OBSERVATION STUDY INTO THE INFLUENCE OF VIEW BLOCKING OBSTRUCTION AT AN INTERSECTION ON BICYCLE AND PASSENGER CAR VELOCITY PROFILES

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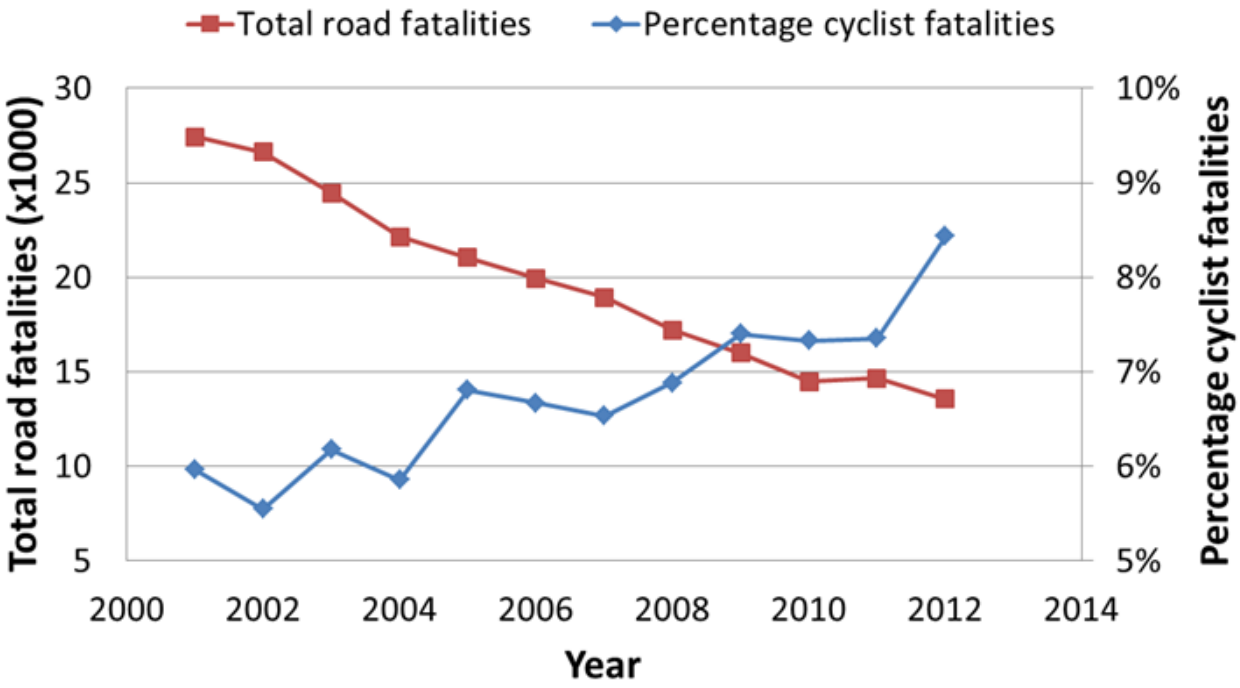
Foto: Tjerja Geerts

