



Sequential Advanced Guide Signing for Work Zone Related Rerouting on Highways

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The Effect of Longitudinal Location on the Driver's Trajectory Control

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1. Introduction (1)

- Work zones create complex road geometry:
 - Closed lanes
 - Multiple splits
- Disturbance of normal traffic flow
- Driver's control over vehicle movements (i.e., *trajectory control*) is affected:
 - abrupt speed alterations (longitudinal dimension)
 - sudden maneuvers (lateral dimension)





1. Introduction (2)

- Rerouting:
 - form of incident management
 - avoidance strategy (-> work zone is surrounded)
 - primary route -> secondary route -> primary route
 - no direct contact with construction workers
 - less congestion on primary route



1. Introduction (3)

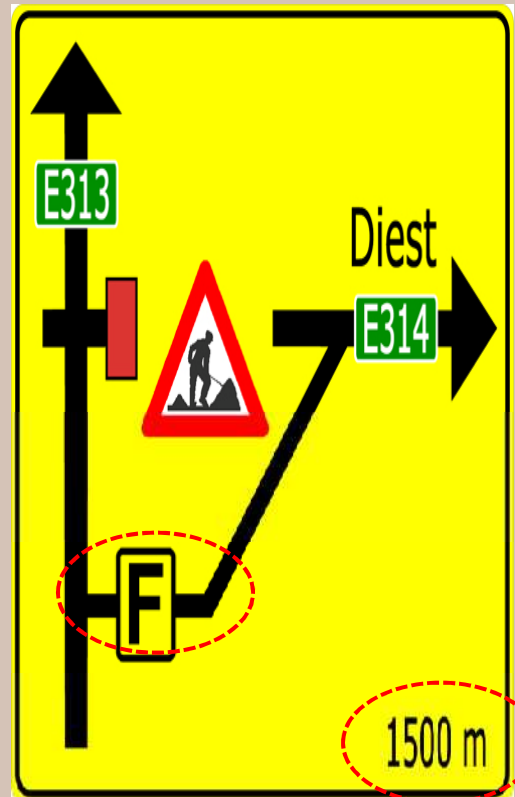
- Drivers must (re-)act appropriately
- Advanced guide signing:
 - GUIDANCE: what, where?
 - PREPARATION: when?
- Multiple sign sequence:
 - MULTIPLE => avoid information overload
 - SEQUENCE => sufficient processing time



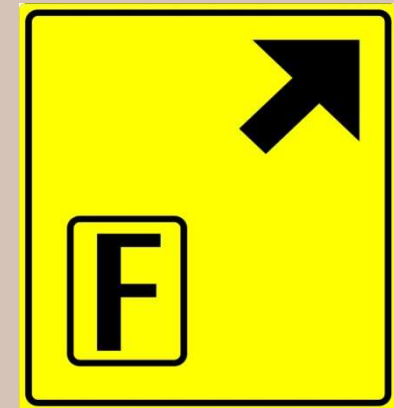
Triple sign sequence



Announcement
sign (WHAT)



Instruction sign
(HOW & WHEN)



Marker sign



2. Problem statement

- Different approaches co-exist
- No strict regulation in terms of sign *location*

! Upchurch et al. (2005)

- Flemish guidelines:
 - Announcement sign: 2000m > exit
 - Instruction sign: ??m > exit
 - Marker sign: 50-100m > exit



3. Research questions

- Q1: Do the announcement and instruction sign affect driving behavior?
- Q2: Does the effect of the instruction sign on driving behavior vary in function of its location?
- Q3: Is it possible to derive an optimal location for the instruction sign?


