Installation of section control & speed cameras

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Please note: The studies included in this synopsis were selected from those identified by a systematic literature search of specific databases (see supporting document). The main criterion for inclusion of studies in this synopsis and the DSS was that each study provides a *quantitative effect estimate*, preferably on the number or severity of crashes or otherwise on road user behaviour that is known to be related to the occurrence or severity of a crash. Therefore, key studies providing qualitative information might not be included in this synopsis.

1. Summary

De Ceunynck, T., October 2017

1.1 COLOUR CODE: GREEN

Results consistently show that section control and fixed speed cameras have favourable effects on the number of crashes that occur.

1.2 KEYWORDS

Automatic speed enforcement, section control, average speed enforcement, point-to-point speed enforcement, fixed speed cameras, Empirical Bayes, spillover effects.

1.3 ABSTRACT

Section control and fixed speed cameras aim to reduce the number of crashes by enforcing the sign-posted speed limits. While fixed speed cameras measure the driving speed at one specific point, section control measures the average driving speed over a longer road section.
Most research regarding speed cameras and section control suggests a favourable impact on road safety. **Section control** was found to significantly reduce the number of crashes in a meta-analysis that was published in 2014. The estimated reduction in the number of crashes is somewhat stronger than for fixed speed cameras: -30% for the total number of crashes and -56% for crashes involving killed or severely injured victims. These results were confirmed by three more recent papers. Some indications are found of favourable spillover effects to non-treatment sites further downstream.
Results from the same meta-analysis indicate that **fixed speed cameras** significantly reduce the total number of crashes by about 20%. The results are to some extent confirmed by three more recent papers. The results suggest that the effect is very local, and no indications of spillover effects to non-treatment sites were found. A stronger effect was found for fatal crashes (-51%), but this could partly be explained by regression to the mean.

1.4 BACKGROUND

1.4.1 What are fixed speed cameras and section control?

Fixed speed cameras are cameras that are positioned at a specific location and programmed to take pictures of vehicles exceeding the speed limit (usually with a certain tolerance). Vehicles are identified by their number plate and the vehicle owner can then be fined. Section control can be seen as an extension of fixed speed cameras. Speed is not measured at a single point but on a longer road section. Based on pictures taken at two camera locations that can be several kilometres apart, the average speed is calculated, and if the average speed exceeds the speed limit, the vehicle owner can be fined (Høye, 2014).

There may be some country specific differences in the implementation of speed camera and section control programs, such as when cameras are in operation (continuously or only at certain times) or thresholds for sanctioning vehicle owners/drivers. In general, however, fixed speed camera and section control programs are quite similar in different countries and are usually clearly visible and signposted (Høye, 2014).

1.4.2 What is the rationale behind fixed speed cameras and section control?

Fixed speed cameras and section control (also referred to as average speed enforcement or point-to-point speed cameras) aim to reduce the number of crashes by enforcing the sign-posted speed limits. Excessive speed is a major road safety issue on all road types. Exceeding the speed limit, even by small amounts, has been found to be associated with substantial increases in crash risk as well as the severity of the outcomes should a crash take place (Aarts & van Schagen, 2006; Elvik et al., 2004). Therefore, even small reductions in vehicle speed can produce substantial reductions in the number and severity of crashes (Nilsson, 2004).

In addition, speed variation between vehicles has also been demonstrated to increase the risk of crash involvement (Soole et al., 2013). Fixed speed cameras and section control could affect road safety not only through their impact on mean speed and/or exceedance of the speed limit, but also through an effect on the speed variation.

1.4.3 Description of the main research methods

The safety effects of section control and fixed speed cameras have been studied quite extensively. A recent meta-analysis (Høye, 2014) has been identified, as well as a number of more recent studies in peer-reviewed scientific journals. All studies apply a before-after study design, usually the Empirical Bayes method. Only studies that provide estimates on the number of crashes have been included; studies that only looked at non-crash measures (e.g. driving speed) were not included. Most of the studies provide multiple estimates for different levels of crash severity.