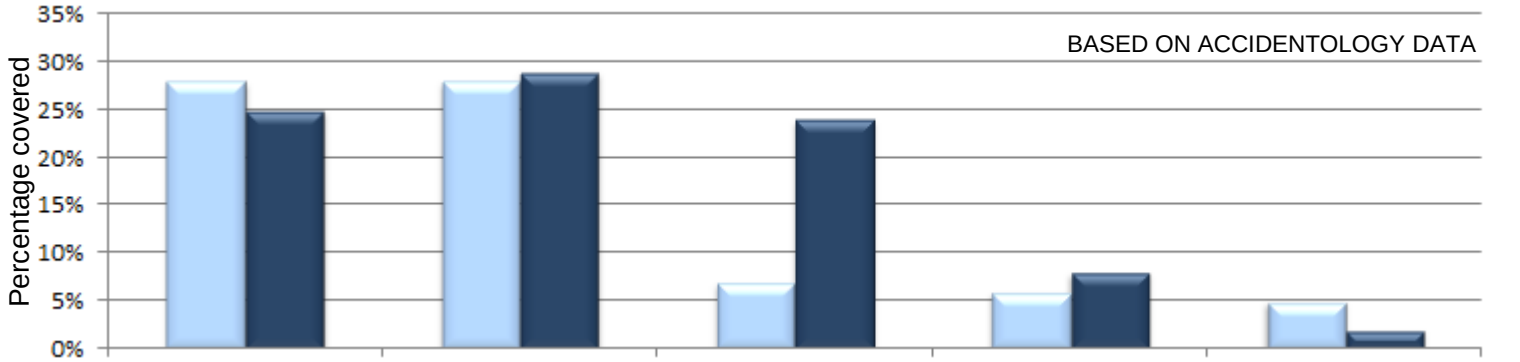
INTRODUCTION



CATS PROJECT

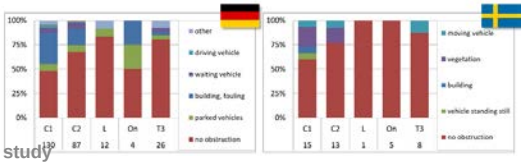
- **Objective:**
  - Prepare the introduction of a **protocol for consumer tests** of **Cyclist-AEB systems** on board passenger cars.
  - Propose a **test setup** (incl. hardware) and **test protocol** for Cyclist-AEB systems based **on technical/scientific considerations**.
  - Base the tests on analysis of most **relevant cyclist accident scenarios in EU countries**.
- **Timing:**
  - Start : 2014 Q2
  - Finish: 2016 Q1

MOST COMMON CAR-TO-CYCLIST SCENARIOS



CROSSING *CROSSING* *LONGITUDINAL* *ONCOMING* *TURNING*

MOST COMMON OBSTRUCTION SCENARIO



Test parameters:
- Car speed
- Bicycle speed
- Bicycle intention/trajectory
- Contact point in case of collision
- Time-To-Collision
- Size & location of view-blocking obstructions

Limited detailed data of these scenarios available → **Observation study**

OBJECTIVE OBSERVATION STUDY

- *Objective:*

  Determine the influence of the presence of a view-blocking obstruction on the behaviour of cars and bicycles when approaching a crossing

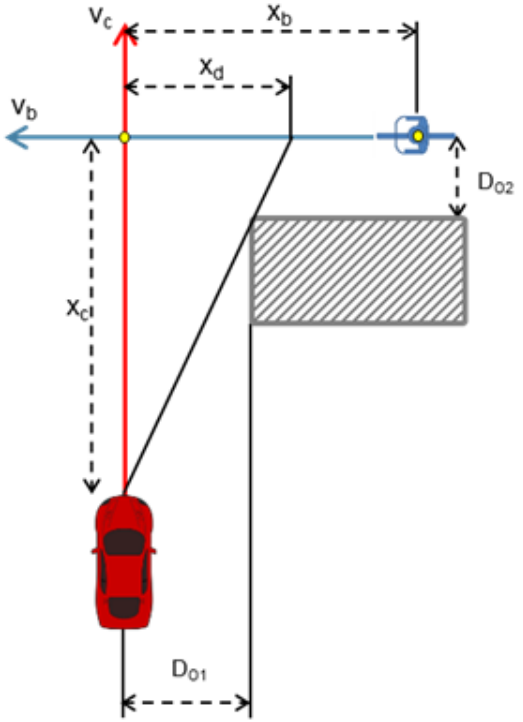
- *Hypothesis:*

  Both bicyclists and car drivers **reduce speed** in case the **view on the crossing is limited** because of an obstruction (e.g. building, fouling, parked car). The more the view is limited, the larger the effect on speed reduction is expected to be.