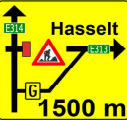









4. Methodology (1)





4. Methodology (2)

	AANKONDIGING		INSTRUCTIE		INSTRUCTIE		INSTRUCTIE		MARKERING		
Afstand tot afslag (meters)	2500	2250	2000	1750	1500	1250	1000	750	500	250	AFRIT
Conditie 11500			 E313 Hasselt Afgesloten volg route G		 Hasselt 1500 m						 G
11000			 E314 Aarschot Afgesloten volg route D				 Aarschot 1000 m				 D
1500			 E314 Diest Afgesloten volg route E						 Diest 500 m		 F



4. Methodology (3)

1. Parameters for longitudinal control:

- > Mean speed
- > SD mean speed
- > Acceleration/Deceleration
- > SD Acceleration/Deceleration

2. Parameters for lateral control:

- > Number of lane switches
- > Latest switch to the right lane
- > Percentage of time on the right lane



5. Results (1)

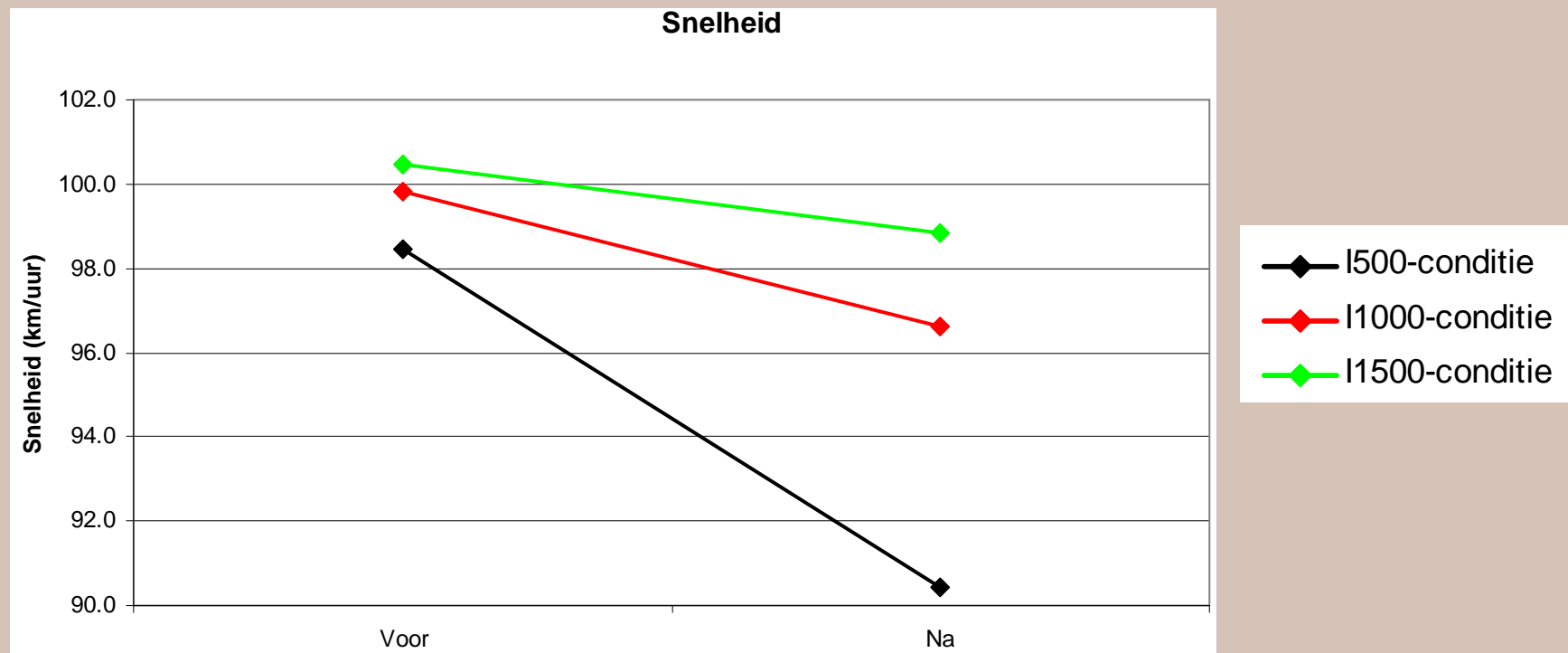
Q1: Do the announcement and instruction sign affect driving behavior?

Answer: YES !