1.5 OVERVIEW OF STUDY RESULTS

Section control significantly reduces the number of crashes according to a meta-analysis by Høye (2014). The estimated reduction in the number of crashes is somewhat stronger than for fixed speed cameras: -30% for the total number of crashes and -56% for crashes involving killed or severely injured victims. These results are also confirmed by the more recent individual studies on the effects of section control (Høye, 2015b; Lahrmann et al., 2016; Montella et al., 2015). Some indications are found of favourable spillover effects to non-treatment sites further downstream (Høye, 2015b; Montella et al., 2015).

Results from the meta-analysis (Høye, 2014) indicate that **fixed speed cameras** significantly reduce the total number of crashes by about 20%. A stronger effect was found for fatal crashes (-51%), but this could partly be explained by regression to the mean. The effects of the meta-analysis are to some extent confirmed by the more recent individual studies (Høye, 2015a; Hu & McCartt, 2016; Li & Graham, 2016). The results suggest that the effect is very local, and no indications of a spillover effect were found.

1.6 NOTES ON RESEARCH METHODS

The methodology of the studies is quite robust. The studies correct for possible confounders such as general trends and RTTM at least to some extent. Most of the studies are European.

The number of treatment sites is generally lower in studies about section control than in studies about fixed speed cameras. The effects of section control have mostly been studied on roads of higher order (highways and motorways), while the effects of fixed speed cameras have mostly been studied on roads of lower order. The results of all the studies appear to be relatively homogenous.

The large body of available studies, their high quality and the homogeneity of their results suggest that the found results are reasonably well transferable to similar locations in other European countries.

2. Scientific overview

2.1 ANALYSIS OF STUDY DESIGN AND METHODS

The number of studies of good quality on the effects of section control and fixed speed cameras is relatively high. A recent meta-analysis is available that summarizes the results of a number of individual studies on both speed measures (Høye, 2014). The meta-analysis on section control combines the effects of four individual studies; the meta-analysis on fixed speed cameras combines the effects of 15 individual studies. The meta-analysis does not provide details about the types of locations that are assessed in the individual papers it summarizes. There are likely to be substantial differences between the individual studies that are included.

All individual studies apply a before-after study design, usually the Empirical Bayes method. All papers have corrected for general trends and Regression to the Mean (RTTM) at least to some extent.

The three additional studies about section control assessed the effectiveness of section control on higher order roads (highways and motorways, speed limits of 80 km/h or higher). Two of the studies (Høye, 2015b; Montella et al., 2015) did not only look at treatment sites, but also at some spillover sites downstream of the treatment sites. Sample sizes are relatively low in the studies by Høye (2015b) and Lahrmann et al. (2016). The sample size is somewhat higher in the study by Montella et al. (2015), although all sites are situated on the same motorway.

The three additional studies about fixed speed cameras assessed the effectiveness of section control on roads of a lower order. These include urban as well as rural roads, with speed limits up to 90 km/h. Two of the papers had large sample sizes (Høye, 2015a; Li & Graham, 2016), while one paper had a small sample size (Hu & McCartt, 2016). One paper included a small sample of spillover sites as well (Hu & McCartt, 2016).

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Table 1: Information on sample and design of coded studies.