APPROACH

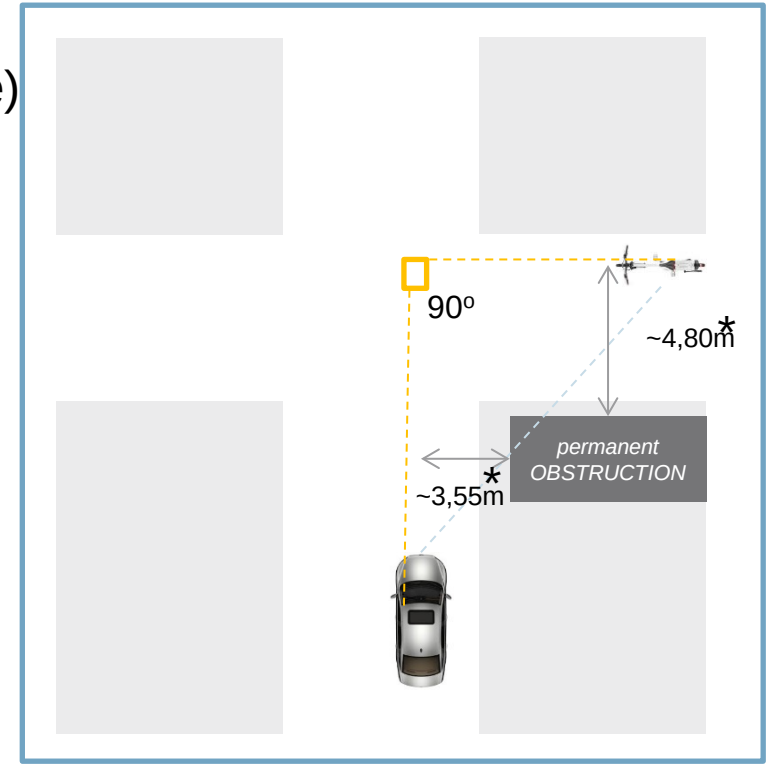
METHOD

- Measure cyclist and car behaviour
  - **Velocity-profile** as function of distance (with automotive radar)
  - **Visual behaviour** (with camera)
- Locations:
  - 2 bicycle crossings in Eindhoven area
  - Reasonable severe permanent view-blocking obstruction



SELECTION CRITERIA INTERSECTION

- Urban area
- Speed limit = 50 km/h (also 20 km/h possible)
- Severe obstruction prevents direct view on right hand sight (w.r.t. car)
- Permanent obstruction (e.g. hedge, building)
- Cyclist have priority, however
  - No traffic control lights
  - No stop signs (for neither cyclist nor car)
  - No or only low speed bumps
- Significant traffic flow
- No specific requirements w.r.t. road layout



** Values: based on typical TTC and characteristic measures for road-layout*

MEASUREMENT EQUIPMENT

- **Speed measurements** by use of road-side-unit
  - 2x Automotive radar (Continental SSR 208)

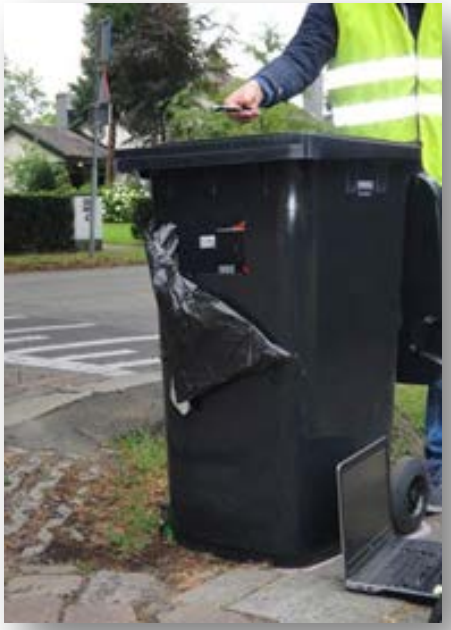
    Short-range-radar, update rate 33 Hz

