High Conspicuity Livery for Police Vehicles

Home Office
Police Scientific Development Branch

Publication No. 14/04

Paul Harrison

High-Conspicuity Livery for Police Vehicles

Paul Harrison

Publication No 14/04

POLICE SCIENTIFIC DEVELOPMENT BRANCH

HIGH-CONSPICUITY LIVERY FOR POLICE VEHICLES

PAUL HARRISON

FIRST PUBLISHED 2004

Published by:

Home Office
Police Scientific Development Branch
Sandridge
St. Albans
Hertfordshire
AL4 9HQ
United Kingdom

COVER PHOTOGRAPHS

Top: Full battenburg

Centre: From the left: full battenburg rear view; half battenburg in residential street; half battenburg front view

Bottom: Close-up of half battenburg in a High Street environment

Printed by:

eSP Colour
Elgin Drive
Swindon
Wiltshire
SN2 8XU

Foreword

In 1998, the Police Scientific Development Branch (PSDB), at the request of the then National Motorway Policing sub-committee of the former Association of Chief Police Officers (ACPO) Traffic committee (now ACPO Roads Policing Operations Forum, RPOF), published a "Specification for the Livery on Police Patrol Cars." This document provided the police service with a practical corporate high-conspicuity vehicle livery that met ACPO operational requirements. Owing to its use of alternating blocks of contrasting colour, the livery subsequently acquired the name "Battenburg."

Since the release of the battenburg livery specification, uptake by the police service has been steady. 46% of forces had applied battenburg to at least three quarters of their vehicles for motorways and trunk road patrol duties by 2001. A survey in 2003 has shown that this number has increased to 76% of forces. The survey also suggested that this figure is likely to climb to 85 or 90% by the end of 2004.

The United States National Institute of Justice is considering trials of the battenburg livery in order to promote officer safety and corporacy.

Within the last few years and in light of the policy of "high visibility policing," it has become apparent that a livery similar in appearance to battenburg was required for urban police patrol vehicles, building on the corporate image established by battenburg. The operational requirement was agreed by the ACPO RPOF and an evaluation has been completed by PSDB. The resultant livery, known as the "Half Battenburg," is detailed in this publication.

It is hoped that this police vehicle livery specification will be adopted by all forces within the United Kingdom, enhancing the corporate image of the police service and promoting greater safety on our roads.

S. M. Green QPM

Chief Constable Nottinghamshire Police

ACPO Roads Policing Operations Forum Portfolio Holder

B. R. Coleman OBE

Director, Home Office Police Scientific Development Branch

Management Summary

This document provides specifications for high-conspicuity livery schemes for both motorway and urban patrol vehicles. The schemes described are for application to motorway/trunk road patrol vehicles – “full battenburg” – and urban/suburban patrol vehicles – “half battenburg.” The following items are provided:

- A summary of the research and development work that went into the original “battenburg” scheme, as well as an outline of the scientific principles behind it;
- A brief description of the evolution of the “half battenburg” adaptation for urban patrol duties, together with an evaluation of its performance compared with earlier schemes;
- Information enabling the application of the battenburg and half battenburg marking schemes to police vehicles;
- Detailed technical specifications for the minimum performance of materials used for marking vehicles in order to gain the full benefits of the liveries;
- Information concerning the correct application of the materials for marking vehicles;
- Recommendations for the proper routine maintenance procedure for the high conspicuity materials used for the marking scheme; and
- Recommended procedures for the removal of high conspicuity marking materials to permit either the replacement of damaged or degraded panels or the decomissioning of vehicles, for example prior to resale.

Information given within this document will enable fleet managers to commission the application of livery to various types of police vehicles. Alternatively, companies specialising in the marking of emergency vehicles should be aware of the requirements of the livery schemes and offer professional services. Contact details for some of these companies are listed in this document, together with the details of some the manufacturers of the retroreflective and fluorescent films whose products were available at the time of writing.

Acknowledgements

The author wishes to extend his gratitude to the Chief Constable of Hertfordshire Constabulary for the provision of vehicles and staff time for the trials on vehicle livery and for the photography used in this publication.

The Police Scientific Development Branch would like to thank the members of the original working party, led by Superintendent Derrick Bristow of Cambridgeshire Constabulary (until June 1994) and Superintendent Robert Good of Essex Police (until June 1995) for providing the practical information required to produce the scientific results for the original battenburg livery. In addition, the PSDB would like to thank former Superintendent Rodney Brown of the Thames Valley Police for his valuable support for this project.

The PSDB gratefully acknowledges the contribution of the police service in providing vehicles and time for the trials on this livery.

Disclaimer

The photographs of vehicle liveries portrayed in this guide are intended to be typical of the type under discussion in this publication. It is beyond the remit of the PSDB or the ACPO Livery Working Group to stipulate that the liveries described must be used, but they form a recommendation for police vehicle liveries.

Contents

page

Contents

page

List of Tables

page

List of Photographs

1 History and Science of "Battenburg"

The origins of the "battenburg" livery scheme and the philosophy behind it will be described in this chapter.

In the context of this document, the following definitions are intended. "Conspicuity" is the degree to which a specific object can be seen easily and recognised within its immediate visual context. "Battenburg" is currently the recommended livery scheme introduced as a nationwide corporate and highly-conspicuous livery intended for application to motorway patrol vehicles to increase safety. "Half battenburg" is currently the recommended livery scheme introduced to build upon the theme of corporacy promoted initially by the original (full) battenburg livery scheme. Its intended use is on urban/suburban patrol vehicles.

1.1 Background to 'Full Battenburg'

1.1.1 Details of the Full Battenburg Operational Requirement

An operational requirement for livery for motorway and trunk road patrol vehicles was set in October 1995 by the then ACPO Traffic National Motorway Policing sub-committee (see Reference [1]). It required that a police patrol car operating on a dual carriageway or motorway should be:

- Visible throughout the day and night and capable of being seen from a minimum viewing distance of 500 metres from on-coming road users; and
- Clearly recognisable as a police car.

The 500 metres minimum distance condition should apply during daylight hours in rain, mist, etc., though not necessarily in heavy rain or fog. Minimum illumination at night was defined as being that which is provided by an approaching vehicle with headlights set at the normal dipped position. This criterion applies without the roof lighting in operation on the police vehicle, since it is possible that this equipment can fail.

With the operational requirement for a conspicuous marking scheme having been defined by ACPO, the Home Office Police Scientific Development Branch (PSDB) was tasked with the development of a suitable livery scheme, together with the identification of appropriate lighting treatments. The aim of the development work was defined as:

"To determine for police traffic patrol vehicles operating in a motorway environment a suitable common standard of markings which enhances, at a distance, conspicuity and recognition as a police vehicle."

1.1.2 Objectives of the Battenburg Livery Scheme

The stated objectives of the work were that the proposed scheme should:

- Enhance officer and public safety by reducing the likelihood of road accidents where conspicuity of the police vehicle is a factor;
- Be recognisable as a police vehicle up to a distance of 500 metres in normal daylight;
- Assist in high visibility policing so as to reassure the public and enhance the potential deterrent benefits of proactive traffic patrol activity;
- Be readily identifiable nationally as a police vehicle, but retain the ability to associate force corporate logos with it;

- Capitalise on the latest materials and systems available and seek to achieve a cost-neutral option when compared with the average costs of current liveries; and
- Be acceptable to at least 75% of the staff using it.

