UP TO THE MARK?

THE REPORT OF THE RSMA SURVEY OF ROAD MARKING PERFORMANCE LEVELS ON UK ROADS

INTRODUCTION

The RSMA Ecodyn Survey of UK roads is the second such survey, covering a representative sample of approximately 1000km of roads in England and Scotland. The first survey was undertaken in 1996, whilst the second analysis was completed in 1998.

Both the 1996 and 1998 surveys were commissioned by the Road Safety Markings Association in order to determine the performance of road markings against the broadly accepted minimum performance level of 100 mcd/m²lx. This retro-reflectivity level is also the set minimum standard designated within the new European Standards for road marking due to be introduced in the UK on January 1st 2000.

As the basic level 100 mcd/m²lx takes account of both night-time and wet weather visibility in basic conditions only – there may be conditions where safety would require that a much higher performance would be desirable and/or necessary.

The impetus for the survey was to identify the level of road marking that fell below this minimum and to see whether industry perceived under-investment in road markings by responsible authorities, in the period between 1996 and 1998, was having appreciable impacts upon the road network and consequently on the safety of roads for the road user.

The surveys were undertaken using Ecodyn equipment operated by Prismo Ltd to a geometry that is accepted throughout Europe and would if anything provide higher reading in terms of retro-reflectivity than would be the case with the geometry specified within the forthcoming European Standards.

SUMMARY OF FINDINGS AND CONCLUSIONS

Findings

The survey undertaken in 1998 identified a dramatic reduction in the performance levels of road markings on major UK roads since 1996.

This reduction in performance meant that across all roads on the test circuit 49% of markings failed to meet the minimum criteria for retro-reflectivity performance in comparison of 29% two years ago.

This figure was broken down across road types and this identified major declines in the performance levels of markings on

i.) Motorways – 51% below minimum safety levels in 1998 compared with 24% in 1996.
ii.) Major A Roads (Dual Carriageways) – 54% below minimum safety levels in 1998 compared with 24% in 1996

All categories of roads had a decline in performance between 1996 and 1998 underlining the generally inadequate levels of investment in the most basic of road safety features.

Under funding of minor roads may be exposing road users to added dangers with up to 70% of lines failing to achieve minimum standards.

Improvements in performance levels were recorded where investment in infrastructure was taking place – making roads safer for all road users.

Conclusions

Based on previous RSMA research it is clear that under funding of basic road safety features such as markings, places an extra burden on the economy and public expenditure (including the NHS[1]).

Urgent Government action is required in the following areas:

Immediate and urgent investment is required to bring markings on UK roads up to minimum safety levels.

A schedule of programmed performance measurement and maintenance is required.

Specialised specification criteria need to be drawn up for marking on UK roads.

All responsible authorities (Central and Local Government) should develop and implement a plan to improve safety on UK roads.

METHODOLOGY

Ecodyn

Both surveys (1996 and 1998) were undertaken using an Ecodyn machine operated by Prismo Ltd. This machine operates a geometry accepted throughout Europe, although at a lower level than that designated under the new European Standards and that generally specified by responsible authorities in the UK.

The effect of this change in geometry is that the readings outlined in this report are marginally higher than those that would be obtained using conventional hand held equipment that is used by contractors to measure performance. Ironically this geometry will consequently tend to show markings as having a higher performance level than that used to judge performance levels in a contractual situation.

Ecodyn equipment is the only equipment currently available in the UK that would allow the form of surveying undertaken in this study.

Measurement

Where reference is made to markings throughout this report they should be taken to represent the following road markings as measured:

Motorways - Markings delineating lanes on motorways.

Dual Carriageways - Markings delineating the two lanes on the dual carriageway.

A Roads and B Roads
Single Carriageway - Centre line markings delineating the two lanes.

