VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION

SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

SUMMARY

This issue of TA 83 introduces a revised Annex A and Annex D. Annex A incorporates Interim Advice Note 27/99 (IAN 27/99) that introduced the Motorway Signal Mk 3 (MS3) and Interim Advice Note 43/02 (IAN 43/02) that clarifies but does not increase the standard of provision. Annex D incorporates an amended first bullet point to clause D1.2.14.

INSTRUCTIONS FOR USE

This Advice Note is to be incorporated in the Manual.

1. This document supersedes TA 83/99.
2. Remove Contents pages for Volume 9 dated February 2004.
3. Insert new Contents pages for Volume 9 dated November 2005.
4. Remove TA 83/99 from Volume 9, Section 4, Part 6.
5. Insert TA 83/05 into Volume 9, Section 4, Part 6.
6. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

THE HIGHWAYS AGENCY

SCOTTISH EXECUTIVE

WELSH ASSEMBLY GOVERNMENT
LLYWODRAETH CYNULLIAD CYMRU

THE DEPARTMENT FOR REGIONAL DEVELOPMENT
NORTHERN IRELAND

Guide to the Use of Variable Message Signs for Strategic Traffic Management on Trunk Roads and Trunk Road Motorways

Summary: This issue of TA 83 introduces a revised Annex A and Annex D. Annex A incorporates Interim Advice Note 27/99 (IAN 27/99) that introduced the Motorway Signal Mk 3 (MS3) and Interim Advice Note 43/02 (IAN 43/02) that clarifies but does not increase the standard of provision. Annex D incorporates an amended first bullet point to clause D1.2.14.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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Contents

1. INTRODUCTION

1.1 General

1. This Advice Note provides guidance for the feasibility study, design, implementation and evaluation of Strategic Traffic Management Systems (STMS) using Variable Message Signs (VMS).

1.2 Scope

1. The specific requirements for each Overseeing Organisation are contained in the relevant Annex to this Advice Note. They are as follows:

- Annex A for England
- Annex B for Scotland
- Annex C for Wales
- Annex D for Northern Ireland.

2. This Advice Note is intended to be used by Overseeing Organisation staff, their consultants, Agents and maintenance contractors.

1.3 Implementation

1. The appropriate Annex should be used forthwith for all STMS schemes currently in preparation, provided that in the opinion of the Overseeing Organisation this will not result in additional expense, or delay progress.

2. Design agents should confirm its application to particular schemes with the Overseeing Organisation.

2. ENQUIRIES

All technical enquiries or comments on this Advice Note should be sent in writing as appropriate to:

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VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX A (ENGLAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

SUMMARY

This issue of TA 83 Annex A incorporates CHE Memo 73/99 (IAN 27/99) that introduced the Motorway Signals Mk3 (MS3) and CHE Memo 112/02 (IAN 43/02) that clarifies but does not increase the standard of provision.

INSTRUCTIONS FOR USE

This is a new document to be incorporated into the Manual.

1. Insert TA 83/05 Annex A as Part 6 of Volume 9, Section 4.

2. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
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TA 83/05 ANNEX A (ENGLAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

Contents

Chapter

A1. INTRODUCTION

A1.1 General

1. *Clause not used.*

2. *Clause not used.*

3. *Clause not used.*

4. *Clause not used.*

Glossary

5. A Glossary of Terms is given in Chapter A6.

Standard Drawings and Specifications

6. HA specifications referred to in this TA are available from www.tssplansregiustry.org

A1.2 Related Standards and Advice Notes

7. TD 33 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads', provides criteria for the selection, siting and use of all types of VMS on all purpose and motorway trunk roads. This TA relates purely to light emitting VMS. Most VMS currently used for Strategic Traffic Management are based on light emitting technology.

8. For VMS based on light emitting technologies, the design criteria and performance standards for road applications are given in Highways Agency Specification TR 2516, 'Performance Specification for Discontinuous Variable Message Signs'.

9. Highways Agency Specification TR 2517, 'Performance Specification for Electromechanical Variable Message Signs', covers performance requirements for that category of sign.

10. *Clause not used.*

A1.3 Scope

11. *Clause not used.*

12. *Clause not used.*

13. This TA takes precedence in the case of any conflicting directions given in TD33 and advice in TA60, or other existing Advice Notes in so far as they relate to STMS.

VMS Applications

14. VMS are provided for Driver Information, Tactical Control and Strategic Traffic Management. The scope of these applications are:

- **Driver Information Legends** - provide the motorist with information of a tactical and strategic nature, but also with messages relating to conditions on the network that may affect expected journey times, but which are not of a direct or instructional nature. This may include information on major events (eg. shows, sports events etc.) and inter network connections such as ferries, tolled roads and crossings.

- **Tactical Control** - provides supplementary information to complement matrix signals and other traffic control signs for management of incidents or occurrences on local roads in the area. Signs set in support of tactical objectives display messages specifically related to achieving improvements on localised sections of the network eg. 'ACCIDENT/SLOW DOWN'.

- **Strategic Traffic Management** - provide the motorist with information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

15. This TA covers the application of VMS to STMS only.

16. Strategic Traffic Management seeks to ensure that a strategic view of network status and conditions is available, and that strategies and decisions which have more than a local impact can be identified correctly, and effectively implemented. Signs set in support of these objectives offer alternative or diversionary route choices.

17. This TA also describes the different types of VMS currently available for STMS schemes, and outlines the approach to the feasibility study, scheme design, implementation and evaluation.