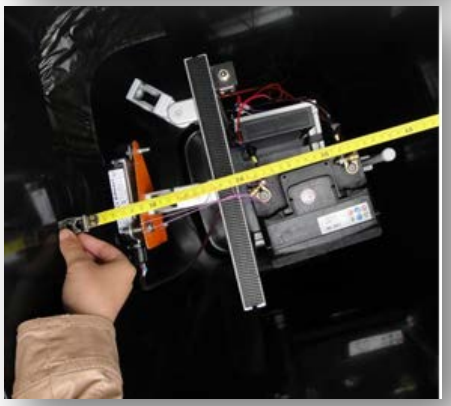
    FoV +/-20º, range 50m
  - Data acquisition box

    filtering, target tracking, data recorder,*

    wireless communication unit

- **Visual behaviour** by use of camera
  - 2x Action camera's *(GO PRO)*

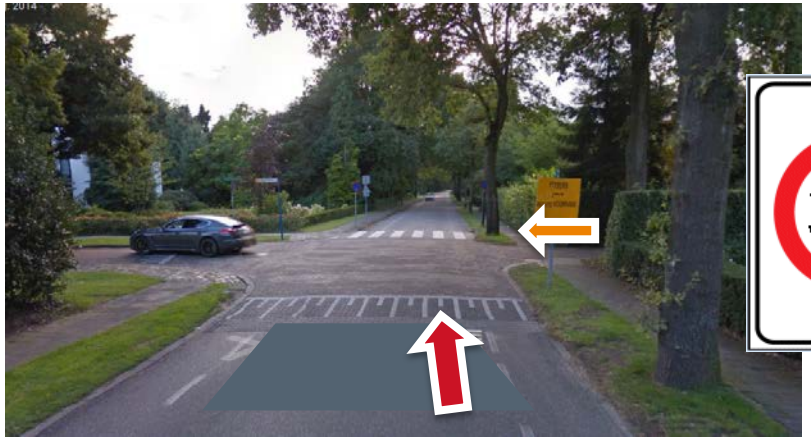




* Based on: life time, minimum velocity, ROI

bicycles
cars

SELECTED LOCATIONS



SON: busy bicycle crossing

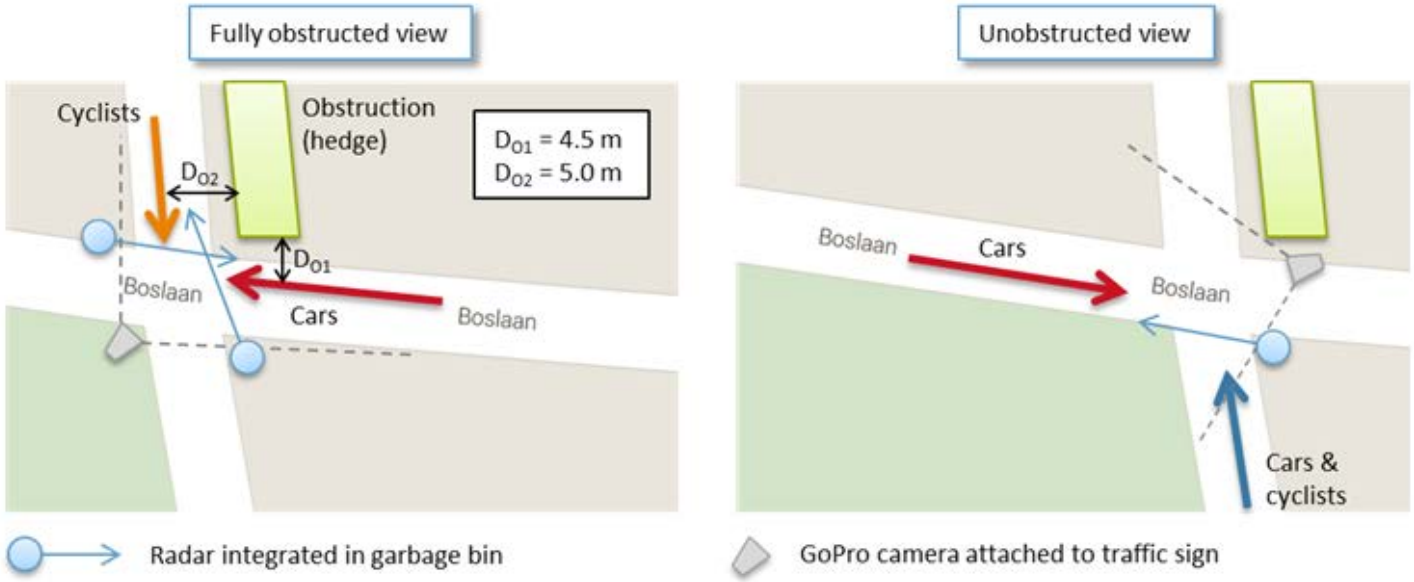
- *Obstruction:* hedge
- *Cyclist lane:* exclusively for cyclists
- *Location:* crossing connects living area with busy village center
- *Priority:*
  - Non-priotorized intersection
  - Cyclist from right have right of way
  - Cyclist give yield to traffic from right