1.1.3 Scientific Rationale Behind Battenburg

"Conspicuous" may be defined as "standing clearly in view; manifest; distinguished" (see Reference [2]). The concept of "conspicuity" derived from this definition involves temporal and spatial uncertainty on the part of an observer, combined with a lack of expectation concerning what he or she might encounter (see Reference [3]). In such circumstances, which are completely normal when driving, for instance, some visual attribute of an object makes the observer aware of its presence, location and nature. Police vehicles fall into this category. There is a need for them to attract the attention of motorists, but an equally important need for them to be quickly identifiable as police vehicles: to be "conspicuous."

At the time the initial research into police vehicle conspicuity was started in 1992, several levels of markings were identified, namely:

- White vehicle – could be almost any road user;
- White vehicle with high-visibility stripe – this is shared with a variety of road users, including vehicle repair, courier services and others wishing to convey a sense of 'urgent attention;'
- White vehicle with high-visibility stripe and blue light – shared by emergency services in general, including the military police and the private sector (e.g. private ambulances); and
- Vehicle with unique identifier – unique identification can only really be achieved with these marking configurations by use of the word "POLICE" or force emblems. "POLICE" can be understood by several European nationalities and may be helpful in identifying the vehicle to foreign visitors unfamiliar with the vehicle markings and the officers' uniforms.

The conspicuity of an object depends on its contrast with its background (Reference [3]). Visual attributes of primary importance are colour, luminance and form. Scope in using form to attract attention within the road traffic environment is very limited. Police vehicles themselves have a variety of shapes and sizes in an environment with an even larger variety of similar forms. Light bars and other equipment specific to police vehicles affect vehicle form, but are likely to aid recognition. As a consequence of these factors, it was decided that the greatest benefits to conspicuity would be realised by using colour and luminance contrast.

The environment contains colours across the whole visible range. Therefore, to attract attention, one needs to use high-visibility colours as identified in many texts, for example BS 6629: 1985: "Optical performance of high-visibility garments and accessories for use on the highway." What remains in question is how the relevant colours should best be employed to maximise conspicuity.

1.1.4 Daytime Conspicuity

It was deduced during initial research that the sides and rear of police vehicles are the areas that benefit most from having maximum conspicuity. It is these areas that passing motorists will see first when police vehicles are parked on the near-side of the road. The front of the vehicle is usually only seen in rear view mirrors. A literature search was undertaken and revealed that blocks of

colour as close to square as possible tend to be the most conspicuous. It has also been observed (Reference [4]) that "… fluorescent paints possess greater visual fields than their ordinary counterparts." The same researcher also noted that blocks tended to be more conspicuous the larger and the squarer in shape they were and that surrounding the blocks with contrasting colour was a major factor in increasing the effectiveness of the stimulus in being conspicuous.

Acceptance by police forces of a colour scheme involving blue and yellow for maximising conspicuity and contrast was felt to be likely, since many of them used these colours in existing schemes. Stripes should be avoided because, when covering large areas, they are analogous to camouflage markings and there are examples in nature and in military applications where they have been used to break up form and provide visual texture. This would tend to defeat the object of the marking scheme.

There is usually less opportunity for plain fluorescent areas to the rear of a vehicle since a larger amount of visual clutter exists, including the rear lamp units and the number plate. Similarly, the front of a vehicle does not lend itself to the application of large areas of fluorescent-coloured materials to increase conspicuity due to the presence of the headlamp units, the number plate and the radiator grille.

1.1.5 Night-Time Conspicuity

At night, different mechanisms of achieving conspicuous markings need to be sought because fluorescent properties of materials cease to be of benefit in the absence of ultraviolet illumination from sunlight. Fluorescent yellow appears to be bright and attention-getting under street lighting, but this is due to the spectral distribution of the colour rather than the fluorescent property. Most often, retro-reflective aids and light sources are used to promote conspicuity under dark conditions.

As with daytime conspicuity research, much effort has been directed towards accident avoidance rather than "conspicuity for conspicuity's sake." Research (Reference [3]) has demonstrated that the value of the use of retro-reflective materials on the front of motorcycles is obliterated by the glare of the headlamp. The same rationale can be applied to the front of any police vehicle and it can be said that the use of reflective treatments on the front is likely not to offer any benefit, except in a few very special cases. Another option to increase frontal conspicuity is to use specific configurations of lights or to modulate the existing lights in a characteristic way, specific to police vehicles. Modulation of lighting to the front of the vehicle on a continuous basis has the potential pitfall that it can convey the impression that the vehicle is engaged on an emergency call when this might not necessarily be the case.

1.1.6 Livery Development

Taking the principles discussed above into account, a suitable livery was designed and developed. This was then subjected to a series of laboratory and field trials in order to ensure that its performance met the operational requirement and exceeded that of earlier designs.

Laboratory trials involved making up slides simulating side or rear views of three vehicles at a time. These were then shown to volunteer test subjects using a slide projector tachistoscope for a period of 0.3 seconds in order to model the minimum time taken by a driver to glance at a specific road scene in order to obtain information (Reference [3]). The proposed markings were compared with civilian vehicles that were conspicuous in their own right, including a St. John's Ambulance car. Test subjects were not told to look for a police vehicle,

but were asked to note down which vehicle in the scene stood out the most. This ensured that the experiment was a test of true conspicuity, which is the ability of a vehicle to attract attention to itself.

When viewed under daylight conditions, the proposed livery was selected most frequently as being the most conspicuous from the side (53% compared with 42% for the most conspicuous civilian vehicle, Reference [3]). It also outperformed the other police force schemes in the experiment. Under night-time viewing conditions, the proposed livery dramatically outperformed all the civilian vehicles and performed almost twice as well as the best-performing police livery; 32% for civilian vehicles, 56% for best police scheme, 90% for proposed livery. Subjective feedback indicated that the proposed markings were described as distinctive and readily associated with the police.

Initial results were sufficiently encouraging to suggest that the proposed markings were suitable for field trials on the roads without major revisions. These would serve to identify opinions and attitudes of trial vehicle drivers and highlight any issues surrounding the durability and maintainability of the markings. Trials were conducted between March and October 1994 and involved 12 police forces.

One police vehicle per force involved was marked up in the proposed livery. This was then used for routine patrol duties. A structured questionnaire was used to obtain the required information, including the confidence the police drivers had in the proposed livery improving their safety and authority on the road.

One hundred and seventy police drivers responded to the questionnaire. Their opinions are summarised in Table 1.

Considering the stated objectives of the livery that it should present a conspicuous image that is representative of the police, the results summarised in this section appear to indicate that this has been achieved. The novel livery scheme was developed along proven ergonomic principles and achieved superior conspicuous performance, especially under night-time conditions, when compared with existing police livery schemes under laboratory conditions. Furthermore, following six months of field trials, the opinions of 170 police officers indicated that the livery was acceptable and that its introduction would be favoured.

1.1.7 Full Battenburg Recommendations

A. Full battenburg livery should be applied to all police vehicles intended for motorway/trunk road patrol duties, except in cases where vehicles need to remain unmarked.

B. Livery application should be carried out in accordance with Chapter 2 of this document.

C. Livery materials used should conform to the specification laid down in Chapter 4 in order that the benefits of the livery are realised.