A2. SCHEME PROCESS

A2.1 General

1. There are no standard provision criteria for STMS schemes and each must therefore be individually justified by means of a feasibility study incorporating an economic analysis.

2. The Scheme Process is illustrated in Figure A2.1 The implementation of Strategic Traffic Management schemes will generally comprise the following elements:

- Feasibility Study (Chapter A2.2)
- Design and Implementation (Chapter A2.3)
- Scheme Evaluation (Chapter A2.4)

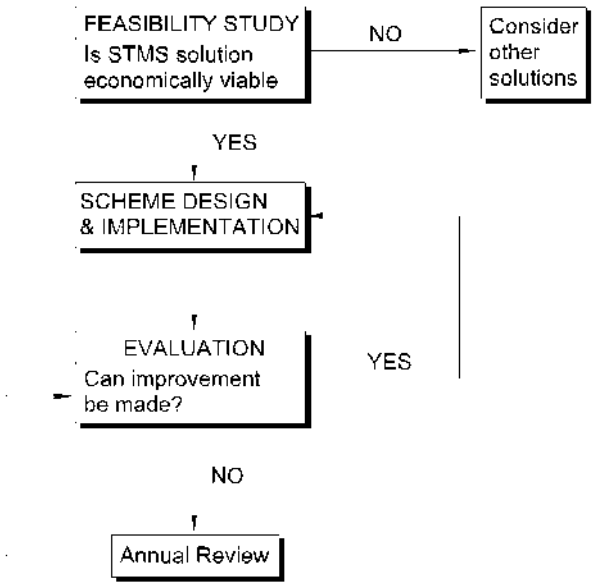

Figure A2.1 Scheme Process

A2.2 Feasibility Study

3. A feasibility study is needed to determine the practicality and value for money of STMS schemes. A Feasibility Study Report should be produced at the end of the study period and consider the following:

- review of existing systems and traffic management practice
- operational objectives
- network and traffic analyses
- diversion routes and intervention nodes
- scheme operation and management
- strategic VMS messages and sign type selection
- engineering
- future Maintenance
- economic evaluation
- environmental assessment
- scheme evaluation requirements
- implementation programme
- legislation
- risk assessment/hazard identification.

Review of Existing Systems and Traffic Management Practice

4. The feasibility study should consider the extent of the existing and planned facilities within the area of the proposed scheme. These include:

- Control Office operational boundaries and their interaction with respect to the control of incidents and traffic management
- institutional issues, policy and codes of practice with respect to the control of incidents and traffic management

- the location, type and objectives of existing and planned VMS schemes including, where appropriate, local authority initiatives
- the location and form of existing Fixed Signs, Signals and Gantries
- the NMCS Infrastructure and its capability to support new systems
- extent of CCTV coverage at the relevant point of the network
- extent of existing Traffic Data Collection Systems.

Operational Objectives

5. STMS schemes are likely to deal with the management of unusual or unexpected events affecting road traffic rather than day to day congestion. Designers should identify the main objectives of the scheme. These might include:

- provision of information in a timely manner
- achievement of reduction in delay
- achievement of local incident management
- supporting diversion routes and controlling traffic on these routes
- satisfying drivers' needs for reliability and consistency in information and legends
- avoiding an adverse impact on safety and the environment
- consistency with existing and planned VMS schemes on a national basis
- long term viability in terms of meeting other objectives throughout the design life of the system.

Network and Traffic Analysis

6. Designers should classify the road network applying to the STMS scheme into strategic and non-strategic routes. Aspects to be considered at this stage include:

- the disruptive impact of unusual incidents and planned road works on network operation
- the frequency of route diversions by studying historic records of motorway and trunk road closures
- traffic characteristics as for network congestion and the capacity of alternative routes to accept diverted traffic
- the impact of potential diversions on alternative routes, especially through towns and villages.

7. A traffic assignment programme should be used to assess and develop strategic control plans that may be used for the STMS. This programme should have the facility to represent traffic diversions that may be applied to the road network, and to evaluate the economic and operational performance of the proposed diversion strategies.

8. The depth and level of the network and traffic analysis should be appropriate to the needs and objectives of the STMS scheme. The output from this analysis should form the basis for the Economic Evaluation.

Diversion Routes and Intervention Nodes

9. Based on the Network and Traffic Analysis, the report should identify the diversion routes, strategic and non-strategic intervention nodes and the recommended locations for the provision of VMS.

10. The current view is that designers should preferably restrict diversion strategies to the Trunk and Motorway Network. Where this is not possible, the views of the Police and Highway Authorities likely to be affected, must be sought before the strategy is drawn up.

11. Any existing diversion route agreements developed by the Police and Highway Authorities within the scheme area should be considered and reviewed for inclusion in the STMS scheme as local diversion strategies.

Scheme Operation and Management

12. Options for the operation and management of the scheme should be considered. The points to be addressed include:

- integration with existing and planned control and communications systems and any necessary extension in capability of those systems

- integration with the existing management of the strategic network
- implementation of a management structure taking into account longer term proposals for Traffic Control Centres
- the need to publish traffic data to third party organisations and the potential for generating revenue
- the need for consultation to develop effective Codes of Practice.

13. Designers should assess the suitability of using existing control and communications systems for the STMS scheme in consultation with the Overseeing Organisation. Existing or planned systems used for VMS control include:

- Stand Alone Control Systems
- NMCS2 - Message Sign subsystem.