THE PREVIOUS SURVEY – 1996

The survey undertaken in 1996 covered 1055 km of UK highways across 33 designated roads, of this only 965.8 km is used for comparison purpose with the 1998 study. Inclement weather made it impossible to undertake detailed surveying of two road sections surveyed in 1996, whilst excess moisture on the lines, dirty areas and major works rendered random areas of road incomparable between the new surveys. The effect of these omissions is deemed to be neutral.

The 1996 survey indicated that some 28% (weighted average) of the markings surveyed fell below the 'minimum' standard of 100 mcd/m²lx, this failure rate was broken down across the various road categories as indicated in Figure 1.

Figure 1 – 1996 Basic Data

Type of Road	Km Surveyed	% of Markings < 100 mcd/m²lx
Motorways	373.2	22
A Roads	629.1	30
B Roads	52.7	51
ALL ROADS	**1055**	**28**

Whilst just less than one third of lines failed the test, the average reading for all lines was a relatively healthy 125.5 mcd/m²lx. This average should not be read as compensating for the 28 % failure level since performance minimums are relevant to immediate sight lines and not over 1000 km of roads. The average retro-reflectivity level does however provide a useful level from which to assess relative line performance over the period of the two surveys.

Consequently the 1996 survey and its findings are used as the base line for comparing the relative performance of markings in the 1998 study and the possible implications that the 1998 results may have for road safety.

THE LATEST SURVEY – 1998

As outlined above, the 1998 survey sought to cover the same roads as those surveyed in 1996 and 92% coverage of the previous survey was obtained.

The findings of the 1998 survey are shown with comparative figures derived from the 1996 report, where the 1996 figures have been re-profiled as to allow accurate comparisons with the latest data.

Figure 2 shows the failure rate of lines, again across road type along with the weighted average for failure of all lines.

Figure 2 – Revised 1996 Data and 1998 Basic Data

Type of Road	Km Surveyed	1996 % of lines < 100 mcd/m²lx	1998 % of lines < 100 mcd/m²lx
Motorways	323.4	24	51
A Roads	599.8	30	46
B Roads	42.4	53	70
ALL ROADS	**965.8**	**29**	**49**

These results indicate a marked deterioration in the performance of road markings in the time period between the two surveys being undertaken. This deterioration is at its most marked on motorway sections, although the results on 'A' roads are a cause for major concern due to the volume of traffic using these roads.

A more detailed breakdown analysis of the above grouped data has also been undertaken and is detailed below, the categories being used for analysis being:

Motorways, A Roads – Dual Carriageways, A Roads Single Carriageway, B Roads and Minor A Roads.

The results of this analysis are detailed in Figures 3 to 6 and show the change in the average retro-reflectivity reading on each stretch of road monitored along with any changes in the percentage of markings that fall below the accepted minimum standard of 100 mcd/m²lx. Where a stretch of road has not been re-analysed in the 1998 survey, those readings attained in the original 1996 survey are shown without comparison.

ANALYSIS BY CLASS OF ROAD

The breakdown analysis of the performance levels of markings in Motorways (Figure 3) shows a substantial decline in the performance level on the M1 and M69 and that all sections of motorway analysed with the exception of the M62 showed a decline in performance levels. Indeed across all Motorways – 51% of markings were below minimum safety levels in 1998 compared with 24% in 1996.

Figure 3 - Motorways

Motorway Surveyed	Average retro-reflectivity reading 1996 mcd/m²lx	Average retro-reflectivity reading 1998 mcd/m²lx	Percentage change in retro-reflectivity level '96 to '98	Percentage of lines below mcd/m²lx 1996	Percentage of lines below mcd/m²lx 1998	Kilometres Surveyed
M40	213	140	-34	4	31	68.3

M69	138	95	-31	10	74	23.8
M62	134	-	-	25	-	22.9
M1	145	103	-29	15	57	89.1
M62	102	130	+27	44	39	30.8
M66	129	115	-11	27	44	13.2
M6	128	100	-22	41	58	98.2

The breakdown analysis of the performance levels of markings on Dual Carriageways (Figure 4) indicates a substantial fall in performance levels with the percentage of lines below the performance minimum more than doubling from 24% in 1996 to 54% in 1998.