Question	Agreed	Disagreed
Do you favour the introduction of the proposed livery?	70%	20%
Do you prefer to undertake your duties in vehicles with the proposed livery?	50%	19%
Do you feel safer undertaking your duties in vehicles with the proposed livery?	58%	10%
Do you consider that you achieve greater public awareness in vehicles with the proposed livery?	67%	14%
Do you consider the proposed livery to be more conspicuous than your force's legacy scheme?	86%	7%
Do you feel that the proposed livery is radical and different to any previous marking schemes?	73%	5%
Does the proposed livery convey efficiency?	68%	9%
Do you consider the proposed livery to be appropriate for police motorway patrol vehicles?	63%	16%
Do you consider the proposed livery to have an "official" appearance?	58%	21%
Do you consider the proposed livery to have an "authoritative" appearance?	53%	22%
Do you consider the proposed livery to be reassuring?	48%	21%

Notes:

1. These are representative of the original questions that appeared on the questionnaire but are not the exact questions used.
2. Where the sum of the two percentages quoted does not equal 100%, this is due to the remainder of the respondents expressing "no preference" or leaving answers blank.
3. The livery was favoured because of improved conspicuity and its use of high quality materials.

Table 1. Summary of livery trial survey responses

1.2 Background to 'Half Battenburg' Livery

1.2.1 Summary of the Half Battenburg Operational Requirement

The half battenburg design evolved from the original full battenburg scheme. It is a result of a desire to associate urban/suburban patrol vehicle livery schemes with the highly visible, easily recognisable full battenburg. In the case of the half battenburg, however, the operational requirement was different. It can be summarised as follows:

- The emphasis is on ease of recognition as a police vehicle to increase awareness among the public of the fact that police resources are present, thereby providing reassurance and a deterrent against crime; and
- Outright visibility is of lower importance since vehicles will generally be seen at close quarters by pedestrians and road users travelling

comparatively slowly. It was suggested that the likely maximum viewing distance would be closer to 200m.

Maximising officer safety whilst on duty in dangerous roadside locations was not the main reason for the fitment of the half battenburg livery but is an obvious benefit. Since extensive research went into the original full battenburg livery design on which half-battenburg is based and bearing in mind the reasons for its fitment, the scientific rigour applied to the original scheme was not considered necessary in designing the trial for the half battenburg. Instead, a simple evaluation was conducted. Having filmed vehicles in the half battenburg, full battenburg, 'red stripe' motorway patrol and navy blue double chequer band panda car liveries in a visually-cluttered environment (a busy shopping street), the footage was shown to volunteer test subjects. A discussion was initiated, being very careful not to direct the volunteers towards any conclusions and the relative merits of the marking schemes were discussed. The results are presented below. Further details of the method of evaluation, together with some photographs of the vehicles that were filmed, can be found in Appendix C.

1.2.2 Conclusions from the Half Battenburg Study

A. The half battenburg livery scheme appears to perform well within the context of an environment containing a large amount of visual clutter. Reasons for this include:
   - ♦ "POLICE" appearing in large, highly-contrasting, bold letters on the flanks of the vehicle;
   - ♦ Effective rear markings – retro-reflective red and retro-reflective and fluorescent yellow-green chevrons in this instance (although the recommendations stipulate retro-reflective and fluorescent orange in place of red on visibility performance grounds); and
   - ♦ White colour of the base vehicle stands out in this context.

B. Use of the police force logo tends to enhance the recognisability of the vehicle as a police vehicle, promoting "High Visibility Policing."

C. A simple evaluation exercise has indicated that it is likely that full battenburg livery offers little advantage over half battenburg livery within the visually cluttered context considered. Indeed the half battenburg livery performed the best in that environment. Comparing the half battenburg with the battenburg livery and all other factors being equal (for example, size of vehicle, quality of materials, etc.), the half battenburg scheme offers the enhanced corporacy being sought in order to promote greater public awareness. This is especially true bearing in mind the maximum viewing distance that is generally possible in urban and suburban contexts.

D. The evaluation demonstrated that the older general purpose (non-motorway) vehicle livery scheme was not easily recognisable as a police vehicle. Since the idea of the trials was observation of liveried police vehicles at close quarters, this leads one to the conclusion that the older scheme was not performing its intended function of raising awareness of the presence of a police vehicle.

1.2.3 Half Battenburg Recommendations

A. It is recommended that the half battenburg livery scheme should be adopted for application, as laid down in Chapter 2, to all appropriate police vehicles within every police force for vehicles other than those used for

motorway/trunk road patrol duties, to which the full battenburg livery should be applied.

B. Only appropriate classes of vehicle, dependent upon force policy, should be marked in half battenburg. Clearly, it is desirable for some types not to be identifiable, an obvious example being unmarked traffic vehicles.

C. Application of half battenburg livery to as many vehicles as is practical within police fleets will bring benefits since members of the public will tend to notice police vehicles and officers more easily. They will tend to perceive an increased police presence, which should lead to a reduced fear of crime and an increased feeling of reassurance, as well as providing a deterrent effect for criminals.

D. Adoption of half battenburg across all police forces will lead to additional benefits from the point of view of corporacy and a “professional” and an “authoritative” image for the Police Service.

E. Livery materials used should conform to the specification laid down in Chapter 4 in order that the benefits of the livery are realised.

2 Livery Specification

2.1 Base Colour of Vehicle

The battenburg livery was developed using extensive research and testing. Although the development was carried out with vehicles that were painted white, since the majority of the vehicle is covered in livery film, the base colour is not critical to the performance of the livery. As long as the instructions given in the following sections are adhered to, the livery will be effective. The use of base colours other than white is illustrated by Photograph 1 and Photograph 2 below.

Photograph 1. Half battenburg vehicle with silver base colour

Photograph 2. Full battenburg vehicle with black base colour

The letters used to construct the word “POLICE” should be specified in a colour that contrasts with the base colour of the vehicle. In the case of a navy blue vehicle, for example, a logical choice would be fluorescent yellow-green livery film, since this offers the maximum possible contrast with the dark blue background colour. It is preferable to use a highly-contrasting colour directly on the base colour of the vehicle than to use a panel of film to create the contrast both for reasons of professional appearance and cost. Similarly, using letters outlined in another colour does not serve to raise their legibility and increases costs.

It is recommended that the word “POLICE” to the sides – in the half battenburg case – or rear of the vehicle be produced from livery film that is retro-reflective. Fluorescent orange or red must be used to the rear of the vehicle. As already described, the colour that gives the best contract against the vehicle base colour should be used with the half battenburg livery.

Please note: Only red, blue, silver/white, white, fluorescent yellow-green and fluorescent orange retro-reflective materials may be used in police vehicle livery. These are permitted under an exemption from the Road Vehicle Lighting Regulations, 1989 and would otherwise be prohibited by primary legislation (refer to Chapter 5).