14. It is important to consider the effect of the scheme design on STMS and other traffic management schemes elsewhere on the road network. It is essential that different systems provide motorists with accurate and consistent information when moving from one area to another.

15. The feasibility study should address the interests of all organisations who may be involved in the operation and management of the proposed STMS and where relevant, other existing or planned traffic management and control facilities. These organisations will include:

- Divisions of the Overseeing Organisation
- the Police
- Highway Authorities
- DBFO Concessionaires
- Traffic Control Centre Operating Company.

VMS Legend and Sign Type selection

16. The feasibility study should identify the type and size of VMS needed for each location and appropriate costings should be used in the Economic Evaluation.

17. The type and range of information to be displayed will generally limit the choice of sign technologies, whereas the sign location, road classification and vehicle speeds will all affect character heights and therefore the size of the VMS.

18. Deriving a common strategy for VMS signing is important, whatever the technology and application. Chapter A1 describes the scope of VMS applications covering Driver Information, Tactical Control and Strategic Traffic Management. The type of VMS and the range of messages used for STMS applications will therefore be influenced by the type and extent of any other VMS signing at a given location.

19. The Feasibility Study must therefore consider in sequence:

(i) the information needed in the VMS legend to meet the scheme objectives

(ii) the content and number of VMS legends for each location

(iii) the VMS technology needed to display the required legends

(iv) the technology used by other VMS on the same section of road

(v) the VMS size and performance level needed for the application, or applications.

20. VMS legends should normally be selected from those given in the Traffic Signs Regulations and General Directions (TSRGD). Any other legends needed for a specific scheme must be authorised by the Overseeing Organisation.

21. The practice for STMS messages is to state the location and cause of the diversion, followed by the suggested alternative route. Research suggests that messages should be restricted to a maximum of seven words, or four units of information. The aim should be to use the shortest message possible. Examples currently used for STMS applications are:

M40(S) CLOSED J15
FOR LONDON
USE M6, M1

M40 ROADWORKS
FOR M1 AND M6
USE A46(N)

22. *Clause not used.*

23. Where the system will include VMS legends relating to more than one application, ie. Tactical and STMS, the hierarchy must be explicit and designers must develop setting resolution rules to decide which legend to use for each specific set of circumstances. The Highways Agency document 'Code of Practice for Operation of Motorway and Trunk Road Signals and Variable Message Signs', prepared with consultation with the Association of Chief Police Officers (ACPO) gives further guidance on this subject, as does TD 46.

Sign Types

24. If the only information to be provided is a route change, ie. alternative direction signing, Fixed Text Message Signs (FTMS) may be adequate. Where the designer requires a wider range of options, discontinuous light emitting signs should be used.

25. For most STMS applications, the most appropriate type of VMS will be the Motorway Signals Mark 3 (MS3), based on light-emitting technology and comprising 3 lines of 18 characters with the capability to display EMI aspects

26. If Motorway Signals Mark 2 (MS2), or MS3 2x16 are already provided, designers must consider meeting the STMS requirements using these signs. If they are shown to be unsuitable, the study should examine alternatives, and identify a solution that meets the needs of all applications.

27. SVMS will normally be provided in pairs on the approach to a strategic junction. This reinforces the legend and reduces the potential for it to be obscured from the driver by high-sided vehicles. In selecting the VMS type it is essential that all signs on the approach to a node show the same legend and therefore both signs must use the same technology and design.

Engineering

28. The feasibility study should consider the engineering design needed to support the STMS. A variety of engineering solutions should be considered and prioritised to decide the most cost effective approach to each particular scheme. Designers should address the following aspects of engineering design:

(i) Traffic Data Collection

(ii) control system

(iii) signs

(iv) infrastructure and transmission.

29. A key factor for STMS is the collection of accurate real-time traffic information. The study should consider the means by which this is to be achieved cost effectively, including on non-motorway roads.

30. The STMS control system as a whole must support the operational and management strategy and any development of that strategy over time. The need for any interlocking reaction with, and interaction to, other existing or planned traffic management and control facilities must be identified and the implications assessed. This will include such elements as the number and type of STMS legends, setting strategies, setting resolution rules between different applications, and the operational Code of Practice.

31. The type(s) of sign should be identified from the guidance in Chapter A3, 'Strategic VMS Types'. However the study should also consider the engineering aspects related to possible sign locations and the means of installation, ie. verge mounted posts or cantilevers, or portal gantries.

32. The requirements for the STMS infrastructure and transmission should be considered and assessed. It is important to identify how the existing infrastructure can be used to reduce the scheme cost, and maximise the return on previous investments. The standard NMCS motorway infrastructure should support the needs for most STMS applications. Elsewhere, a variety of solutions should be considered and prioritised. These will include cabling, followed by radio and the use of private lines, ISDN or similar links to more remote or difficult locations.

Economic Evaluation and Environmental Assessment

33. Economic Evaluation and Environmental Assessment shall follow the guidelines given in the DETR publication 'A New Deal for Trunk Roads in England: Guidelines on the New Approach to Appraisal' and HA publication 'Appraisal of Technology Projects'. Designers should agree the scope of the evaluation and assessment with the Overseeing Organisation.

34. For conventional means of procurement the study must include an evaluation to decide the economic viability of the scheme. The level of detail and the

evaluation methodology will be scheme-dependent and should be agreed with the Overseeing Organisation.

35. Whole life costs to be considered should include system development, implementation, staffing, service and maintenance. The study should seek to prove that the provision of a STMS scheme is preferable to an alternative traffic solution.