Figure 4 – A Roads (Dual Carriageway)

Road Surveyed	Average retro-reflectivity reading 1996 mcd/m²lx	Average retro-reflectivity reading 1998 mcd/m²lx	Percentage change in retro-reflectivity level '96 to '98	Percentage of lines below mcd/m²lx 1996	Percentage of lines below mcd/m²lx 1998	Kilometres Surveyed
A45	123	100	-19	16.8	67	25.7
A46	106	86	-19	28	87	6.8
A56	99	110	+11	43	57	13.3
A66	137	111	-19	24.8	53	77
A1	115	81	-30	42.2	85	69.4
A75	162	198	+22	2	21	30.4
A303	127	137	+7	12	9	27.9

Whilst improvements can be seen on roads where major improvements have or are taking place the overall figures provide major cause for concern in terms of safety for drivers on dual carriageways.

Particular reductions in performance levels on the heavily trafficked A1, A45 and A46 roads indicate a need for additional investment on these trunk routes, whilst improved maintenance scheduling may be required more generally.

Figure 5 shows the breakdown analysis for single carriageway roads and as would be expected following the analysis in figure 4, these results are marginally better than those recorded for the dual carriageway roads. Nevertheless performance levels of markings on the tested stretched of road still show a decline, with 44.5% now below the minimum standard against 34% in 1996.

Figure 5 – A Roads single carriageway

Road Surveyed	Average retro-reflectivity reading 1996 mcd/m²lx	Average retro-reflectivity reading 1998 mcd/m²lx	Percentage change in retro-reflectivity level '96 to '98	Percentage of lines below mcd/m²lx 1996	Percentage of lines below mcd/m²lx 1998	Kilometres Surveyed
A361	214	136	-36	4	19	22.4
A161	105	94	-10	55	74	36.3

A629	108	115	+6	48.5	63	37.1
A671	123	91	-26	51.5	77	6.9
A59	135	116	-14	10.9	47	18.3
A68	146	130	-11	17	32	24.4
A7	141	128	-9	14	26	51.9
A709	111	119	+7	39.6	21	15.9
A359	120	99	-18	29.3	60	24.3
A358	102	119	+17	52	26	13.6
A373	136	110	-19	56.4	50	15.5
A356	118	116	-2	29.3	33	23.1
A352	115	102	-12	33	50	20.4

The breakdown analysis for single carriageway roads would tend to suggest that maintenance patterns on these roads are more regular and/or lighter trafficking on these routes. However, the results still indicate a deteriorating situation in performance levels and a consequent reduction in the safety of UK roads. Maintenance patterns would benefit from review to ensure that time-scales are as required and that specifications are adequate to traffic needs.

The breakdown analysis on B Roads and Minor A Roads shown as Figure 6 also

Figure 6 – B Roads and Minor A Roads

Road Surveyed	Average retro-reflectivity reading 1996 mcd/m²lx	Average retro-reflectivity reading 1998 mcd/m²lx	Percentage change in retro-reflectivity level '96 to '98	Percentage of lines below mcd/m²lx 1996	Percentage of lines below mcd/m²lx 1998	Kilometres Surveyed
B1403	106	85	-20	55.4	81	6.3
B7608	99	-	-	53	-	27.6
B3181	143	97	-32	57	71	7.3
B3092	106	97	-8	46	62	27.0
A6088	163	130	-20	11.9	21	21.8
A3066	111	106	-5	37	38	17.4

Identifies a decline in performance levels with nearly 55% of lines now below minimum standards compared with just under 42% in 1996.

However, these average figures tend to hide an alarming trend that may be developing in the B Road network in the UK, whereby maintenance is accorded very low priority. Although only a snapshot of B Roads our figures show an average of 70% of markings on B Roads to be below minimum performance levels.