EINDHOVEN: busy 4-armed intersection*

- *Obstruction:* building
- *Cyclist lane:* for all traffic
- *Location:* crossing in city center
- *Priority:*
  - Non-priotorized intersection
  - Traffic from right has right of way
  - Cyclist give yield to traffic from right

* This is not a round-about!!

MEASUREMENT SETUP: SON



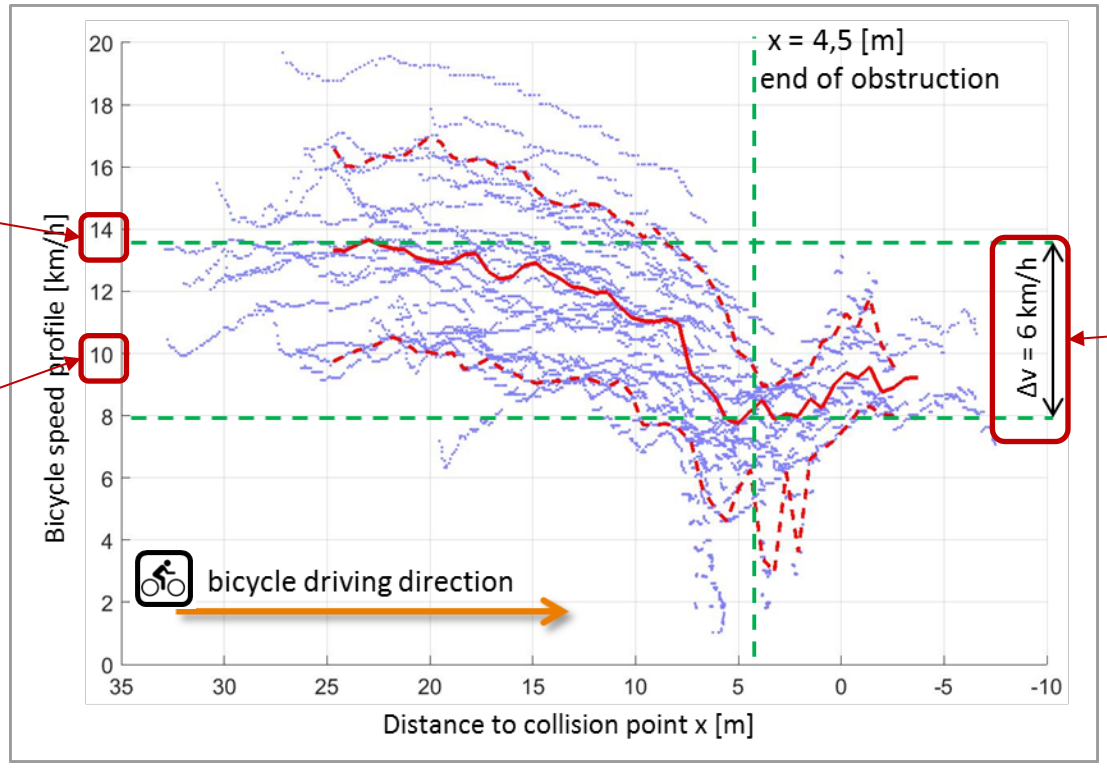
RESULTS SON: BICYCLE

Bicycle manouevre		*Stopped pedaling*		*Continued pedaling*
		Continued riding	*Full stop*	*Continued riding*
Straight	**total**	**20**	**9**	**2**
	no cars present	9		
	car from left	8	2	2
	car from right	3	7	
Turning left	**total**	**4**	**6**	**2**
	no cars present	3	1	2
	car from left		2	
	car from right		3	
	cars from both sides	1		
Turning right	**total**	**1**	**0**	**0**
	cars from both sides	1		
Total # bicycles		25	15	4

- Most bicycles stopped pedalling but continued riding

Based on video-observation

RESULTS SON: BICYCLE



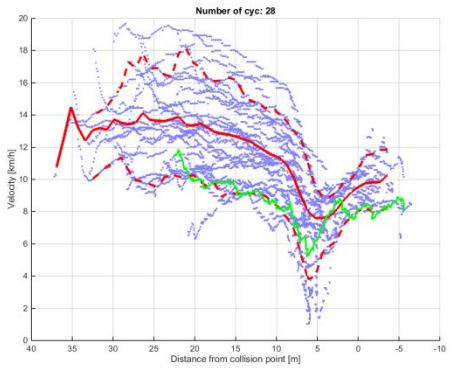
- Decrease of speed by bicyclists in approaching intersection

(in case view is blocked on approaching cars, even if bicyclists have priority)