36. The feasibility study must consider the impact of the STMS on the environment. This should include:

- consideration of the visual impact of signs/ support and ancillary equipment such as cabinets, duct runs and steps etc., viewed from the road itself and from nearby developments and open space
- residential properties and consideration of the land classification of adjacent areas
- consideration of the need to fell or reduce the size of trees on the approach to VMS
- light pollution caused by VMS
- an appreciation of the environmental effects on the roads receiving diverted traffic as for increased congestion, noise and air quality.

Designers should agree the scope of the environmental assessment with the Overseeing Organisation.

Scheme Evaluation Requirements

37. The study should identify the objectives that need to be evaluated when the scheme is in operation to assess its effectiveness, optimise performance and confirm that the economic benefits are being attained. The evaluation should generally include considerations of accident reduction, speed changes and traffic volumes leaving the road in response to given messages. The reduction in delay costs and driver frustration leading to risk of accidents should also be considered.

Implementation Programme

38. The above study should identify an implementation programme for the preferred scheme option. The programme should outline the logical steps of implementation, indicate the likely spend profile, and present (where appropriate) the incremental economic benefit for each stage of the programme.

39. The programme should also identify appropriate stages for consulting and agreeing design proposals, operational and maintenance boundaries and system engineering interfaces.

Legislation

40. Many areas of legislation exist which will apply to the various elements of a STMS scheme. Most are common to all design, procurement and construction projects and guidance is beyond the scope of this Advice Note. However two specific areas of legislation will apply to STMS schemes and these are outlined below.

41. To be legally placed on the highway in England all signs, including all VMS legends must be either prescribed or authorised. Prescribed signs and VMS legends are defined in the TSRGD. Any sign not so prescribed must be authorised by the Overseeing Organisation.

42. VMS that are other than manually operated, will also need statutory Type Approval. Designers should consult the Overseeing Organisation on this issue.

Risk Assessment/Hazard Identification

43. A Risk/Hazard Assessment should be considered as it relates to the role of the Highway authority. This makes it necessary to maintain the highway in a safe condition and to secure the safe movement of traffic including pedestrians. The matters to be considered therefore include:

- signs not operating correctly
- reliability
- failure of a legend to appear or the appearance of an incorrect legend
- maintenance.

44. Depending on the outcome of the assessment process, requirements such as message monitoring, interlocking and/or message sequencing rules may need to be developed during the design stage to ensure safety integrity levels are achieved.

A2.3 Scheme Design and Implementation

45. Outline proposals developed during the Feasibility Study should be reviewed, refined and

developed into the scheme design. This should take into account not only the requirements for implementation, but for effective maintenance and operational support throughout the operational life cycle.

46. The scheme design should normally commence with a consultation, survey and information collection phase, followed by preparation of preliminary design to be agreed with the Overseeing Organisation. The preliminary design should detail proposals for:

- traffic data and information collection systems
- VMS types
- VMS site locations
- control system
- communications infrastructure and transmission
- structures, geotechnical and civil engineering
- traffic management.

47. Designers should examine existing site records, transmission arrangements and control facilities to establish the impact of the scheme on existing systems, and the scheme design requirements. This stage will involve consultation with relevant divisions of the Overseeing Organisation, the Police and other organisations having an interest in the STMS scheme.

General Design of the Works

48. The detailed design and preparation of working drawings should not commence until the design proposals have been presented to and agreed with the Overseeing Organisation.

49. The options for collecting accurate real-time traffic data and information identified during the feasibility stage may be developed into the overall scheme. On motorways the provision of MIDAS and CCTV will normally deliver this data. Where this is not being provided and on other roads, the standard designs may need to be developed and modified to provide additional data and information collection sites at key locations to suit the needs of the scheme.

50. VMS must conform to the Overseeing Organisation's standards and will normally be based on the Highways Agency 'TR' series of specifications. These detail the sign design and performance requirements to be achieved, and standard interfaces to the NMCS infrastructure. The designer should consult the Overseeing Organisation before placing contracts for VMS procurement as existing contracts may offer benefits in terms of cost savings and approved designs.

51. The control system requirements must be defined based on the operational and management objectives and taking into account the need for integration with existing and planned systems, and any extension to the functionality or capacity of these systems. The Overseeing Organisation and the Police should be consulted at an early stage and proposals agreed before finalising the design and scope of the STMS contract.

52. Control room and equipment room layouts must be examined to ensure the proposed system can be accommodated in terms of space for equipment and power supplies etc.

53. Design of the communications infrastructure should conform to Highways Agency standards defined in the Highway Construction Details 'MCX' series and any modifications required by the Overseeing Organisation.

54. The transmission network should take account of the capacity of existing systems. For motorways, cable pairs and channel allocations will need to be agreed with the Overseeing Organisation and works arranged to re-configure and provide additional communications circuits as required. For other locations, the provision of circuits by Private Telecommunications Operators (PTOs) must be planned at an early stage in the design process.

55. The provision and upgrading of power supplies for VMS can be a lengthy process, particularly for remote sites where the Electricity Supply Company (ESC) may need to negotiate wayleaves. Power supply locations should therefore be identified early in the design process, and works orders placed accordingly.

56. VMS will normally be installed on posts or cantilever gantries in the roadside verge, or on new or existing portal gantries. Standard arrangements exist for sign cantilevers and for modifications to some types of portal gantry. Designs, technical assessments and design checks should be carried out incorporating the requirements as applicable for:

- Post, Cantilever or Portal Gantry sign and superstructure
- foundations and holding down arrangements

- technical assessment/design modifications to existing gantries
- retaining walls.