Author(s), year, country	Measure description and sample	Study design	Types of location included	Outcome indicators
SECTION CONTROL				
Høye, 2014, (meta-analysis), several countries	Effects of section control from 4 individual studies	Meta-analysis, some of the included estimates are corrected for RTTM	- No details about individual sites of included studies provided - Likely differences between studies	- Number of injury crashes and crashes of unspecified severity - Number of killed and severe injury (KSI) crashes
Høye, 2015b, Norway	Effects of section control at 14 treatment sites and 6 spillover site	Empirical Bayes before-after study, RTTM accounted for	- Tunnels and open roads - most sites have a speed limit of 80 km/h - length of treatment sites 2.05-10.54 km - length of spillover sites 3-6km	- Number of injury crashes - Number of KSI crashes
Lahrmann, Brassøe, Johansen, Madsen, 2016, United Kingdom	Effects of section control at 10 sites on one highway	Before-after study, RTTM partly accounted for	- A77 highway - 2- and 4-lane sections - Speed limit 60-70 mph	- Number of injury crashes
Montella, Imbriani, Marzano, Mauriello, 2015, Italy	Effects of section control at 167 sites on one motorway; includes treatment (length of 18.1km) and spillover sites (22.3 km)	Empirical Bayes before-after study, RTTM accounted for	- A56 Motorway - Nearly half of the studied stretch of motorway is equipped with section control	- Number of crashes - Number of property damage only (PDO) crashes - Number of injury crashes
FIXED SPEED CAMERAS				
Høye, 2014 (meta-analysis), several countries	Effects of fixed speed cameras from 15 individual studies	Meta-analysis, some of the included estimates are corrected for RTTM	- No details about individual sites of included studies provided - Likely differences between studies	- Number of crashes of unspecified severity - Number of injury crashes - Number of KSI crashes - Number of fatal crashes
Høye, 2015a, Norway	Effects of fixed speed cameras at 223 sites	Empirical Bayes before-after study, RTTM accounted for	- Sites outside urban area - Mostly two-lane sites - Speed limits 50-90 km/h	- Number of injury crashes - Number of KSI crashes
Hu & McCart, 2016, United States	Effects of fixed speed cameras at 18 treatment sites and 9 spillover sites	Before-after study, RTTM partly accounted for	- School zones and residential roadways with speed limits of 35 mph or less	- Injury severity; likelihood of incapacitating or fatal injury
Li & Graham, 2016	Effects of fixed speed cameras at 771 treatment sites	Propensity score matching, RTTM accounted for	- Diverse sample of roads with speed limit of 30-40 mph	- Number of injury crashes - Number of KSI crashes

2.2 OVERVIEW OF STUDY RESULTS

A recent meta-analysis is available that combines the results of multiple scientific studies regarding the effects of fixed speed cameras and section control on crashes (Høye, 2014). A review-type analysis has been made that departs from this meta-analysis, supplemented by a number of more recent studies on the topics that have been published in peer-reviewed journals. The meta-analysis is supplemented with three more recent studies about the safety effects of fixed speed cameras (Høye, 2015a; Hu & McCartt, 2016; Li & Graham, 2016), and three more recent papers about the safety effects of section control (Høye, 2015b; Lahrmann et al., 2016; Montella et al., 2015). Most of the papers made use of the Empirical Bayes method, in which unbiased estimates of effect are obtained by correcting for elements such as general trends in crash records, traffic volumes and regression to the mean. As a result, the found effects constitute an actual change in crash risk. A summary of the main results can be found in Table 2.

Most research towards speed cameras and section control suggests that they **significantly improve road safety**.

The meta-analysis about **section control** (Høye, 2014) found that section control significantly reduces the number of crashes by about 30%. The analysis of the most severe crashes showed a significant reduction by 56% in the number of crashes involving fatal and severe injury (KSI) crashes. The impact of section control on KSI crashes was found to be higher than on all crashes, but this result should be interpreted with caution since the estimate of the impact on KSI was based on one estimate from only one study. An overall improvement in road safety is therefore found by the meta-analysis.

Lahrmann et al. (2016) found a significant reduction in injury crashes after the installation of section control. Montella et al. (2015) found a significant reduction in all crashes, injury crashes and property damage only (PDO) crashes. Høye (2015b) found a significant reduction in KSI crashes, but the impact on all crashes was not statistically significant. Both tunnels and open roads were included in this study, and the results for both types of locations were highly similar. These results largely confirm the results of the meta-analysis.

The meta-analysis on **fixed speed cameras** (Høye, 2015a) found that fixed speed cameras significantly reduce the number of crashes of all severity categories. The strongest reduction was found in the number of fatal crashes.

Li & Graham (2016) found that fixed speed cameras lead to a significant reduction in the number of injury crashes as well, but could not confirm a significant effect on the number of fatal crashes. Hu & McCart (2016) found a significant reduction in the crash severity, expressed as the likelihood that a crash leads to an incapacitating or fatal injury, as a result of installing fixed speed cameras. The study by Høye (2015a) looked into different levels of crash severity and different section lengths around the position of the speed camera, but could only confirm the results of the meta-analysis to a limited extent. A significant reduction in the number of injury crashes was only found for segments of medium length (100m upstream to 1km downstream of the camera position). For longer and shorter lenghts, and in separate analyses for KSI crashes, no significant effects were found.

