Influence of Billboards on Driving Behaviour and Road Safety

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ABSTRACT

Advertising billboards placed at roadsides are designed to draw drivers' attention, and therefore might distract drivers' from the primary driving task, detract from their vehicle control performance and, consequently, lead to road crashes. In recent years the issue of roadside advertising has gained headlines in Israel, because of the increasing prevalence of billboards and due to the public debate with respect to the proposed signposting law of 2006. Following discussions in the Israeli parliament and the decision of the Court in 2008, the placement of billboards adjacent to the Ayalon Highway was forbidden (and existing billboards had to be covered or removed). Therefore, a rare research opportunity presented itself, namely, a comparison of road crashes in two periods – with and without roadside advertising billboards.

The present study includes two parts. A literature review focusing on a quantitative summary of previous studies on the effect of roadside advertising and road safety, and an analysis of the impact of advertising billboards adjacent to the Ayalon Highway on the occurrence of crashes on that highway. A third part of the research program was to develop a real-time measurement method for assessing the impact of billboards on traffic and driver behavior. A field test of the method at a signalized junction encountered technical difficulties and was not completed.

The literature survey shows that both early and recent studies found a negative impact of advertising billboards on safety. However, a critical analysis of the studies reveals that many studies were not methodologically adequate. Recent studies were more rigorous, and while the findings were also in the same direction, the results were often not statistically significant.

Quantitative weighted estimates of the impact of billboards on road accidents (meta-analysis) agreed with previous findings of a generally negative impact. However, the values of the estimated impacts should not be taken at face value. It is advisable not to use them as firm estimates of the expected percentage change in road accidents as a result of placing billboards.

The behavioural research on billboards is more conclusive. Advertising billboards have a negative effect on road safety, as they interfere and distract drivers' attention from the primary task of driving. Laboratory experiments, including simulator studies, have shown deteriorating driving performance in the presence of advertising billboards and messages, especially dynamic advertising media. However, the findings of field studies do not provide consistent evidence for the negative effects of billboards on driver behavior.

Nevertheless, quantitative findings such increased frequency and duration of glances in the direction of dynamic billboards, support the possibility that such attention demanding advertising might, in complex or unexpected traffic situations, prolong drivers' response time, cause drivers to miss an event requiring a response, or cause a reaction that is not appropriate to the situation.

Reviews of billboard advertising were conducted in many countries in support of setting policies about roadside advertising. Our review of policies found that most of the rules and regulations on the subject function to limit the use of advertising signs (including billboards), essentially in two ways: (a) restriction / prohibition of the use of advanced advertising media that attract significant driver attention; (b) the prohibition / restriction of posting advertising signs at critical roadway locations, such as in the branching / weaving areas where advertising signs would harm visibility / conspicuity of critical traffic control devices.

The accident analysis in this study examined the influence of billboards on accidents occurrence on the Ayalon Highway in Tel Aviv metropolitan area. Two periods were compared: "before" - when the billboards were present along the roadside (years 2006-2007) and "after" - when the billboards were covered (2008). The accident database that was used in the analysis was derived from the "Incidence Logbook" maintained by the Traffic Control Center of Ayalon. This digital record contains all crashes (with and without injury) taking place on the highway, regardless of police involvement. Therefore, the accident database is much larger than he corresponding "official record" based on police reported injury crashes. The Ayalon TCC also monitors traffic volumes, data we used in the analysis.

The analyses compared the number of accidents at treatment sections, where billboards were posted adjacent to the road, with a control group that included the remaining road sections. Interchange (exit & entry) areas were excluded as billboards are not allowed there. The analyses considered various accident classes, including: (1) All accidents at all levels of severity; (2) Damage Only accidents; (3) Injury accidents, including fatal; (4-5) Accidents with casualties by day and night; (6-7) Accidents with casualties on weekdays and on weekends. Two types of models were fitted to the accident series: model 1 with traffic volumes as an explanatory variable, and model 2 without traffic volumes.

The results indicated a general reduction in accidents on the Ayalon Highway following the removal of billboards. In most comparisons the downward trend was larger in the Treatment sites compared with Control sites sections. Significant effects were found for All crashes and for Injury accidents. The effects for Damage accidents were not significant. The models with traffic volumes and without it gave similar results.

Due to reservations which are noted in the report regarding the data, the uniqueness of the Ayalon Highway and the Treatment characteristics, it is recommended not to attach undue weight to the (relative large) derived statistical value for the percentage reduction in accidents following the removal / cover of advertising billboards. However, the downward trend in accidents in the "after" period was robust and consistent, in all examinations, particularly for injury crashes. Therefore we can conclude that under Israeli road conditions, there is empirical evidence of a link between the removal of advertising signs and the improvement of road safety on an urban / suburban highway.

Since the completion of the study, the moratorium on displaying advertising billboards on the Ayalon Highway was lifted. This new situation provides another research opportunity, to compare a set of three periods- the same road sections 'with billboards', 'without', and 'with' again.

Table shows Database of crashes for model testing.