57. The design process should include an early desk study of available soils data, to establish whether a contract for an additional geotechnical investigation is needed to complete the scheme design. Designers should identify any such work early in the programme as it may have major impact on the implementation timescale.

58. Safety barrier must be provided at all locations according to the Overseeing Organisation's standards. Any existing barrier at or near to the sign location should be upgraded and extended as necessary.

59. Traffic management systems for STMS schemes must conform to Chapter 8 of the Traffic Signs Manual. The Overseeing Organisation, Maintaining Agent and the Police must be consulted to agree local arrangements, lane closure timings and road space bookings etc. taking into account other programmed works.

Siting of VMS

60. The locations for VMS should be identified by site survey according to the criteria given in Chapter A4, 'VMS Siting Criteria'. A detailed site survey is required for each of the VMS locations identified during the feasibility study.

61. When locations have been defined, consideration must be given to carrying out an Environmental Impact Assessment study of the STMS scheme.

Notifications

62. If considered necessary by the Overseeing Organisation, notification of the STMS scheme should be sent to the Planning Authority for information and comment. This notification should comprise a package of information, describing the scheme and its objectives and showing the locations of the signs on a 1:25000 scale map of the area.

Legend Authorisation

63. The recommendations for VMS types and legends identified during the feasibility stage should be reviewed and if necessary further developed.

64. Any messages not included in the TSRGD must be authorised by the Overseeing Organisation as described in Chapter A2.2.

Traffic Modelling and Diversion Strategies

65. The diversion routes and intervention nodes identified during the feasibility stage should be reviewed and developed in consultation with the Police and Highway Authority.

Operational Procedures

66. Procedures should be developed and worked into a Code of Practice for operation of the STMS. Depending on the scope of the scheme, this may involve consultation with the Overseeing Organisation and the Local Police and the Secretary of the National Motorway Policing Subcommittee of the Association of Chief Police Officers Traffic Committee.

Safety Audits

67. Safety Audits should be carried out in accordance with the Highways Agency's specific requirements stated in HD 19, 'Road Safety Audits'.

As-Built Drawings and Records

68. The designer should provide as-built drawings and records of the completed works for all contracts. All electrical inspection documentation should be provided at completion of the works. Where required, 'As-Built' information must be incorporated into the existing NMCS record drawings. All structural information, both for the signs themselves and the supports, should be provided on completion of the works.

Detailed Risk Assessment

69. The safety issues considered during the feasibility stage should be reviewed and amended as necessary.

70. The assessment should take into account best practice achieved elsewhere on the road network, and the consequential driver's expectation and reliance on STMS information.

71. Requirements such as message monitoring,

interlocking and/or message sequencing rules must be developed at this stage to ensure safety integrity levels are achieved.

72. The hazard identification and risk assessment process should consider among other matters the following:

- the signs not operating or operating incorrectly
- possible conflict with signing and/or driver information systems
- message priority
- failure of a legend to appear or the appearance of an incorrect legend - (this must be done on an individual sign basis and a system and sequence basis)
- the legends to be displayed and how easily they can be read and understood
- failure of real time traffic data sources
- maintenance.

A2.4 Scheme Evaluation

73. When the scheme is in operation, the STMS should be continuously evaluated to assess its effectiveness, optimise performance, and confirm that the economic, operational and other benefits of the scheme are being attained. The evaluation should be presented in the form of a Scheme Evaluation Report.

74. The evaluation requirements, initially identified as part of the feasibility study, should be reviewed and if necessary adjusted when the scheme is in operation. If required, elements of the STMS should be modified to ensure maximum benefits are realised.

75. Data from the detection and VMS systems should be collected and analysed to check whether the algorithm or operational rules select the appropriate strategy and to assess the actual diversion achieved. Where appropriate rules or algorithms should be refined.

76. Monitoring should continue whether the initial results show that refinements are needed or not, so that changes in conditions and driver responses over time can be met with appropriate system responses.

A2.5 System Certification

77. The system certification procedures specified in MCH 1813 should be followed.

A3. STRATEGIC VMS TYPES

A3.1 Introduction

1. VMS for STMS applications may be of the Light Emitting Technology type or the FTMS types.

2. All Strategic VMS should be fitted with flashing amber lanterns. The lanterns should flash in synchronous horizontal pairs alternating top and bottom to draw the attention of drivers to the message displayed on the VMS. Lantern design requirements must comply with the TSRGD.

A3.2 VMS Technologies and Types

Enhanced Message Signs

3. Message Signs are active light emitting signs. Two main technologies are used in such signs, these are Light Emitting Diode (LED) and Optical Fibre. A third variety uses the combination of a reflective disc with light emitting technology.

4. The arrangements of text most frequently used for display purposes are:

- two lines of twelve characters (2x12)
- two lines of sixteen characters (2x16)
- three lines of twelve characters (3x12)
- three lines of eighteen characters (3x18)

5. Each character is formed from a matrix of display cells 5 wide and 7 deep and has a nominal character height of 400mm, although 2x12 signs on gantries use a nominal character height of 320mm. Combined Message Signs/EMI are now available whereby part of the display panel is assigned a continuous matrix capable of either text or EMI display depending on the particular need at any given time.