When comparing the effectiveness of section control and fixed speed cameras, one should take the **length of the treatment area** into account. Fixed speed cameras are spot measures, and their effects have a more limited length than section control. The fixed speed cameras studies that were included in the meta-analysis by Høye (2014) apply very different lengths of observation of effects, which makes it difficult to pinpoint exactly how far the effects of fixed speed cameras reach. For

example, the study by Høye (2015a) found a significant reduction of injury crashes in an area 100m upstream to 1km downstream of the fixed speed camera location, but no significant effect over a longer distance of 100m upstream to 3km downstream, or over a shorter distance of 100m upstream to 100m downstream. Section control studies, on the other hand, measure the effect on crashes over the entire length of the section control installation. These installations vary greatly in length, but generally are several kilometres long. For example, the length of the section control sites in the study by Høye ranges from 2.05 to 10.54 km.

In addition, some indications were found that section control can have **spillover effects** on other locations (i.e. they can lead to a reduction in crashes at other sites where no section control is installed as well). Høye (2015b) found a significant reduction in the number of injury crashes at spillover sites, but no significant influence on KSI crashes. Montella et al. (2015) found a significant reduction in all crashes and in injury crashes at spillover sites, but no significant effect on PDO crashes. One study (Hu & McCartt, 2016) looked into a possible spillover effect of fixed speed cameras, but no significant spillover effect was found for fixed speed cameras.

Findings by De Pauw et al. (2014b) indicate that drivers slow down quite abruptly near fixed speed cameras on motorways and speed up again shortly after passing the camera. For section control, on the other hand, a similar study by De Pauw et al. (2014a) found favourable effects on driving speed up to 6km before and after the enforced section. These findings can probably explain why the favourable effects of section control on crash records seem to extend beyond the actual treatment sites.

Additionally, a review by Soole et al. (2013) states that the high degree of compliance to the speed limits that is associated with section control also leads to reduced speed variation because the majority of motorists travelling on enforced sections of road tend to drive at speeds close to the sign-posted speed limit. Since a higher level of speed variation tends to have a negative effect on road safety (Aarts & van Schagen, 2006), this is an additional favourable effect on driving speed.

2.3 TRANSFERABILITY

The methodology of the studies is quite robust. All included studies correct for possible confounders such as general trends and RTTM at least to some extent. Most of the studies are European.

The number of treatment sites is generally lower in studies about section control than in studies about fixed speed cameras. The effects of section control have mostly been studied on roads of higher order (highways and motorways), while the effects of fixed speed cameras have mostly been studied on roads of lower order. The results of all the studies appear to be relatively homogeneous.

The large body of available studies, their high quality and the homogeneity of their results suggest that the found results are reasonably well transferable to similar locations in other European countries.

Table 2 Summary of study results.

Authors and Country	Dependant / outcome type	Futher specification of sites	Best estimate of effect [95% CI]	Impact on road safety
SECTION CONTROL				
Høye, 2014 (meta-analysis), Several countries (4 studies included)	**Injury crashes and crashes of unspecified severity**	**/**	**-30% [-36; -24]**	↗
	Fatal and severe injury (KSI) crashes	**/**	**-56% [-66; -42]**	↗
Høye, 2015b, Norway	Injury crashes	Treatment sites	-12% [-34; +9]	/
		Spillover sites	-46% [-64; -29]	↗
	KSI crashes	Treatment sites	-49% [-81; -18]	↗
		Spillover sites	+30% [-92; + 125]	/
Lahrmann, Brassøe, Johansen, Madsen, 2016, United Kingdom	Number of injury crashes	/	-33% [-41%; -24%]	↗
Montella, Imbriani, Marzano, Mauriello, 2015, Italy	All crashes	Treatment sites	-32.0% [-41,6; -22.3]	↗
	Property damage only (PDO) crashes		-21.6% [-39.9; -3.3]	↗
	Injury crashes		-36.8% [-48.0; -25.6]	↗
	All crashes	Spillover sites	-20.8% [-31.0; -10.6]	↗
	PDO crashes		-12.0% [-29.8; +5.8]	/
	Injury crashes		-25.7% [-37.9; -13.5]	↗
FIXED SPEED CAMERAS				
Høye, 2014a (meta-analysis), Several countries (15 studies included)	**Crashes of unspecified severity**	**/**	**- 20% [-28; -10]**	↗
	Injury crashes	**/**	**-20% [-26; -12]**	↗
	KSI crashes	**/**	**-15% [-24; -6]**	↗
	Fatal crashes	**/**	**-51% [-72; -12]**	↗
Høye, 2015a, Norway	Injury crashes	Long segments (100m upstream – 3km downstream)	-5% [-12; +2]	/
		Medium segments (100m upstream – 1km downstream)	-22% [-30; -14]	↗
		Short segments (100m upstream – 100m downstream)	+1% [-36; +37]	/
	KSI crashes	Long segments (100m upstream – 3km downstream	-17% [-47; +14]	/
		Medium segments (100m upstream – 1km downstream)	-24% [-72; +24]	/
		Short segments (100m upstream – 100m downstream)	-14% [-92; + 65]	/
Hu & McCart, 2016, United States	Crash severity – likelihood of incapacitating or fatal injury	Treatment sites	-19.4% [Significant at α=0.05; CI not reported]	↗
		Spillover sites	-17.2% [not significant at α=0.05; CI not reported]	/
Li & Graham, 2016, United Kingdom	Injury crashes	/	-25.9% [Significant at α=0.05; CI not reported]	↗
	KSI crashes	/	-4.5% [not significant at α=0.05; CI not reported]	/