- Announcement sign: speed decrease, but afterwards increases again
- Instruction sign:
 - Longitudinal behavior: speed decrease, but very abrupt decrease in 500m condition
 - Lateral behavior: increase in lane switches, most present in the 1500m condition



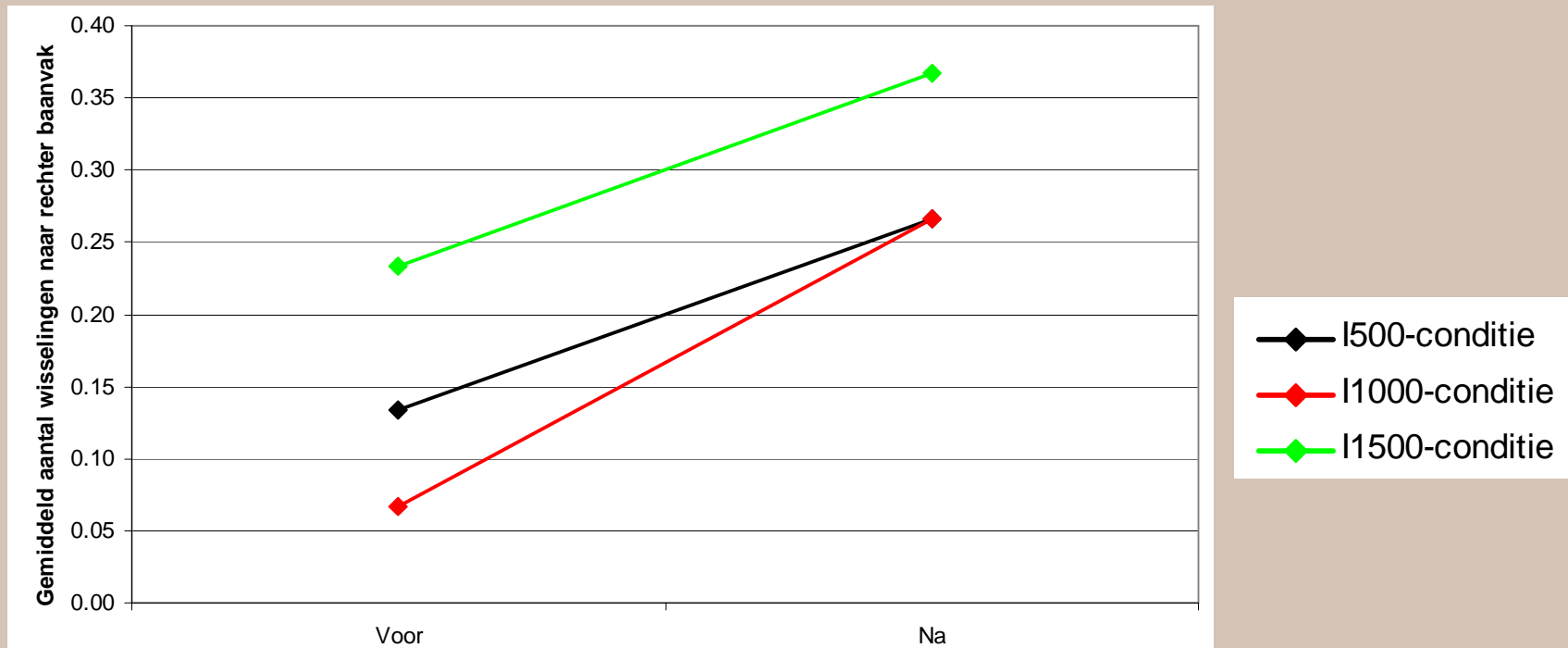
5. Results (2)