2.2 "Full Battenburg"

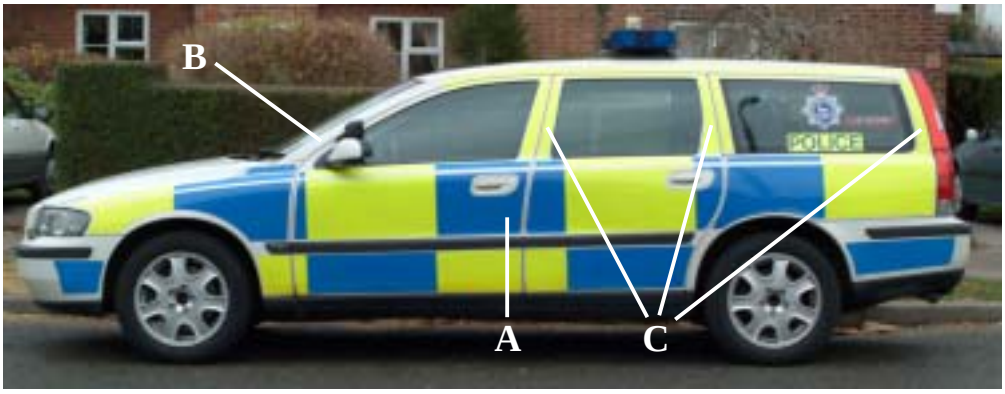
2.2.1 Front of Vehicle

Photograph 3. Full battenburg front livery application

The word "POLICE" should appear close to the front edge on the upper surface of the bonnet. The letters should be sized to be as large as possible whilst retaining visibility when viewed from the front. They may be either the right way around (as in Photograph 3) or laterally inverted (mirror image, as in Photograph 2). Block capitals in a typeface similar to that applied to British road signs as specified in The Traffic Signs Regulations and General Directions, 2002 should be used (refer specifically to Schedule 13, Parts I and II).

The colour of the letters should be chosen so as to maximise contrast with the background colour to which they are to be applied. For example, blue letters over a white or a silver background or yellow letters over a navy-blue background.

2.2.2 Side of Vehicle



Photograph 4. Full battenburg side livery application

The pattern of retro-reflective high-grade materials should start at position A as shown in Photograph 4, with a blue retro-reflective panel at the centre of the vehicle. Panels should be sized so that:

- Their horizontal length is 600 mm or greater and is equal for all panels, except the frontmost and rearmost; and
- Their vertical height is 300 mm or greater and is equal for all panels, except for the lowest row on the vehicle.

Fluorescent retro-reflective (dual performance) yellow-green panels should be fitted to either side of panel A. The pattern should be extended using alternating blue and fluorescent yellow retro-reflective material along the centreline of the side of the vehicle, as shown. Panels at the ends of the vehicle should be in fluorescent yellow retro-reflective and may be less than 600 mm long, but ideally not less than 400 mm.

The pattern should be extended downwards, starting with a fluorescent yellow retro-reflective panel vertically below panel A. This should then be extended horizontally to the front and rear of the vehicle. The lowest row should be sized so as to fill the side of the vehicle below the original row of panels.

Vehicle outlining is provided by silver/white or white retro-reflective tape applied to the front pillar (marked B). The door edges adjacent to the windows and rear pillar (marked C) should be marked in either silver/white, white or fluorescent yellow-green retro-reflective material.

Livery film should not be folded over the edges and cut-outs of vehicle panels, but instead should be cut short of them (see Photograph 5 and Photograph 6). It is also recommended that a clear fuel-resistant film is fitted over the fuel filler area.

Photograph 5. Detail of front of full battenburg vehicle showing how livery film is ‘cut around’ headlamp and bumper

Photograph 6. Detail of centre of full battenburg vehicle showing how livery film is ‘cut around’ door handles and sharp curves on bodywork

Please note: It is important to the effectiveness of the livery scheme that retro-reflective materials of the highest available grade be used throughout (see Chapter 4).

2.2.3 Rear of Vehicle

Photograph 7. Full battenburg rear livery application

All material used throughout should be high-grade fluorescent retro-reflective strip with a minimum width of 150 mm, edge sealed where applicable.

Note that the angle of the chevrons is determined by the width of the vehicle.

Material should be fitted as follows:

- Locate the approximate centre point of the rear window and draw a line from this point to the corners of the rear of the vehicle (as shown marked D in Photograph 7);
- First, an orange strip should be applied, below and to the edge of the line drawn starting at the window level. Any vehicle fittings should be cut around;
- Next, fluorescent yellow-green retro-reflective (dual performance) strips are laid above and below the orange strip;
- As much of the rear area as possible is then filled with additional strips, in an alternating pattern; and
- The rear window and roof line should be outlined with a minimum width of 25 mm of the fluorescent yellow-green retro-reflective (dual performance) material. As much material as possible should be used.

It is recommended that no other material should be overlaid onto the strips used for this chevron pattern as any such overlay would reduce the effectiveness of the design. Some police forces have chosen to include the word “POLICE” to the rear, as illustrated. This is acceptable, provided that the area covered by chevrons is maximised as far as possible and not itself covered, since this would detract from the effectiveness of the rear markings.

2.3 "Half Battenburg"

2.3.1 Front of Vehicle

Photograph 8. Half battenburg front livery application

The word "POLICE" should appear close to the front edge on the upper surface of the bonnet. The letters should be sized to be as large as possible whilst retaining visibility when viewed from the front. They may be either the right way around (as in Photograph 8) or laterally inverted (mirror image, as in Photograph 2). Block capitals in a typeface similar to that applied to British road signs as specified in The Traffic Signs Regulations and General Directions, 2002 should be used (refer specifically to Schedule 13, Parts I and II).

The colour of the letters should be chosen so as to maximise contrast with the background colour to which they are to be applied. For example, blue letters over a white or a silver background or yellow letters over a navy-blue background.

2.3.2 Side of Vehicle

The method of application of the half battenburg livery is very similar to that of the full battenburg scheme, except that not all of the surface area of the near-vertical surface to the sides of the vehicle is taken up by fluorescent retro-reflective yellow-green and retro-reflective blue blocks. Another key difference is that outlining the vehicle is not necessary.

The pattern of high-grade retro-reflective materials should start at position E, as shown in Photograph 9, with a blue retro-reflective panel at the centre of the vehicle. Panels should be sized so that their horizontal length is 600 mm or greater and is equal for all panels, except the frontmost and rearmost.

Photograph 9. Side on view of half battenburg livery

Fluorescent retro-reflective (dual performance) yellow-green panels should be fitted to either side of panel E. The pattern should be extended using alternating blue and fluorescent yellow retro-reflective material along the centreline of the side of the vehicle, as shown. Panels at the ends of the vehicle should be in fluorescent yellow retro-reflective and may be less than 600 mm long.

Below the centreline of the vehicle, or the coachline or rubbing strip if present, the word "POLICE" should appear in block capitals as large as possible given the space available whilst maintaining clarity, as shown in Photograph 10. Research has shown that this feature significantly improves public recognition of vehicles as police resources (see Appendix C). Block capitals in a typeface similar to that applied to British road signs as specified in The Traffic Signs Regulations and General Directions, 2002 should be used (refer specifically to Schedule 13, Parts I and II).

Livery film should not be folded over the edges and cut-outs of vehicle panels, but rather cut short of them (for example, see Photograph 11). It is also recommended that a clear fuel-resistant film is fitted over the fuel filler area.

Photograph 10. "POLICE" script on side of half battenburg

Photograph 11. Detail of half battenburg, illustrating how fuel filler is 'cut around'

Please note: It is essential to the effectiveness of the livery scheme that retro-reflective materials of the highest available grade be used throughout (see Chapter 4).

2.3.3 Rear of Vehicle

Photograph 12. Half battenburg livery rear markings

All material used throughout should be high-grade fluorescent retro-reflective strip with a minimum width of 150 mm, edge sealed where applicable.