6. Message Signs are usually installed on Cantilever or Portal Gantries.

Fixed Text Message Signs

7. FTMS are any type of VMS that display two or more fixed legends (or a blank display and one or more legends). There are currently a number of technologies used in such signs, the more common being active light emitting (as above), flexible roller blind and rotating plank or prism, the latter two normally being electro mechanical. Of these types the rotating plank or prism is most suitable for strategic use. Because of the drawbacks noted below, FTMS are now not widely used and are generally most suitable for signing diversion routes.

8. The rotating plank or prism sign normally consists of a series of planks or prisms that align to form a flat sign face. When required to show a different aspect, the planks or prisms realign to present a different sign face. Either the whole sign face can be changed in this way, or only those parts of the sign face that need to be changed. In this way the number of legend options available can be increased.

9. The arrangement of text used for display purposes on rotating plank or prism signs must either be as prescribed in the TSRGD or specially authorised by the overseeing organisation.

10. FTMS are normally mounted on posts installed in the motorway verge, or on Portal Gantries. The main drawbacks of FTMS are:

- they can not be routinely tested without displaying the message which may confuse road users
- unless they are regularly exercised they are prone to electro-mechanical failure.

A3.3 Applications of Strategic VMS

Enhanced Message Signs

11. It is accepted that under conditions of normal visibility, Message Signs are less easily legible than conventional fixed traffic signs. This is a factor that must be balanced against their ability to display many different legends. However, if they comply with character height and optical performance requirements, they may actually be more easily legible under poor conditions. This performance under poor conditions may influence the choice of technology for a given application.

12. Experience suggests that strategic message signs on motorways should be provided at the approach to strategic junctions on the network, upstream of associated one-mile and half-mile Advance Direction Signs (ADS). Strategic junctions are as defined in TD 46.

13. Where there are verge mounted ADS and no signal gantries any existing one-mile 3x18 strategic VMS should be replaced by a 3x18 MS3 with EMI. It should be possible to re-use the existing post and structure. The two VMS will have the following priorities:

- SVMS upstream of the one-mile ADS – tactical legend priority
- SVMS upstream of the half-mile ADS – strategic legend priority.

14. Wherever possible SVMS are normally provided in pairs. Both should display either the same strategic or tactical message. In case of conflict between tactical and strategic legends, the tactical legend is the most important legend to be displayed. The specific use of signs in the event of needing to use both a tactical and strategic legend is as follows:

15. On the SMVS upstream of the one-mile ADS:

- If a tactical legend is displayed it cannot be replaced by a strategic legend.
- If a strategic legend is displayed a tactical legend shall take priority and shall replace the strategic legend.
- If no legend is displayed any legend can be displayed.
- Once the tactical legend has been removed the strategic legend shall be displayed (if still required).

16. On the SVMS upstream of the half-mile ADS:

- If a non-strategic legend is displayed a strategic legend shall take priority and shall replace the non-strategic legend.
- If a strategic legend is displayed it cannot be replaced by a non-strategic legend.
- If no legend is displayed any legend can be displayed.
- Once the strategic legend has been removed the non-strategic legend shall be displayed (if still required).

Fixed Text Message Signs

17. FTMS are more commonly used for diversion routeing and local traffic management where there are a low number of route options. They may most effectively be used to display messages linking to a predetermined diversionary route, marked by symbols, eg. “Follow ■ for London”. Symbols for use on directional signs are shown in Part VII of Schedule 13 of The Traffic Signs Regulations and General Directions 2002.

18. Other FTMS applications include tunnel/bridge maintenance requiring lane or road closures, weighbridges, tidal flow operations, level crossings and bus lane management.

19. The use of FTMS for Strategic Traffic Management is more likely to be on roads approaching intersections with motorways, rather than on motorways themselves. However, around major urban areas it may be necessary to use FTMS instead of MS3 along certain sections of motorway to achieve a satisfactory level of signing.

20. Unlike MS3, FTMS normally replace existing ADS as the normal sign face contained on the ADS will be incorporated as one of the faces of the FTMS. Diversion destinations, when shown, shall appear in black legends on yellow background, designed to the same rules as set out in Chapter 7 of the Traffic Signs Manual. When the diversionary route is displayed, flashing amber lanterns, as referred to in A3.1.2 shall be used.

A4. VMS SITING CRITERIA

A4.1 General

1. The siting criteria to be used when identifying VMS locations depends on the sign type selected during the feasibility and design stages.

2. For FTMS type signs the criteria to be applied are the same as for ADS on motorway and trunk roads. Such signs will normally replace the existing ADS and be installed on posts in the verge or on portal gantries as appropriate to the scheme design.

3. When siting Light Emitting Technology type signs, such as MS3 it is important that the sign is positioned so that the motorist can relate any message with the associated ADS downstream of the VMS.

4. The advice given in Chapter A4.2 should be followed to determine appropriate locations for Message Signs.

A4.2 Siting Criteria for Message Signs

5. Figure A4.2a and TD 46 cover the general decision process and siting arrangements for VMS. The information should be read in conjunction with the advice given in Chapter A2 of this TA guide, particularly in relation to the selection of VMS sign and legend types.

6. By definition, MS3 for STMS purposes need to be on the approaches to road junctions that can be broadly categorised as either All-Purpose Road or Motorway/Motorway. Whereas the standards for these with regard to the type of signing and signalling are quite different, the general arrangement of the direction signs is usually a one mile, followed by half mile and a Final ADS on motorways, but the one mile ADS is often not provided on All-Purpose roads.