2.4 CONCLUSION

In conclusion, there is ample evidence that both section control and fixed speed cameras improve road safety. All effect studies report a decrease in at least some types of crashes at locations that are equipped with section control or fixed speed cameras. A meta-analysis reports a decrease of 30% in injury crashes and crashes of unspecified severity, and a decrease of 56% in KSI crashes as a result of installing section control. The meta-analysis results of installing fixed speed cameras indicate a reduction of 20% in injury crashes and crashes of unspecified severity, 15% in KSI crashes and 51% in fatal crashes. A number of more recent studies about both topics largely confirmed the results from the meta-analysis. Some evidence was found of favourable spillover effects of section control to non-treatment sites. The large body of available studies, their high quality and the homogeneity of their results suggest that the found results are reasonably well transferable to similar locations in other European countries.

3. Supporting document

A literature search for studies that assessed effects of section control and speed fixed cameras was carried out in three databases (ScienceDirect, TRID, Scopus) with combinations of search terms and operators. These studies were assessed and checked for their relevance. Coding has focused on the most recent available meta-analysis (Høye, 2014), and articles in peer-reviewed scientific journals that are more recent than the meta-analysis (and that were therefore not included in it). Only articles that provide effect estimates on the number or severity of crashes are included; papers that only applied non-crash measurements such as driving speed have not been included.

3.1 METHODOLOGY

3.1.1 Literature search strategy – section control

Principles

Excluded:

- Effects on non-accident outcome (mainly speed and/or speed distribution) (will be diagonally checked for scientific background section)
- Driving simulator studies
- Impact on traffic capacity/flow
- Studies that are included in the 2014 meta-analysis
- Studies before 2013 (since these should be included or at least taken into consideration as part of the meta-analysis)
- Studies that deal with speed (or speed enforcement) at large, with speed cameras and/or section control only being a smaller part of the study
- Studies about red light cameras or mobile speed cameras

Research terms and hits

Database: ScienceDirect **Date:** 9th February 2017

Limitations/ Exclusions:

- Search field: TITLE-ABS-KEY
- Published: 2013 to current
- Document Type: ALL

search no.	search terms / operators / combined queries	hits
#1	pub-date > 2013 and TITLE-ABSTR-KEY(("section control" OR "section speed control" OR "average speed enforcement" OR "average speed control" OR "average speed cameras" OR "point-to-point average speed") AND ("road safety" OR accident* OR crash*))	4

⇨ **4 selected**

Database: Scopus **Date:** 9th February 2017

Limitations/ Exclusions:

- Search field: TITLE-ABS-KEY
- Published: 2013 to current
- Document Type: ALL

	search no.	search terms / operators / combined queries	hits
Speed cameras	#1	pub-date > 2013 and TITLE-ABSTR-KEY(("section control" OR "section speed control" OR "average speed enforcement" OR "average speed control" OR "average speed cameras" OR "point-to-point average speed") AND ("road safety" OR accident* OR crash*))	8