Note that the angle of the chevrons is determined by the width of the vehicle.

Material should be fitted as follows:

- Locate the approximate centre point of the rear window and draw a line from this point to the corners of the rear of the vehicle (as shown marked F in Photograph 12);
- First, an orange strip should be applied, below and to the edge of the line drawn starting at the window level. Any vehicle fittings should be cut around;
- Next, fluorescent yellow-green retro-reflective (dual performance) strips are laid above and below the orange strip;
- As much of the rear area as possible is then filled with additional strips, in an alternating pattern; and
- The rear window and roof line should be outlined with a minimum width of 25 mm of the fluorescent yellow-green retro-reflective (dual performance) material. As much material as possible should be used.

It is recommended that no other material should be overlaid onto the strips used for this chevron pattern, as any such overlay would reduce the effectiveness of the design. Some police forces have chosen to include the word “POLICE” to the rear, as illustrated. This is acceptable, provided that the chevrons themselves are not covered.

3 Application and Maintenance

3.1 Introduction

Whilst many police fleet personnel do not fit entire livery schemes to vehicles often, if at all, it is likely that panels of livery film will need to be replaced from time to time due to accident repairs or film deterioration. For this reason, a brief series of notes has been included to provide guidance as to the use of livery film materials.

3.2 Cleaning of surfaces

Livery film should be applied only to surfaces that have been thoroughly cleaned and degreased to remove any road film and other contaminants. This will ensure maximum adhesion of livery film materials.

3.3 Air temperature

The range of air temperatures and surface temperatures at which livery film application should be undertaken is stated in the manufacturer's instructions. Application of self-adhesive materials within the stated temperature range will ensure that adhesion is optimised.

3.4 Application

IMPORTANT NOTES:

- **Do not touch the adhesive side of the film during application.** This will remove part of the adhesive backing, reducing the adhesion performance of the product, increasing the likelihood of curling at the edges.
- **It is important that excessive force is not used when pressing and smoothing livery film into place, since this will tend to stretch the film.** This tends to cause shrinkage of livery film panels after a period of time.

The recommended approach is to peel back a small section of the release liner along one edge of the film, enabling alignment of the livery film panel onto the target surface of the vehicle. Application involves aligning the livery film panel onto the vehicle, removing the remainder of the release liner and applying the film. Any air bubbles should then be removed by use of a spatula covered with a soft cloth, or other suitable applicator, working from the centre of the livery film panel towards the edges. If air bubbles cannot be removed in this way, they can be pierced with a pin and then flattened out.

Manufacturers' instructions should be followed. In general, the recommended application technique involves aligning the panels and pressing them into place using a spatula covered with a soft cloth, or other suitable applicator, to prevent scratching of the reflective surface of the film.

Application is usually carried out with the target surface dry, but some manufacturers' instructions give advice that the application of their products can be eased by spraying the target surface with a mixture of 98-99 parts water and 1-2 parts liquid soap. This helps with aligning the livery film panels onto the target surface by allowing some repositioning of the film if necessary.

3.5 Curved surfaces

Livery films generally conform to flat or simple shallow curved surfaces with a single radius. Most are not suitable for use on surfaces with curvature in more than one direction (compound curves).

3.6 Panel cutting

Livery film materials can be cut easily using a sharp knife or scissors. Note that some livery film materials require edge sealing when they are cut; the manufacturer's instructions should be followed. Some companies offer livery film panels pre-cut to the correct size and shape for application to specific vehicles. A list of some of these companies can be found in Appendix A.

3.7 Material storage

When not in use, livery film materials should be stored in the packaging in which they are supplied. It is also advisable to place wax paper at either end of rolls of adhesive film to prevent dirt and dust from sticking to the edges.

3.8 Removal

If it becomes necessary to remove livery film panels for damage repair or decommissioning of vehicles, the panel should be heated gently with a hot air gun to help to soften the adhesive. One side of the livery film panel should then be lifted and slowly pulled back, folding it back flat against the surface.

Should any adhesive remain on the vehicle, it can be removed by dabbing a fresh piece of livery film material onto the relevant areas, adhesive side down. Alternatively, it may be possible that isopropanol or paint thinners can be used, wiped over the surface to be cleaned using a soft, clean cloth.

Please note: Reference should always be made to the manufacturers of both the livery film products being removed and the vehicle from which they are being removed to ensure that the solvent being used will remove any adhesive residue without causing damage to the paint finish on the vehicle.

4 Livery Film Specification

The following is the recommended specification for the minimum level of performance of livery films that would be acceptable if the conspicuity benefits of conspicuous livery schemes are to be realised over a typical three year vehicle lifespan.

Material thickness	Preferably less than 1.7 mm
Orientation requirements	As per manufacturer's instructions
Applicable automatic cutting methods	Die, plotter or manually cuttable using laser or knife
Life expectancy	As per manufacturer's advice
Warranty period	As per manufacturer's advice
Temperature range	$-25^{O}C$ to $50^{O}C$

Table 2. General livery film material information

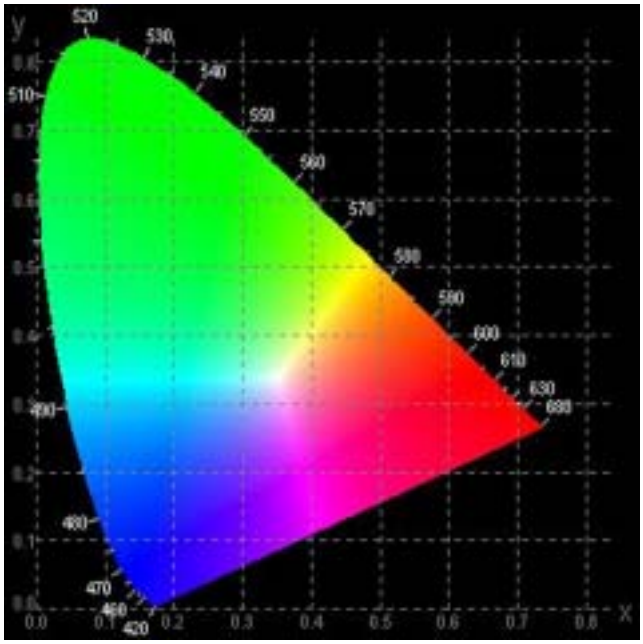
Observation Angle	Entrance Angle	R_A				
		Fl. Yellow-Green	Fl. Orange	Blue	White	Red
0.20°	5°	300	160	25	350	60
	30°	150	80	12	150	25
	45°	33	18	3	40	7
0.33°	5°	80	80	10	150	25
	30°	60	50	4	60	10
	45°	16	20	2	30	5
0.50°	5°	50	45	7	110	20
	30°	20	20	3	60	10
	45°	9	8	1.3	20	3.6
1.00°	5°	8	8	1	9	2.5
	30°	6	4	0.75	6	1
	45°	2	2	-	3	-
Coefficient of retroreflection, R_A, is a measure of the amount of light radiation retroreflected from a surface relative to the amount of light radiation incident upon the surface, per unit area. Units are candelas per lux per square metre, $cd.lx^{-1}.m^{-2}$. Further details are available from CIE publication 54.2 – 2001.						
Note: These values are similar to those quoted in BS 873: 1983 and ASTM D 4956 – 01a.						