7. In deciding locations for Message Signs it is necessary to consider and balance the following needs:

- all types of information and directional signing and any signals must be in a position where they can be seen and read by drivers
- sign clutter and information overload must be avoided. In this respect, the maximum number of units of information presented to the driver should not exceed seven
- STMS signs should be positioned so the driver can associate the MS3 message with the route information on directional signing
- the siting needs of other VMS applications such as for tactical control purposes.

8. Figure A4.2a and TD 46 set out in general terms how this balance might best be achieved in a given location. Further advice may be obtained from the Overseeing Organisation.

9. Sign legends should be duplicated to reinforce the information or instructions given. Therefore, two Message Signs should generally be provided on the approach to the key junctions within any STMS.

10. It is recommended that the following parameters be used in conjunction with Figure A4.2a and TD 46:

- Message Signs with 400mm nominal character height.
- A separation between cantilever strategic message signs and the one mile and half mile of 200m minimum, 300m desirable and 400m maximum. However, the downstream Message Signs should not be closer than 200m to either the upstream or downstream ADS. Where there is no one mile ADS a single Message Sign should be provided, located in advance of the half mile ADS in accordance with these siting requirements.
- A separation between portal strategic Message Signs and the one mile and half mile ADS of 300m minimum and 400m maximum. However, the downstream Message Sign should not be closer to either the upstream or downstream ADS. Where there is no one mile ADS a single Message Sign should be provided, located in advance of the half mile ADS in accordance with these siting requirements.
- A protected sightline to the Message Signs of 225m minimum and 400m desirable.

A4.3 Siting Considerations for VMS

11. Factors that need to be taken into consideration when locating the VMS include other structures, environmental and other considerations. These are discussed below.

Location Relative to Structures

12. VMS should be positioned to ensure that bridges and other structures do not obstruct visibility. It is equally important to ensure that VMS do not obstruct the visibility of other signs and signals, the detection field of Fog Detectors, or the view from CCTV surveillance cameras.

13. Where it is necessary to place a VMS downstream of an overbridge, the resultant sightline should be carefully checked to ensure that the protected sightline requirements are satisfied.

Location Relative to Lighting Columns

14. Where road lighting is on the verge, VMS should be located at least one column length away from the nearest lighting column. This is to prevent damage being sustained by the sign in the event of the lighting column being knocked down by a vehicle. Where a VMS has to be sited between two lighting columns, it shall be placed immediately upstream of a column wherever possible.

Environmental Considerations

15. All VMS structures should be assessed for their visual impact at each sign location. Consideration should be given to the design and location of these structures to take account of the local setting in terms of landscape, townscape character and conservation designations such as National Parks and special landscape areas.

16. For new roads and motorways consideration of the type, location and degree of visual intrusion, caused by the strategic VMS structures, should be included in the Environmental Assessment under Landscape Effects.

17. The procedures set out in Department of the Environment Circular 18/84 - Crown Land and Crown Development - do not apply to the provision of VMS within the existing highway boundary. However when siting signs, due consideration should be given to assessing and reducing their visual impact.

Other siting considerations

18. Other design considerations for siting of VMS include:

- proximity of power supplies
- available space for communications and power cabinets including paved areas, access steps and where necessary retaining walls
- access for maintenance including a possible need for an off-road parking site.

On link roads it is essential that VMS are correctly oriented so that they can be clearly distinguished from main carriageway VMS. This may be achieved be means of louvres or narrow angle emitters.