			Controls, inter-changes		Control sections away from interchange				Low density treatment sections			M density treatment sections		H sign density treatment sections				
Grand Total	Total control group	**Total treatm't group**	C6	C5	C4	C3	C2	C1	DE_S	CD_S	BC_S	JY_N	EF_N	DE_N	CD_N	BC_N	Crash type	year
955	849	**106**	65	417	57	66	130	114	13	8	3	10	8	40	21	3	All	2006
952	857	**95**	77	461	55	58	100	106	8	10	6	16	8	17	25	5	crashes	2007
890	825	**65**	48	367	88	69	149	104	7	7	3	3	7	12	20	6		2008
670	605	**65**	41	304	37	45	98	80	7	3	0	4	8	26	16	1	DMO	2006
650	591	**59**	48	319	37	47	66	74	5	6	3	10	6	11	15	3		2007
615	567	**48**	32	251	57	51	102	74	6	5	3	3	4	10	13	4		2008
280	240	**40**	23	110	20	21	32	34	6	5	2	6	0	14	5	2	Injury	2006
297	262	**35**	28	140	18	11	33	32	3	4	3	5	2	6	10	2	crashes	2007
272	255	**17**	16	114	30	18	47	30	1	2	0	0	3	2	7	2		2008
5	4	**1**	1	3	0	0	0	0	0	0	1	0	0	0	0	0	Fatal	2006
5	4	**1**	1	2	0	0	1	0	0	0	0	1	0	0	0	0	crashes	2007
3	3	**0**	0	2	1	0	0	0	0	0	0	0	0	0	0	0		2008

Treatment effect (removing billboards during 2008) was assessed by comparing crash numbers “after” and “before” while considering changes in the control sites, which provide estimate for the expected changes in the treatment group even without the intervention of removing the billboards. Other variables considered in the models were monthly traffic volumes at sites, seasonal effects, day / night, week / w-e, and billboard density.

The analysis is essentially fitting regression models to explain differences in monthly series of crashes at treatment and control sites.

Billboard density level, day /night, week / weekend had no significant effect in models. Model 2 without traffic volumes gave similar results as model 1 that included volumes. Below translated excerpt from the 20 pp + appendix, of stat analysis.

[Recently (end of 2012) we were asked by the Road Safety Authority to propose a re-evaluation of the impact of Billboards along the Ayalon with the added condition of the “return of the billboards”, which occurred overnight in August 2009. The proposal is still under consideration.]

Results of Model1 for all crashes

Solutions for Fixed Effects								
Effect	*y8*	*t_c*	*mon*	*Estimate*	*Standard Error*	*DF*	*t Value*	*Pr > |t|*
Intercept				-14.2301	2.9570	100.4	-4.81	<.0001
Lv				1.1848	0.2606	100.3	4.55	<.0001
y8	0			0.3834	0.1907	115.1	2.01	0.0467
y8	1			0	.	.	.	.
t_c		0		0.7449	0.2112	108.6	3.53	0.0006
t_c		1		0	.	.	.	.
*y8*t_c*	0	0		-0.5152	0.2177	115.4	-2.37	0.0196
*y8*t_c*	0	1		0	.	.	.	.
*y8*t_c*	1	0		0	.	.	.	.
*y8*t_c*	1	1		0	.	.	.	.
mon			1	0.1318	0.1679	305.2	0.78	0.4332
mon			2	-0.02079	0.1816	342.9	-0.11	0.9089
mon			3	0.009715	0.1806	335.1	0.05	0.9571
mon			4	-0.3138	0.1972	332.3	-1.59	0.1126
mon			5	-0.09891	0.1857	332	-0.53	0.5946
mon			6	-0.2591	0.1939	331.8	-1.34	0.1824
mon			7	-0.2057	0.1904	331.7	-1.08	0.2807
mon			8	-0.1252	0.1869	332.7	-0.67	0.5034
mon			9	-0.03311	0.1830	336.5	-0.18	0.8566
mon			10	-0.3614	0.1990	344	-1.82	0.0703
mon			11	0.1878	0.1619	245.3	1.16	0.2472
mon			12	0	.	.	.	.

estimates

Label	*Estimate*	*Standard Error*	*DF*	*t Value*	*Pr > |t|*	*Alpha*	*Lower*	*Upper*
Model coeffi $\beta_{Y8\_t\_c}$	-0.5152	0.2177	115.4	-2.37	0.0196	0.05	-0.9464	-0.08388

statistic	*Mean %*	*Confidence range at 95%*

statistic	*Mean %*	*Confidence range at 95%*	
Net % change in crashes at treatment section after controlling for change at control sites [1]	60	39	92

Estimates for # crash savings at treatment sites

#	section	mean	Confidence range at 95%	
1	BC_N	4.2	0.8	6.3
2	BC_S	2.0	0.4	3.1
3	CD_N	10.5	2.1	15.9
4	CD_S	10.2	2.0	15.5
5	DE_N	10.7	2.1	16.2
6	DE_S	9.6	1.9	14.6
7	EF_N	4.3	0.9	6.5
8	JY_N	3.7	0.7	5.7

Overall crash savings for all sites

statistic	*value*
Mean #	55.2
lower limit	11.0
upper limit	83.8