Table 3. Coefficient of Retroreflection (R_A) Minimum Values

Performance Degradation	Fl. Yellow-Green	Fl. Orange	Blue	White	Red
Acceptable maximum degradation	50%	20%	20%	20%	20%
Degradation period	3 years	3 years	3 years	3 years	3 years
Note: These values are per ISO 4892-1: 1994 and ISO 4892-2: 1994.					

Table 4. Maximum Permissible Retroreflectivity Degradation

Daytime Chromaticity	CIE D65 Illuminant							
	1		2		3		4	
	x	y	x	y	x	y	x	y
Fl. Yellow-Green	0.375	0.620	0.460	0.532	0.398	0.450	0.350	0.508
Fl. Orange	0.506	0.404	0.570	0.429	0.655	0.345	0.560	0.340
Blue	0.065	0.216	0.190	0.255	0.245	0.210	0.144	0.030
White	0.285	0.325	0.335	0.375	0.355	0.355	0.305	0.305
Red	0.550	0.358	0.640	0.365	0.735	0.265	0.660	0.233
Note: These values are similar to those quoted in BS 873: 1983 and ASTM D 4956 – 01a.								



For each colour, plot x- and y-values on the respective x- and y-axis on the plot shown. Four pairs of coordinates generate a four-sided polygon on the plot. The colour of the livery film, as determined in accordance with CIE publication 54.2 – 2001, section 8, must fall within that polygon.

Footnote: Night-time chromaticity data are not yet available. PSDB will publish a revised livery film specification when necessary.

Table 5. Daytime and Night-Time Chromaticity

Fluorescent materials	Luminance factor β, min		
	CIE D65		CIE D150
	β_{Total}	$\beta_{Fluorescent}$	β_{Total}
Fl. Yellow-Green	30	15	40
Fl. Orange	15	7	15
Blue	0.7	N/A	N/A
White	17	N/A	N/A
Red	0.5	N/A	N/A

(N/A – Not Applicable)

Table 6. Fluorescent and Non-Fluorescent Luminance Factor

Impact Resistance	ASTM D4956 – 01a: 6.10 or ASTM D2794 – 93
Shrinkage	ASTM D4956 – 01a: 6.6
Flexibility	ASTM D4956 – 01a: 6.7
Chemical/solvent resistance	BS 873: Part 1: 1983 section 12 (solvent wipe test) Chemicals – at minimum, should be resistant to splashing with diesel, petrol and LPG that can occur during refuelling Solvents – at minimum, should be resistant to white spirit, turpentine, kerosene and cleaning solutions likely to be used

Table 7. Standards compliance

The film, as applied to the vehicle and conditioned as necessary, should withstand washing during routine maintenance under the conditions specified below.

Maximum fluid temperature	38^{O}C or higher
Spray fan pattern required	As per manufacturer's instructions
Minimum incident angle of spray axis	15^{O} or less to perpendicular of surface
Nozzle distance from surface	1.2 metres or further
Nozzle pressure	75 bar or less

Table 8. Power washing guidelines

NOTE: These values should be considered to be minimum performance guidelines for livery film materials. If specific films are resistant to cleaning at a higher temperature, incident angle or pressure or at a shorter distance between the nozzle and the film surface, this may be considered to be superior performance.

5 Legislation

Legislation that applies to vehicle livery schemes includes the Road Vehicle Lighting Regulations, 1989 ('the RVLR'), which restricts the colour, size and positioning of reflective materials to the rear and sides of vehicles. Regulations relating to the rear of vehicles are clear, whilst those relating to the sides are somewhat more vague. Advice from the Department for Transport (Working Group Report for ACPO Traffic, 1997) indicated that amendments to the RVLR would be possible, but only with ministerial support. Basically, the RVLR prohibits the fitment of any other than red retro-reflectors to the rear of vehicles, except in a few very specific instances.

Clearly this has an impact on the police (and other Emergency Services) in that the liveries they employ for Health and Safety reasons and to promote public awareness demand fluorescent yellow-green and red retro-reflectors to the rear. Temporary exemptions to the RVLR are in place that permit the use of these markings.

Lettering used for the word "POLICE" to the sides – in the case of half battenburg livery – and to the rear of police vehicles should be in block capitals and in a typeface similar to that applied to British road signs as specified in The Traffic Signs Regulations and General Directions, 2002 (refer specifically to Schedule 13, Parts I and II).

6 Summary of Key Recommendations

6.1 Motorway and Trunk Road Patrol Vehicle Recommendations

A. Full battenburg livery should be applied to all police vehicles intended for motorway/trunk road patrol duties, except in cases where vehicles need to remain unmarked.

B. Livery application should be carried out in accordance with Chapter 2 of this document.

C. Livery materials used should conform to the specification laid down in Chapter 4 in order that the benefits of the livery are realised.

6.2 Half Battenburg Recommendations

D. It is recommended that the half battenburg livery scheme should be adopted for application, as laid down in Chapter 2, to all appropriate police vehicles within every police force for vehicles other than those used for motorway/trunk road patrol duties, to which the full battenburg livery should be applied.

E. Only appropriate classes of vehicle, dependent upon force policy, should be marked in half battenburg. Clearly, it is desirable for some types not to be identifiable, an obvious example being unmarked traffic vehicles.

F. Application of half battenburg livery to as many vehicles as is practical within police fleets will bring benefits since members of the public will tend to notice police vehicles and officers more easily. They will tend to perceive an increased police presence, which should lead to a reduced fear of crime and an increased feeling of reassurance, as well as providing a deterrent effect for criminals.

G. Adoption of half battenburg across all police forces will lead to additional benefits from the point of view of corporacy and a “professional” and an “authoritative” image for the Police Service.

H. Livery materials used should conform to the specification laid down in Chapter 4 in order that the benefits of the livery are realised.

7 References

[1] “Common Standards of Markings for Traffic Patrol Vehicles,” Working Group report for ACPO Traffic, 1997.

[2] The Peal Dictionary, Peal Press, London W1, no date of publication given.

[3] Various ICE Ergonomics reports for the PSDB, 1992-1998.

[4] Siegel, A I and Federman, P, “Development of a Paint Scheme for Increasing Aircraft Detectability and Visibility,” Journal of Applied Psychology, Vol. 49, 2, pp. 93-105, 1965.

Appendix A Vehicle Marking Companies and Film Manufacturers

Vehicle Marking Companies

Halo Bluelite Limited

64 Victoria Road, Burgess Hill, West Sussex, RH15 9LH

Telephone: +44 (0) 1444 232366

Fax: +44 (0) 1444 232376

Website: http://www.halogroup.co.uk

Kay Premium Marking Films Ltd.

Oakwood Close, Penyfan Industrial Estate, Crumlin, Newport, NP11 3HY, Wales, UK

Telephone: +44 (0) 1495 242300

Fax: +44 (0) 1495 249446

Email: sales@kpmf.com

Website: http://www.kpmf.com

Preview Graphics Ltd.

105 High Street, Hurstpierpoint, West Sussex, BN6 9PU

Telephone: +44 (0) 1273 834434

Fax: +44 (0) 1273 832234

Email: info@preview.co.uk

Website: http://www.preview.co.uk/contact.shtml

Ringway Vehicle Graphics

Winterstoke Road, Weston-Super-Mare, Somerset, BS24 9BQ

Tel: +44 (0) 1934 421400

Fax: +44 (0) 1934 421401

Email: sales@rvgonline.co.uk

Website: http://www.rvgonline.co.uk

Please note: This list does not form a recommendation, nor is it exhaustive. Other companies might offer professional livery application services and it is the responsibility of individual procurement officers to determine their suitability.