Speed behavior before and after the instruction sign for the three conditions



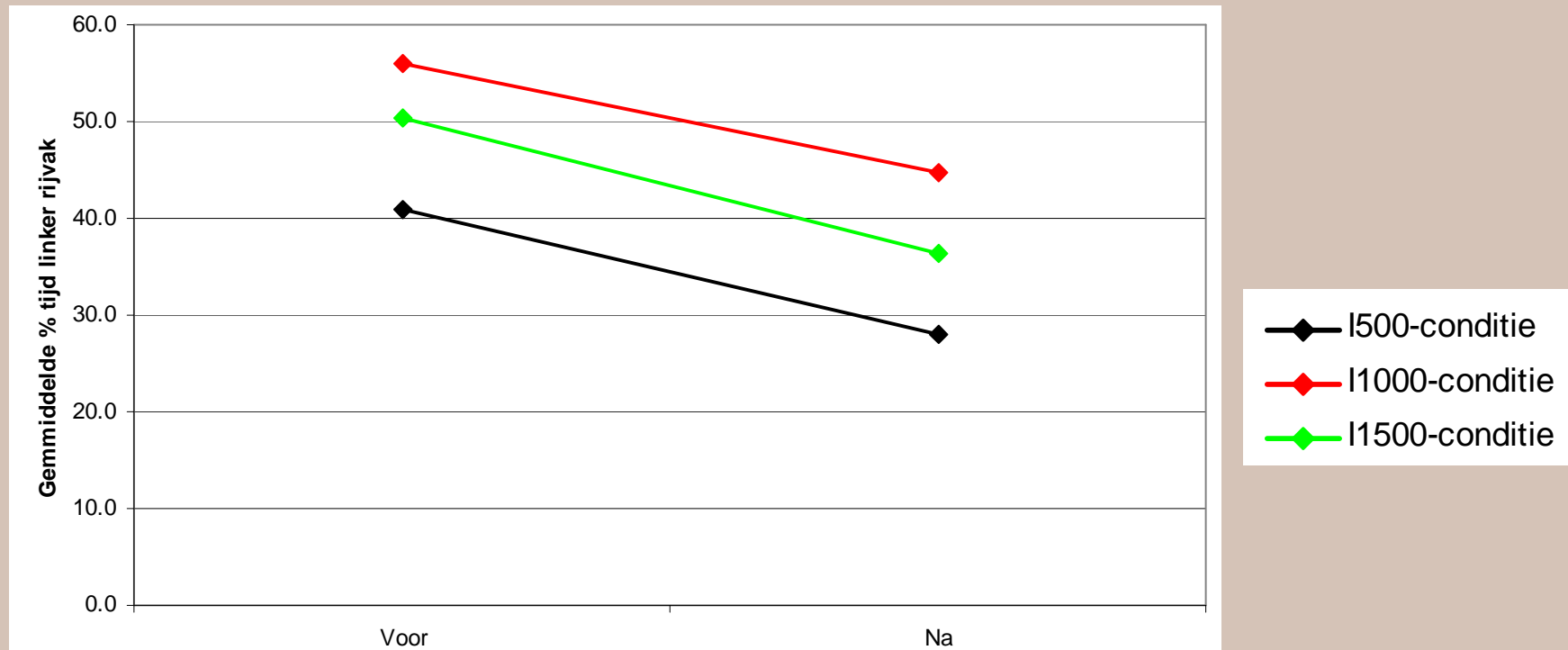
5. Results (3)



Average number of lane changes before and after the instruction sign for the three conditions



5. Results (4)



% of time spent on left lane before and after the instruction sign for the three different conditions



5. Results (5)

Q2: Does the effect of the instruction sign on driving behavior vary in function of its location?

Answer: YES !

- 1500m condition
 - Speed pattern:
 - decrease – increase – decrease
 - no abrupt changes
 - Lateral behavior:
 - Largest % of time on right lane
 - Latest shift to right lane on 848m before exit



5. Results (6)

- 1000m condition
 - Speed pattern:
 - Gradual decrease
 - Lateral behavior:
 - Latest shift to right lane on 725m before exit
- 500m condition
 - Speed pattern:
 - Decrease – increase – decrease
 - Abrupt speed change at the end
 - Lateral behavior:
 - Lowest % of time on right lane
 - Latest shift to right lane on 606m before exit



5. Results (7)

Q3: Is it possible to derive an optimal location for the instruction sign?

Answer: it seems that, based on the speed profile in combination with the number of lane changes, that the optimal location of the instruction sign is 1000m before the exit.

Why?

- 500m: leads to too abrupt speed changes short before the exit
- 1500m: longer time on right lane than needed
- 1000m: smooth decrease in speed, longer time on left lane, fewest lane changes



Thank you!