

BJÖRN PANKOKE:

„Swept path of bicycles with trailer“

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Abstract

Introduction

Cycling is healthy; it trains the body physically and reduces stress. It is faster and more flexible than driving a car, especially in larger cities. There, most destinations, within a 10 km range, can be reached faster and less nerve wrecking with a bicycle. In addition, deciding in favor of a bike will save money otherwise needed for a car or bus ride. The increased environmental awareness of our society certainly contributes to the fact that more and more people in large cities choose the bicycle as means of transportation. And cycling produces neither noises nor fumes. Every kilometer by bike saves, in comparison to the car, nearly 140 g CO². Bicycles can be used as means of transportation to work, for errands, as a vehicle for the family, for free time activities or in everyday use. Especially during free time and transporting goods bicycle trailers are increasingly being used. The increased length of a bicycle with a trailer over a simple bike, as well as the larger width, result in an increased need of space in curves and narrow passages, and thus have a different swept path. This Bachelor thesis, on the swept paths of bicycles with trailer, will be about finding the increased space requirements. For the transferring them into practical considerations there has to be further researches. Therefore the Bachelor thesis is an excellent basis.

Bicycle trailers

First, on the theoretical level, information is collected and analyzed to gain access to the necessary information for currently valid standards/recommendations for bicycle trailers, especially those in relation to the dimensions and the space requirements, needed for test vehicle for the hands on experiments.

The current guidelines in the StVO (§ 32) do not refer explicitly to bicycles, but to vehicles in general. This results in particularly high values for maximum dimensions of trailers, which are rather inconvenient for bicycle trailer. In "Merkblatt für das Mitführen von Anhängern hinter Fahrrädern" (future MMAF), which was developed by TÜV on behalf of the Federal Government, explicit values for bicycles with trailers are stated. The maximum dimensions for bicycle trailers with a maximum authorized gross mass of 40 kg (braked weight 80 kg) are specified here:

- Length 2.00 m (special trailers for transporting sports equipment: length 4.00 m)
- Width 1.00 m
- Height 1.40 m

There are no regulations on the number of axles or wheels. However, in practice, single-axle trailers with either one or two wheels have become the standard. There are two different types of hitch positions when connecting the trailer to the bike. The axle hitch, also called deep towbar, and the high towbar. An axle hitch has special

attachment points, integrated into the rear quick release skewer or bolted onto solid axles, usually on the left side of the rear axle. A high towbar has a temporary or permanent clamp assembly attaching the trailer hitch to the seat post. Due to the construction, a trailer which is fastened in the higher hitch position has a smaller footprint when turning around. The low hitch position, on the other hand, is beneficial for the flow of forces within the framework of the pulling Bicycle.

Test vehicle and Experiment

In order to design the test vehicle the different trailer types and their properties in terms of the space required when turning are considered. For this the coupling points and the position of the axle are viewed next to the length and width of the trailer. The MMAF recommends maximum width and length of the trailer to be 1.00 x 2.00 meters. In consultation with the Police of Detmold the overall length of the trailer will include the towbar. Based on the findings (For more information see the bachelor thesis) the test vehicle will be designed as a singleaxis, two-wheeled trailer with a high towbar. In order to receive the relevant curves, the test vehicle will have an optional front- and rear axle. During the experiment the axles will alternately be equipped with wheels in order to receive the different swept paths. Due to comparisons with the FGSV the swept path is anticipated to be similar to those of semi-trailer combination.

In order to find the swept area practical driving tests are made. For this, the bike is guided / driven along a guiding line. During the experiment, the traces will be marked by Sand. For the experiment, the test vehicle is hitched behind a bike with a 26 inch frame. The trailer with the bike reaches an overall length of 3.22 meters. They take place on a fully paved turning bay. "Slow driving" describes the experiments with about 7 km/h, "normal driving" with about 14 km / h. The noted change of directions will be at 40 Gon, 60 Gon, 80 Gon, 100 Gon, 120 Gon, Gon 140, and 160 Gon. For the documentation of the results a two-dimensional coordinate system is placed on the pavement, origin being placed at the beginning of the guiding line. Every driven meter the exact positions of the markings were measured at a right angle to the guiding line, so the resulting draft is as precise as possible. The results are three swept paths which are presented in the full text. The anticipated similarities to the semi-trailer combination are verified with significant variations in dimensions, turning radii and space consumption.

Practical Relevance

(There has to be further research work.)