Film Manufacturers

3M United Kingdom Plc. 3M House, 28 Great Jackson Street, Manchester, M15 4PA Telephone: +44 (0) 161 237 6394 Fax: 0800 378127
Reflexite U.K. Ltd. 4420 Nash Court, John Smith Drive, Oxford Business Park South, Oxford, OX4 2RU Telephone: +44 (0) 1865 396959 Fax: +44 (0) 1865 396960 Website: http://www.reflexite-europe.com
Rennicks (U.K.) Limited Stuart Road, Manor Park, Runcorn, Cheshire, WA7 1TS Telephone: +44 (0) 1928 579966 Fax: +44 (0) 1928 579965 Website: http://www.rennicks.com

Please note: This list does not form a recommendation, nor is it exhaustive. Other companies might offer professional livery application services and it is the responsibility of individual procurement officers to determine their suitability.

Appendix B Scientific Basis for the High-Conspicuity Livery Scheme

The development work was carried out by an organisation specialising in ergonomic design, Loughborough University Transport Technology Ergonomics Centre (formerly ICE Ergonomics). A very brief summary of the various PSDB/ICE Ergonomics reports relating to this work follows.

May 1992 – ICE Ergonomics Report "Considerations of Conspicuous Markings for Police Vehicles"

Description: A literature review to identify principles of conspicuity and identification of vehicles and consideration of experimental techniques for evaluation of marking schemes.

Main findings:

- Use fluorescent colours in daytime;
- Apply markings in square-like formations rather than stripes;
- Bounding fluorescent areas in blue may increase conspicuity;
- Use retro-reflective materials at night-time;
- Outlining with retro-reflective materials may increase conspicuity; and
- Lighting can also increase conspicuity.

August 1993 – ICE Ergonomics Report "A Study of the conspicuity and recognisability of the proposed side and rear markings for police vehicles"

Description: Aimed to develop a marking scheme and objectively assess its conspicuity against current liveries (Cambridgeshire Constabulary and Essex Police). Subjective assessment of the markings for recognisability and acceptability.

Main findings:

- Side markings
  - As good as other police markings in daytime;
  - Better than other police markings at night; and
  - Considered to be distinctive, acceptable and authoritative;
- Rear markings:
  - As good as other police markings in daytime;
  - Better than other police markings at night; and
  - Considered to be distinctive and acceptable (night only), but not authoritative.

December 1994 – ICE Ergonomics Report "Road trial evaluation of the proposed side and rear markings for police motorway patrol vehicles – police drivers' opinions"

Description: Road trials with 12 forces.

Main findings:

- Overall:

- Main reason for wanting the markings was their increased conspicuity;
- There were favourable responses in terms of wanting to introduce the "Battenburg" marking scheme, preference for use in undertaking duties, feeling of safety and increased public awareness;
- No consensus regarding public respect.

- Proposed side markings:
  - Main reasons for favouring the side markings were the improved conspicuity and the use of high-quality materials; and
  - There were favourable responses in terms of "Battenburg" being: acceptable, noticeable, conspicuous, radical, efficient, appropriate, official, authoritative and reassuring.
- Proposed rear markings:
  - Main reason for favouring the rear markings were the improved conspicuity, the use of high-quality materials and the improved awareness of the general public;
  - There were favourable responses in terms of being: acceptable, noticeable, conspicuous, radical, efficient, appropriate, official, authoritative and reassuring; and
  - Poor image and the possibility of detraction from the brake lights were quoted as dislikes.

February 1995 – ICE Ergonomics Report "Road trial evaluation of the proposed side and rear markings for police motorway patrol vehicles – fleet managers' opinions"

Description: Fleet manager's questionnaire responses from 9 forces: Essex, Gloucestershire, Lancashire, South Wales, Surrey, Tayside, Thames Valley, West Midlands and Wiltshire.

Main findings:

- Durability of markings:
  - Eight forces reported deterioration along unsealed cell edges;
  - There was no consensus as to whether this was better, the same as or worse than current markings;
- Repairs to markings:
  - Five reported the need for repair (three due to accident damage and two due to deterioration or mis-application);
  - Four of the five stated that the frequency of repair was not greater than that with existing markings;
  - All five stated that the repair time was at least as long or longer than existing markings;
- Other comments:
  - Costs in terms of initial purchase, repair/maintenance and labour;
  - Mark-up duration: arrangement time rather than application;
  - Fuel does not affect colour or adhesion; and
  - Not affected by power wash.

June 1995 – ICE Ergonomics Report "UK motorway patrol vehicle markings: Rationale for their design"

Description: Comparison of UK and Dutch vehicle markings.

Scope of report:

- Introduction – the need for the proposed markings in the UK and the parties involved in their development;
- Marking scheme theory:
  - The ergonomics of conspicuity;
  - Implications for the marking scheme design;
- Validation of the proposed marking scheme:
  - Laboratory trials;
  - Field trials;
- Analysis of the Dutch markings:
  - Materials and colour; and
  - Form.

August 1996 – ICE Ergonomics Report "Police motorway patrol vehicles: rationale for their design"

Description: Outline of scientific rationale.

Scope of report:

- The need for the proposed markings;
- Parties involved in their development;
- Development of the proposed marking scheme:
  - The ergonomics of conspicuity;
  - Implications for the proposed marking scheme design;
- Validation of the proposed marking scheme:
  - Laboratory trials; and
  - Field trials.

December 1996 – ICE Ergonomics Report "Public assessment of police vehicle markings against current liveries (Essex, Leicestershire, Metropolitan, Warwickshire)"

Description: Video footage edited from MIRA trials (February 1996) to provide paired comparisons for public evaluation (59 subjects).

Main findings:

- Overall – Proposed markings better in terms of attention-getting ratings;
- Side markings – proposed markings generally better by day and night, although greater advantage by night; and
- Rear markings – proposed markings did not generally out-perform other schemes. May be due in part to test artefact, namely that red only markings

present a greater contrast against a green background than red and yellow rear markings. Also, brightness of rear lights may have been a factor.

1997 – ACPO Report "Common standards of markings for police patrol vehicles"

Description: ACPO recommendations.

Main findings:

- Battenburg livery scheme makes vehicles recognisable as police vehicles at distances of up to 500 metres. In daylight, this is achievable with any fluorescent material. At night, this may only be achieved by using higher grades of material or a mixture of materials.
- Assists high-visibility policing, thereby reassuring the public and enhancing potential deterrent benefits of pro-active traffic patrol activity. Tests carried out on the A12 showed that speed reduction of motorists upon recognition of a police vehicle was more pronounced when using a vehicle marked up with the battenburg livery than with a conventionally marked vehicle.
- Battenburg livery scheme makes a vehicle readily identifiable as a police vehicle yet retains the ability to associate with it logos and images of the local force. With the suggested configuration, force logos do not detract from the conspicuity of the overall scheme, permitting national and local corporacy to be maintained in a safety-enhancing high-conspicuity livery scheme.
- Utilising latest available materials and systems, battenburg seeks to achieve a cost-neutral option compared with average costs of present liveries. Direct comparison of existing liveries with battenburg is difficult because there was considerable variation in schemes used, both in terms of layout and colours. Adopting a "mix and match" approach in the choice of materials whilst maintaining the recommended overall concept, a cost-neutral option can be achieved, or even savings in some instances.
- Acceptable to at least 75% of staff using it. Research conducted convincingly showed that 80% of the staff surveyed were in favour of the introduction of the battenburg concept.