⇨ **8 selected**

Database: TRID **Date:** 10th February 2017

Limitations/ Exclusions:

- Published: 2013 to 2017
- Document source : ALL, Document Type: ALL, Subject area : ALL
- Language: English

	search no.	search terms / operators / combined queries	hits
	#1	[TITLE] "section control" OR "section speed control" OR "average speed enforcement" OR "average speed control" OR "average speed cameras" OR "point-to-point average speed"	11

⇨ **11 selected**

Database: iRAP toolkit, iRAP website and CEDR website **Date:** 09th February 2017
No additional relevant studies

Results Literature Search

Database	Hits
ScienceDirect	4
Scopus	8
TRID	11
Total number of studies to screen title	**23**

Screening

Total number of studies to screen title (in order to evaluate the relevance to the topic)	23
Number of articles remaining after screening of the title and abstract	7

Prioritising Coding

Prioritization:
1. Paper's availability
2. Peer-reviewed journal articles only

Following these prioritisation criteria, the full-text screening of the 7 studies allowed the selection of 4 papers to be coded.

Table 3 Final list of coded studies about section control.

Authors	Title	Year	Country
Alfonso Montella, Lella Liana Imbriani, Vittorio Marzano, Filomena Mauriello	Effects on speed and safety of point-to-point speed enforcement systems: Evaluation on the urban motorway A56 Tangenziale di Napoli	2015	Italy
Alena Høye	Safety effects of section control - An empirical Bayes evaluation	2015	Norway
Alena Høye	Speed cameras, section control, and kangaroo jumps – a meta-analysis	2014	Multiple countries (meta-analysis)
Lahrmann, H;, Brassøe, B, Johansen, J.W.; Madsen, J.C.	Safety impact of average speed control in the UK	2016	United Kingdom

3.1.2 Literature search strategy – speed cameras

Principles

Excluded:
- Effects on non-accident outcome (mainly speed and/or speed distribution) (will be diagonally checked for scientific background section)
- Driving simulator studies
- Impact on traffic capacity/flow
- Studies that are included in the 2014 meta-analysis
- Studies before 2013 (since these should be included or at least taken into consideration as part of the meta-analysis)
- Studies that deal with speed (or speed enforcement) at large, with speed cameras and/or section control only being a smaller part of the study
- Studies about red light cameras or mobile speed cameras

Research terms and hits

Database: ScienceDirect **Date:** 23rd January 2017

Limitations/ Exclusions:
- Search field: TITLE-ABS-KEY
- Published: 2013 to current
- Document Type: ALL

	search no.	search terms / operators / combined queries	hits
Speed cameras	#1	pub-date > 2013 and TITLE-ABSTR-KEY("speed camera*" OR "automatic speed enforcement") and TITLE-ABSTR-KEY("road safety" OR accident* OR crash*)	41

⇨ **9 selected**

Database: TRID **Date:** 25th January 2017

Limitations/ Exclusions:

- Published: 2013 to 2017
- Document source : ALL, Document Type: ALL, Subject area : ALL
- Language: English

	search no.	search terms / operators / combined queries	hits
	#1	("speed camera" OR "automatic speed enforcement")	76

⇨ **8 selected**

Database: iRAP toolkit, iRAP website and CEDR website **Date:** 09th February 2017
No additional relevant studies. Nothing interesting

Results Literature Search

Database	Hits
ScienceDirect	41
TRID	76
Total number of studies to screen title	**117**

Screening

Total number of studies to screen title (in order to evaluate the relevance to the topic)	117
Number of articles remaining after screening of the title and abstract	8

Prioritising Coding

Prioritization:

1. Paper's availability
2. Peer-reviewed journal articles only

Following these prioritization criteria, the full-text screening of the 8 studies allowed the selection of 4 papers to be coded.

Table 4 Final list of coded studies about section control.

