**Submission ID: 6**

Lund, Sweden
10-12 November 2021
iCSC International Cycling Safety Conference

# What can we learn about cycling safety and infrastructure design from one of the worlds' biggest bicycle event?

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**Keywords:** intersection safety, road diversions, cyclist safety, intersection analysis, computer vision, road equipment design

Background

”Vätternrundan” is one of the worlds' larges recreational bicycle rides, with over 23'000 participants. It mainly uses regular roads with mixed traffic and passes through several cities on its 300 km track around lake Vättern in Sweden. Along the route, many temporary diversions and safety barriers are installed to increase safety.

For this, the same equipment as for temporary diversions at road works in urban traffic is used. This equipment is usually not specifically designed for cyclists. However, a major part of accidents during “Vätternrundan” occur at diversions or barriers. Also in urban traffic, cyclists are common victims of accidents at diversions or road works. In 40% of all accidents at road works in Sweden, a cyclist is injured.

Large flows of cyclists, as they occur during “Vätternrundan” but also in urban cycling, accentuate the risks at diversions and intersections. However, little is known about these traffic situations – e.g. how quickly cyclists adapt speed to changing situations, route choice, side margins to obstacles, the impact of speed differences and of crowding. Also the behavior in large groups of cyclists is little studied, e.g. the importance of route choice of the foregoing cyclist. However, this is crucial knowledge both to design safe diversions and intersections for large numbers of cyclists and for designing and choosing suitable equipment.

Aim

“Vätternrundan” offered a unique research opportunity to better understand the behavior of large flows of cyclists through diversions and intersections in a controlled environment. The study aimed at better understanding route choice through intersections and distance to obstacles, the influence of foregoing cyclists on route choice and behavior in intersections and at better understanding risk factors for accidents. Further aims were to test whether camera/computer vision-based measuring equipment was capable to deal with very large flows of cyclists and to provide input to the design of safe equipment for road diversions for cyclists, both for cycling events and normal traffic.

Method

At the 2019-event, selected intersections were equipped with advanced measuring systems with computer vision and artificial intelligence (Viscando) to record and analyse the individual tracks of over 20'000 passing cyclists. The measurement was complemented with on-site observations. Further, a survey with responses from almost 5000 participants was performed, collecting the location data and details about accident and “almost-accident” situation and background data. Location data was analysed in GIS to find whether accidents cluster at certain locations and survey data examined for parameters that might correlate to the occurance of accidents. To further enhance understanding of the cause of accidents, in-depth interviews with selected cyclists that had reported accidents that required care were conducted.

Results

The results of the intersection-analysis show that the measuring method is capable and suitable also to deal with high flows of cyclists. The chosen routes and the statistical distribution of distances to barriers can be shown, as well as the importance of route choice of the foregoing cyclist on following cyclists. Further, clusters of accident-prone areas have been identified as well as key factors for accidents during the event. The highest risks for severe accidents occur in situation of larger groups of cyclists/high flows and when the route narrows or is diverted. In these situation, the viewing field cyclists is often restricted by other cyclists and they can be surprised by the changing situation at the same time when crowding occurs and safety distances to other cyclists and obstacles diminishes. In these situations, collisions between cyclists or with fixed obstacles can occur, often with handlebars, leading to loss of balance and crashes.

Conclusions

The results show the signaling- and diversion equipment needs to be designed in a way that is visible also for cyclists further back if large groups of cyclists are expected. Further, barriers and signal equipment need to be designed in a more forgiving way as to avoid an almost certain fall in case of collision with handlebars. Narrowing of the track should be avoided if possible or only occur gradually and well announced.