INTERPRETATION OF THE RESULTS IN CONTEXT

The centre markings on our roads provide the principal in situ roads safety features on our network and as such it is imperative that they are operating at optimal level. Whilst the above breakdown analysis has provided commentary on the results for each road category and a summation of possible actions that could be taken, the

urgent need for action can be best proven by examining the context within which the markings operate.

The 1997 National Traffic Forecasts published by the Department of the Environment, Transport and the Regions indicated expected traffic growth in all of the categories reviewed in our report – these projections are shown below as Figure 7.

Figure 7 – National Traffic Forecasts by Road Type. Source: DETR

	RURAL ROADS				URBAN ROADS			
	Motorway	Trunk & Other Principal Dual	Other	Total	Motorway	Trunk & Other Principal Dual	Other	Total
Bnveh Km	57.5	49.3	149.1	255.9	15.9	74.3	92.1	182.3
1996 = 100	100	100	100	100	100	100	100	100
2001	116	110	107	110	110	106	110	108
2011	152	129	122	130	129	116	132	125
2021	188	146	136	150	142	125	153	141
2031	217	159	146	165	150	131	170	152

The road categories used in Figure 7 are comparative to those used in the breakdown analysis detailed earlier in this report.

The figures shown in Figure 7 indicate an expectation of rapid growth in vehicle kilometres to be travelled in the short and medium term. Whilst Government policy is to restrict this growth in the medium to long term, latest figures[2] indicate that traffic growth in all categories since 1996 is in line with the above projections.

Continuing growth in traffic volumes, indeed even relative stability in volumes will continue to have an impact upon the performance levels of markings throughout the UK.

Since it is the road markings that provide the clearest and most continuous safety message to all road users, not just drivers but also cyclists and pedestrians, the results of the RSMA survey require an immediate response from the responsible authorities.

The urgency for action in this area is underlined by the imminent introduction of European Performance Standards for road markings on January 1st 2000, when the minimum performance level for a road marking in use shall be set at 100 $mcd/m^2 lx$ – a performance level that the RSMA survey clearly indicates is being met by barely half of road markings in the UK.

The introduction of European Standards will also bring with it opportunities to ensure that UK roads are more adequately specified for the performance of road markings, equally this opportunity can only be optimised if there is clear understanding of the specification process.

The reality is that large stretches of UK roads are failing to provide the most basic and fundamental safety requirements to users and that this failure may put at risk road users throughout the country, especially at night and in wet driving conditions.

It is clear that the findings of this report raise serious issues that need to be addressed, primarily by Central and Local Government, where they have a responsibility for road maintenance and the safety of road users. We hope that the Government and its maintenance agents will take the lead by adopting the recommendations that have come out this and previous research.

Previous research undertaken by the Road Safety Markings Association and the Association for Road Traffic Safety and Management (*Cosmetic or Crucial RSMA/ATRSM, 1998*) clearly identified the link between accident reduction and improvements in road markings (and signage). Indeed this report also outlined the significant savings such improvements can have for the economy through the reduction in accidents, health care needs and associated costs.

The RSMA recommend that the Government and all authorities responsible for this most fundamental element of road safety adopt the following course of action, which will enhance and underwrite the safety of UK roads.

1. The introduction of a dedicated budget for the measurement of in-situ performance levels of road markings.
2. The development of an adequate maintenance regime for road markings.
3. The development of adequate specification criteria, to ensure that road marking performance criteria is not under specified in relation to current traffic and projected traffic conditions.
4. The urgent investment in maintenance to bring UK roads up to at least minimum standards of safety that drivers have a right to expect.

References,

1) Cosmetic or Crucial – The Case for good signing and lining? (Technical Guide), RSMA/ARTSM, 1998
2) Traffic in Great Britain Statistical Bulletin 1st, 2nd & 3rd Quarters 1998 - DETR