Authors	Title	Year	Country
Haojie Li, Daniel J. Graham	Heterogeneous treatment effects of speed cameras on road safety	2017	United Kingdom
Alena Høye	Safety effects of fixed speed cameras - An empirical Bayes evaluation	2015	Norway
Alena Høye	Speed cameras, section control, and kangaroo jumps–a meta-analysis	2014	Multiple countries (meta-analysis)
Hu, Wen, McCartt, Anne T	Effects of Automated Speed Enforcement in Montgomery County, Maryland, On Vehicle Speeds, Public Opinion, and Crashes	2016	United States

3.2 FULL LIST OF CODED STUDIES

Høye, A. (2014). Speed cameras, section control, and kangaroo jumps–a meta-analysis. Accident Analysis & Prevention, 73, 200–208. https://doi.org/10.1016/j.aap.2014.09.001

Høye, A. (2015a). Safety effects of fixed speed cameras—An empirical Bayes evaluation. Accident Analysis & Prevention, 82, 263–269. https://doi.org/10.1016/j.aap.2015.06.001

Høye, A. (2015b). Safety effects of section control - An empirical Bayes evaluation. Accident Analysis & Prevention, 74, 169–178. https://doi.org/10.1016/j.aap.2014.10.016

Hu, W., & McCartt, A. T. (2016). Effects of automated speed enforcement in Montgomery County, Maryland, on vehicle speeds, public opinion, and crashes. Traffic Injury Prevention, 17(sup1), 53–58. https://doi.org/10.1080/15389588.2016.1189076

Lahrmann, H., Brassøe, B., Johansen, J. W., & Madsen, J. C. O. (2016). Safety Impact of Average Speed Control in the UK. Journal of Transportation Technologies, 06(05), 312. https://doi.org/10.4236/jtts.2016.65028

Li, H., & Graham, D. J. (2016). Heterogeneous treatment effects of speed cameras on road safety. Accident Analysis & Prevention, 97, 153–161. https://doi.org/10.1016/j.aap.2016.09.007

Montella, A., Imbriani, L. L., Marzano, V., & Mauriello, F. (2015). Effects on speed and safety of point-to-point speed enforcement systems: Evaluation on the urban motorway A56 Tangenziale di Napoli. Accident Analysis & Prevention, 75, 164–178. https://doi.org/10.1016/j.aap.2014.11.022

3.3 EXTRA REFERENCES INCLUDED IN SYNOPSIS

Aarts, L., & van Schagen, I. (2006). Driving speed and the risk of road crashes: A review. Accident Analysis & Prevention, 38(2), 215–224. https://doi.org/10.1016/j.aap.2005.07.004

De Pauw, E., Daniels, S., Brijs, T., Hermans, E., & Wets, G. (2014a). Automated section speed control on motorways: An evaluation of the effect on driving speed. Accident Analysis & Prevention, 73, 313–322. https://doi.org/10.1016/j.aap.2014.09.005

De Pauw, E., Daniels, S., Brijs, T., Hermans, E., & Wets, G. (2014b). Behavioural effects of fixed speed cameras on motorways: Overall improved speed compliance or kangaroo jumps? Accident Analysis & Prevention, 73, 132–140. https://doi.org/10.1016/j.aap.2014.08.019

Elvik, R., Christensen, P., & Amundsen, A. (2004). Speed and road accidents. An evaluation of the Power Model (No. TØI report 740/2004). Oslo, Norway: Institute of Transport Economics.

Nilsson, G. (2004). Traffic Safety Dimensions and the Power Model to Describe the Effect of Speed on Safety. Lund: Lund University.

Soole, D. W., Watson, B. C., & Fleiter, J. J. (2013). Effects of average speed enforcement on speed compliance and crashes: A review of the literature. Accident Analysis and Prevention, 54, 46–56.

3.4 PAPERS INCLUDED IN META-ANALYSIS BY HØYE (2014)

3.4.1 Section control studies

Brassøe, B., Johansen, J.W., Madsen, J.C.O., Lahrmann, H., 2011. Sikkerhedsmæssig effekt af strækningshastighedskontrol i Storbritannien (The safety Effects of Section Control in Great Britain). Trafikdage på Aalborg Universitet.

Broughton, P.S., Hutchings, C., Stone, D., Walker, L., 2012. Effectiveness of average speed cameras on the reduction of road casualties: analysis of the A77 in Scotland. In: Dorn, L. (Ed.), Driver Behaviour and Training Volume V. Ashgate Publishing, Aldershot.

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