RESULTS SON: BICYCLE

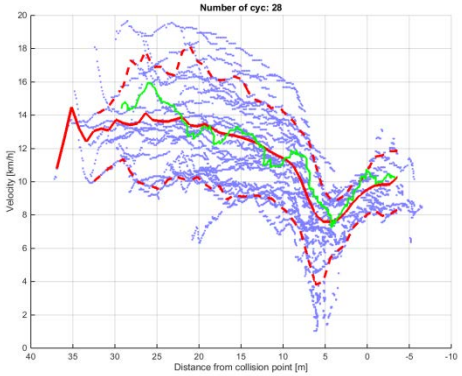
cyclist low speed

V_{ini}= 10 km/h
V_{min}= 6 km/h



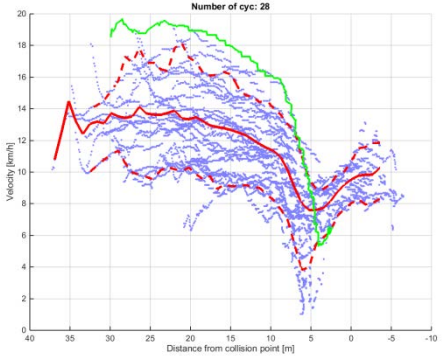
cyclist average speed

V_{ini}= 14 km/h
V_{min}= 8 km/h

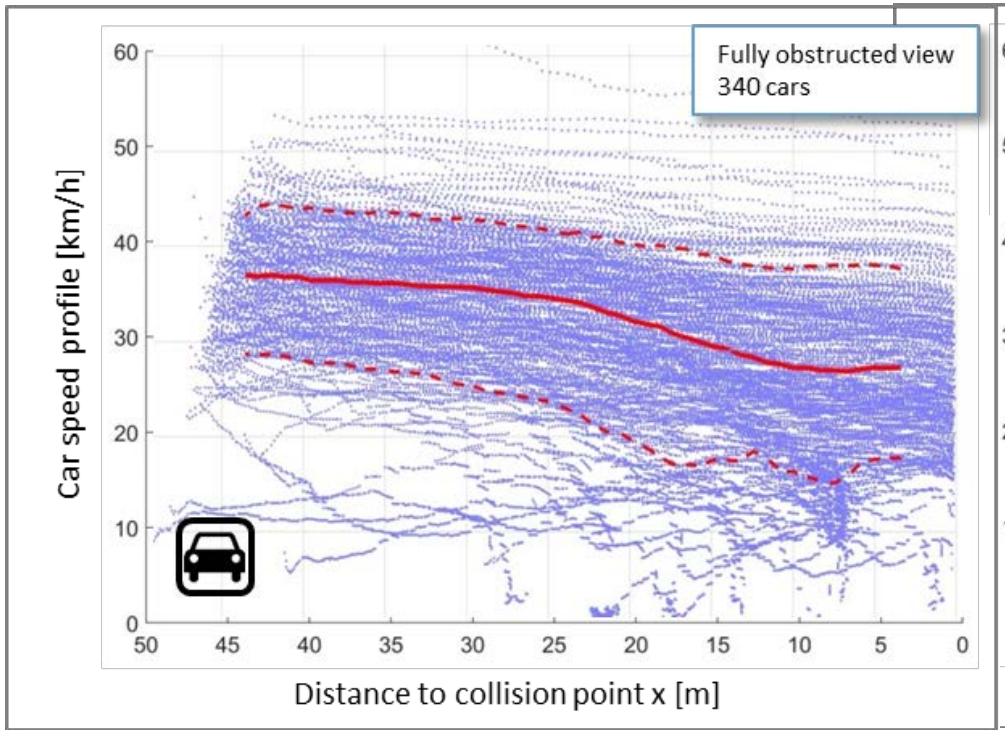


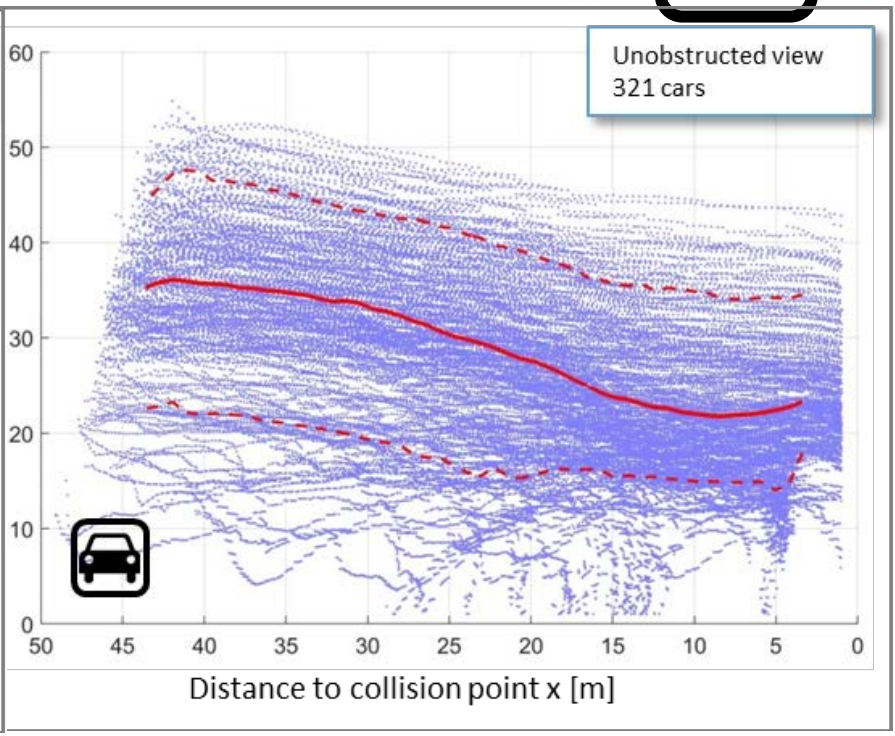
cyclist high speed

V_{ini}= 19 km/h
V_{min}= 6 km/h



RESULTS SON: CARS





- In both situations cars reduce speed when approaching crossing.
- In obstructed case, some cars seem to overlook cyclists might appear from behind obstruction and do not reduce speed (only slightly)

