

Effects of four infrastructural interventions on cycling safety

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The Netherlands is well known for its high cycling mode share (27 %) and remarkable cycling network covering most of the country. Despite the existing cycling culture and vast infrastructure, these vulnerable road users are still at risk of injury and fatality. In the Netherlands, cyclists account for 64% of serious injuries and 34% of road fatalities, which is higher than previous years. As a result, cycling safety is a priority for municipalities, researchers and policy makers. An initiative to improve traffic safety has been initiated by the Hague municipality. Over the years, infrastructural changes have been made at intersections aiming to improve traffic flow and safety. Two intersections have been identified as cycling hotspots; to safety accommodate cyclists at these locations, several infrastructural interventions have been planned and implemented at these locations. The four infrastructural interventions to the cycling facility were:

- 1) moving the cycling stop line closer to the intersection (2 locations)
- 2) moving cycling crossing further away from the intersection (2 locations)
- 3) remove mid-intersection left-turn box (1 location)
- 4) change bike lane from in between right turning and through traffic to dedicated facility on the right (1 location)

The aim of this study is to evaluate the safety implications of each of these infrastructural interventions on cycling safety using surrogate measures of safety.

To study the effects of these interventions, video data was collected for a duration of one week before and after the re-design of the intersection. A general check of the video data was performed to filter out bad quality data and times which could negatively affect the analysis of the data, such as high wind resulting in shaking of the camera, rain resulting in rain drops and fog on the lens, all night time videos due to low contrast of road user with surrounding, sunny periods resulting in shadows that could be detected as road users. After the good quality video data were filtered, roughly 40 hour of video data remained for each before and after scenario at the two intersection (total of 160 hours of video data were processed). For video data processing, an external company with experience in high quality road user detection was utilized to provide us with road user trajectories as well as other information. From there, the trajectories were used to evaluate road user interactions specific to each infrastructural intervention. This was done using post encroachment time (PET) and the probabilistic time to collision method (PTTC) which improves on the traditional TTC computation by predicting the future state of the road user as observed from existing road user motion patterns at that location. Furthermore, speed analysis and trajectory location changes were compared from before to after the infrastructure change.

The results from the study will indicate which infrastructural interventions have been successful in improving cycling safety by looking at the change in number and severity of conflicts. This information can then be used in the planning of future intersections or re-designing intersection to improve cycling safety. Currently the Hague municipality will make use of the results from this study to evaluate the benefits of these interventions for consideration in improving cycling safety at other locations.