May 1998 – ICE Ergonomics Report "Comments on police car livery (Lancashire)"

Description: Comments on Lancashire patrol vehicle (side chevron) livery.

Scope of report:

- Introduction – reason for report and background to ICE Ergonomics' (now Loughborough University TTEC) involvement;
- Discussion of Lancashire's marking scheme in terms of:
  - Marking shape;
  - Information content;
  - Commonality;
  - Subjective comments; and
  - Conclusions.

August 1999 – ICE Ergonomics Report "Comments on police van livery (Sussex)"

Description: Comments on Sussex Police van (side chevron) livery.

Scope of report:

- Introduction – reason for report and background to ICE Ergonomics' involvement;
- Discussion of Sussex marking scheme in terms of:
  - Marking shape;
  - Information content;
  - Commonality; and
  - Conclusions.

Appendix C Results of Half Battenburg Evaluation

Aim of the "Half Battenburg" Police Vehicle Livery Scheme Evaluation

The purpose of the trial described here was to garner opinion on examples of typical police vehicle livery schemes in use across the UK. These ranged from obsolescent schemes such as the old "jam sandwich" motorway patrol vehicle and the recently superseded urban livery to the recently-evolved "half battenburg" schemes that are currently being introduced widely. This particular piece of research does not set out to be definitive or scientifically rigourous in its approach to this complex issue. Rather it seeks to discover whether or not the half battenburg livery achieves its objective of carrying the national corporate image being promoted by the current motorway patrol vehicle "battenburg" livery scheme into other areas of policing, thereby raising the profile of the police and helping to reduce the fear of crime.

Outline of Methodology

Video filming of the various livery schemes was conducted in an environment that might be considered to be a worst case scenario as far as police vehicle conspicuity is concerned – a busy high street scene, with significant quantities of visual clutter. The cars – supplied and driven with the kind co-operation of Hertfordshire Constabulary – were parked parallel to and at the side of a road in a marked bay outside a parade of brightly-coloured shops and restaurants.

Photograph 13. Typical pre-battenburg motorway livery scheme

Photograph 14. Typical pre-half battenburg panda car livery scheme

Photograph 15. Full battenburg livery scheme

Photograph 16. Half battenburg livery scheme

NOTE: These images are for illustrative purposes only and were not used in the evaluation of the livery schemes depicted.

Filming was carried out under bright daylight, twilight and night-time conditions to enable evaluation across all likely ambient lighting conditions, with the exception of cloudy weather and rain, snow, etc.

Later in the lab, two groups of volunteers, a total of 25 people, were shown the video footage and then asked to air their opinions of the various liveries and discuss their relative merits, including those aspects of liveries that they did and did not find effective. Notes were taken of key issues that were raised and these are included below.

Results of Discussion Sessions

Test Session 1

- Many test subjects stated that the word "POLICE," picked out on the side of the vehicle in a highly-contrasting colour (navy blue on a white background), provided a very effective visual cue that they were looking at a police vehicle.
- It was noted that there are many livery schemes, other than police designs, that employ stripes parallel with the line of the sills along the middle of the sides of the vehicle. This detracts from the ability of people to distinguish police vehicles from those of other operators.
- A large police force logo on the side of the vehicle was felt to improve its recognisability as a police vehicle.
- One of the vehicles filmed and viewed was an old motorway patrol vehicle, utilising an orange stripe bordered by narrow navy blue and white chequer stripes along the sides of the car, parallel with the sills. This was felt to perform very badly under night-time conditions, with the orange stripe not very noticeable.
- Hertfordshire Constabulary's older general purpose (non-motorway) vehicle livery was felt not to be readily distinguishable from, for example, a taxi. This is being replaced with the half battenburg livery scheme at present in a fleet roll-out, as new vehicles enter service.
- Under the various lighting conditions tested, Hertfordshire Constabulary's older general purpose (non-motorway) vehicle livery was not considered to vary much in terms of overall conspicuity within its immediate environment.
- It was also observed that none of the livery schemes made good use of the vehicle bonnet for increasing conspicuity.

Test Session 2

- It was observed that stripes on a white vehicle under night-time conditions were not very effective at increasing conspicuity.
- In the case of Hertfordshire Constabulary's older general purpose (non-motorway) vehicle, the police force logo to the side of the vehicle was considered to be at least as effective as the navy blue-white twin-chequer stripe.
- Under night-time conditions, the word "POLICE" on the lower portion of the sides of the half battenburg was considered to increase recognisability as a police vehicle.
- Under night-time conditions, the orange stripe utilised in the older motorway patrol vehicle livery was considered to be less noticeable than the black rubberised rubbing strip down the vehicle flanks.
- Of the vehicles tested, that marked up in half battenburg livery was considered to be the most attention-getting whilst driving past the video camera position.

- Blue panels of retro-reflective film were considered to appear very dark or black under night-time conditions when seen without illumination from headlamps – that is, when not seen under retro-reflection from a light source. They were considered to appear similar to the vehicle windows.
- It was considered that the battenburg livery scheme did not offer any advantage over the half battenburg livery scheme within the context being considered – the high-visual clutter urban environment.
- The half battenburg livery scheme appeared to be the best overall within the present context, primarily due to the word "POLICE" appearing on the sides of the vehicle in large, highly-contrasting, block capital letters.

Conclusions

A. The half battenburg livery scheme appears to perform well within the context of an environment containing a large amount of visual clutter. Reasons for this include:
   - "POLICE" appearing in large, highly-contrasting, bold letters on the flanks of the vehicle;
   - Effective rear markings – retro-reflective red and retro-reflective and fluorescent yellow-green chevrons in this particular case (although the recommendations stipulate retro-reflective and fluorescent orange in place of red on visibility performance grounds); and
   - White colour of the base vehicle stands out in this context.

B. Use of the police force logo tends to enhance the recognisability of the vehicle as a police vehicle, promoting "High Visibility Policing."

C. Battenburg livery offers no advantage over half battenburg livery within the visually cluttered context being considered. Comparing the half battenburg livery with battenburg livery and all other factors being equal (for example, the size of the vehicle and the quality of the materials), the half battenburg livery scheme was found to offer the enhanced corporacy being sought. This is especially true bearing in mind the maximum viewing distance that is generally possible in urban and suburban contexts (100-200 m was considered to be the typical maximum).

D. The older general purpose (non-motorway) vehicle livery scheme was not considered to be easily recognisable as a police vehicle. Since the filming that was used for trials was conducted at close quarters, this leads one to the conclusion that the scheme was not performing its intended function of raising awareness of the presence of a police vehicle.

Home Office
BUILDING A SAFE, JUST AND TOLERANT SOCIETY

POLICE SCIENTIFIC DEVELOPMENT BRANCH
Sandridge, St. Albans, Hertfordshire AL4 9HQ, UK
Telephone: +44 (0)1727 865051 Fax: +44 (0)1727 816233