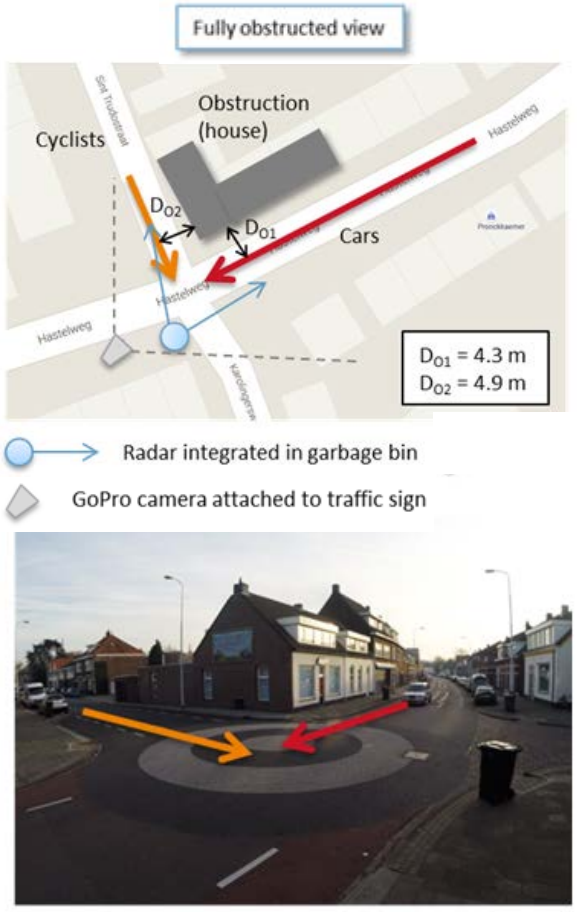
RESULTS SON: CARS

Cars high speed

V_{ini}= 70 km/h
V_{min}=40 km/h

V_{ini}= 60 km/h
V_{min}=50 km/h

MEASUREMENT SETUP: EINDHOVEN



RESULTS EINDHOVEN: BICYCLE

Bicycle manouevre		Stopped pedaling		Continued pedaling
		Continued riding	Full stop	Continued riding
Straight	**total**	**68**	**38**	**15**
	no cars present	25	0	4
	car from left	17	14	5
	car from right	14	13	6
	cars from both sides	12	11	0
Turning left	**total**	**16**	**6**	**1**
	no cars present	5	0	0
	car from left	7	0	0
	car from right	3	3	1
	cars from both sides	1	3	0
Turning right	**total**	**9**	**2**	**20**
	no cars present	2	0	10
	car from left	4	0	3
	car from right	2	0	6
	cars from both sides	1	2	1
Total # bicycles		93	46	36

Speed profile analysis of location Eindhoven has not been concluded yet, as it is hard to make distinction between cars and bicycles in same lane

Prelim results:
speed reduction cyclists is 4 km/h

- More than 85% stopped pedalling
- Even with no cross-traffic vast majority stops pedalling during approach
- More cyclists stop pedalling than continue pedalling

CONCLUSIONS

Method and measurement device developed has served it purpose

- Possible to measure velocity-profiles for bicycles and cars on 2 intersections
- It is difficult to distinguish bicycles and cars automatically

In case of approaching an intersection with severely blocked-view

- **Bicyclists**
  - Appear to reduce their speed: Approximately 6 km/h (Son) ~4 km/h (Eindhoven)
  - Speed reduction coincides with stopping pedalling
  - More than 80% of the observed bicyclists stopped pedalling
  - Obstacle prevents early anticipation on cross-traffic
- **Cars**
  - Generally reduce speed
  - It is very difficult to distinguish between geometrical layout and interaction with other traffic participants
  - Obstacle cause drivers to overlook the traffic from the behind oobstruction
  - No general conclusions can be drawn regarding the speed reduction and the presence of a view-blocking obstruction

RECOMMENDATIONS

- Finish analysis of the observations in Eindhoven
- Perform similar study at typical intersections in Germany, to be able to generalize conclusions, by taken into account
  - More than 2 locations
  - Differences in culture (especially traffic rules)

ACKNOWLEDGEMENT:


THANK YOU FOR YOUR ATTENTION
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