing of the imperative to use bicycle lanes;
- reflection on the regulations concerning shared use with pedestrians;
- complementary measures for EAB45 (speed control, lighting, …)

The reviewed legal framework must be more legible and improve the security of users, while preserving the advantages granted to EAB25 and EAB45 today, which promote these transport modes, as alternatives to car use.

Moreover, the legal framework must be better communicated to planners and users.

Realising that the most frequent accidents involving EAB are linked to loss of control and underestimation of the travel speed of users, measures relating to training, awareness and communication must be strengthened, both for EAB users and other road users.

Further needs in terms of research

Following up from this research, it should be noted that many grey areas remain, highlighting the need for complementary analyses:

- the conclusions of this mandate, based on several conflict points, should be supported by complementary surveys (refer to examples of possible complementary analysis points in the report);
- other analysis methods must be found for the questions remaining unanswered, particularly concerning the respect of priorities in roundabouts: for this reason, the EAB issue should be included in the Federal Roads Office (FEDRO) research on safety in roundabouts;
- finally, and in more general terms, it is necessary that, given their current development, EAB be systematically included in research studies and reflections relating to roadwork amenities.