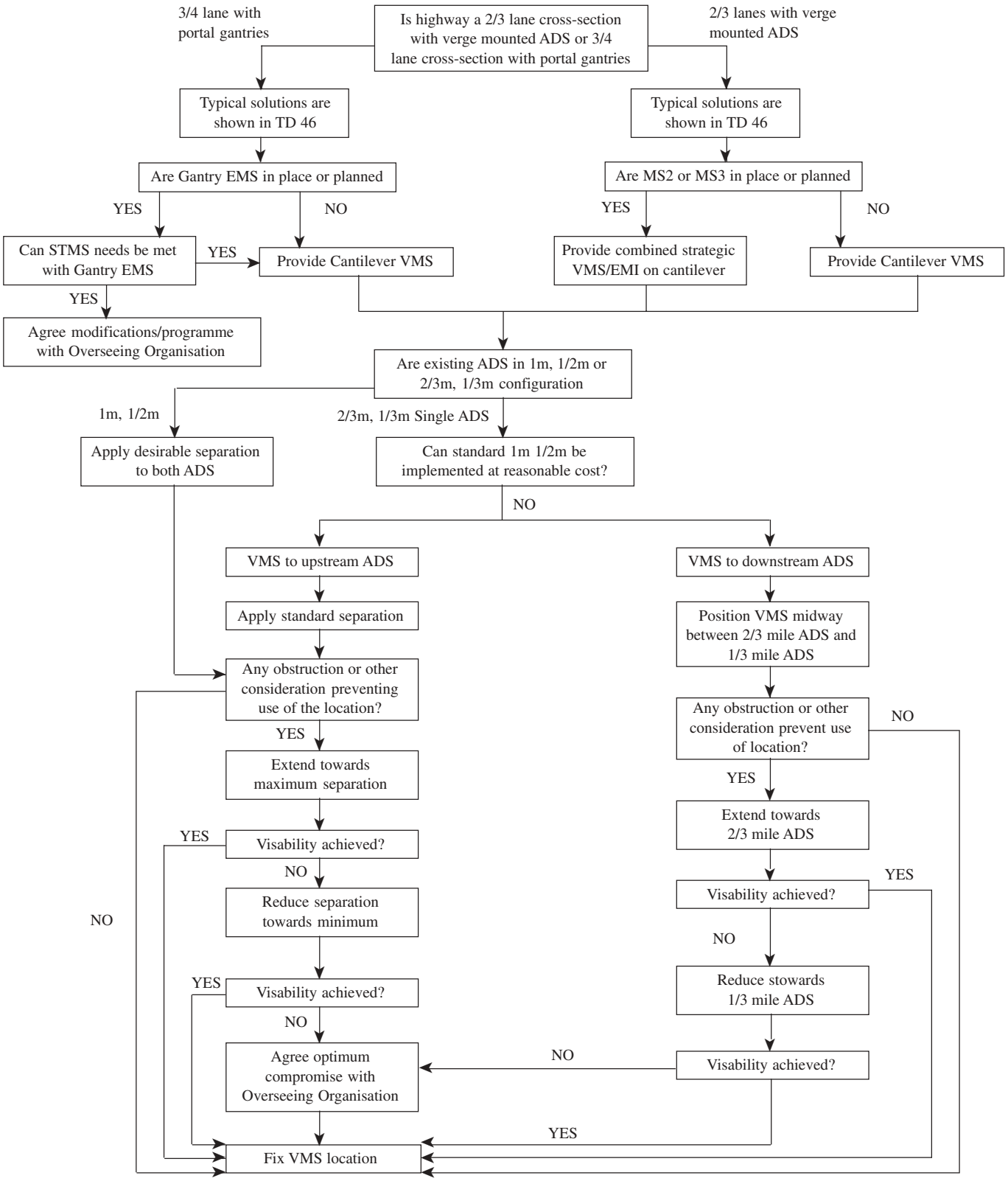

Figure A4.2a - Flowchart to determine sign/support arrangements and siting of VMS related to ADS

A5. VMS INFRASTRUCTURE

A5.1 Control Systems

1. VMS can be controlled by all current motorway control systems. Designers should assess the suitability of using existing control and communications systems for the STMS scheme in consultation with the Overseeing Organisation. Existing or planned systems used for VMS control include:

- Stand Alone Control System
- NMCS2 - Message Sign subsystem.

2. The communications infrastructure needed to support either an NMCS2 or Stand Alone Control arrangement is fully described in TRH 1642, 'Motorway Signals Mark 3, Infrastructure Design Guide'.

A5.2 Roadside Infrastructure

General

3. On motorways, the NMCS infrastructure should also support the majority of STMS applications. Where new STMS schemes are introduced within existing sections of motorway, infrastructure works should therefore be limited to civils work and local modifications to existing cabling and powers supplies.

4. On other roads it will be necessary to develop the solutions identified during the feasibility study such as cabling to the motorway, or radio, private lines, ISDN or similar links to more remote locations.

Enhanced Message Signs

5. The infrastructure for a typical Message Sign site comprises:

i) a foundation and plinth fitted with a standard holding down arrangement to support the cantilever structure and Message Sign enclosure

or

a Portal Gantry suitably modified to provide support for the Message Sign and Enclosure

(ii) Communications Cabinet Type 600 and Power Cabinet Type 609 with associated cabling and ducts

(iii) safety barrier - double height Open Box Beam

(iv) paving, handrails and retaining walls as required by site conditions.

6. A typical Cantilever Message Sign Outstation Layout is shown on Drawing MCX 0582.

7. A Portal Gantry Outstation Layout is shown on Drawing MCX 0800. This shows the arrangement where a ducted cable network is provided. At all other locations, the cables between the gantry and equipment cabinets will be directly buried.

8. Further guidance is given in Specification TRH 1642, 'Motorway Signals Mark 3, Infrastructure Design Guide'.

Fixed Text Message Signs

9. The infrastructure for a typical FTMS site comprises:

(i) a foundation, either a reinforced concrete block with no holding down arrangement where the FTMS post fixings are drilled into this foundation or a similar block with appropriate post holes

(ii) Communication cabinet Type 600 and a Power Cabinet Type 609 with associated cabling and ducts

(iii) safety fencing to suit location

(iv) paving, handrails and retaining walls as required by site conditions.

A5.3 Technical Approval

Cantilever Structures

10. Cantilever gantries are designed as two elements:

(i) foundation

(ii) superstructure.

11. The foundation comprises a reinforced concrete plinth incorporating a standard holding down arrangement for the superstructure. Details are given in Drawings MCX 0583.

12. Technical Approval must be sought from the appropriate Technical Approval Authority. If the foundation and superstructure are designed independently, or by different design organisations, a Technical Approval submission must be made for each element.

13. Cantilever foundations and superstructures are classed as Category II structures and, as such will require independent checks of the design.

Existing Gantries

14. Existing gantries should already be certified to BD 2. Technical Approval is therefore required for the addition of VMS sign enclosures and mounting equipment and the effect of these additions on the gantry structure.

15. Detailed designs already exists for the additional steelwork to support a 320mm Message Sign to be mounted on certain ‘standard’ gantries. This design and where it can be applied is shown on Drawing No. MCX 0584.

16. Where VMS signs other than the 320mm are to be installed, a new design must be developed specifically for each situation.

17. The gantry designers should be asked to carry out checks to ensure there is adequate reserve structural capacity to support the VMS, and to establish whether the gantry loading on foundations is exceeded.

18. The Technical Approval submission must refer to the structure number for the existing gantry. Design and check certificates must be produced for the additions, and a separate check certificate must be produced by the gantry designer for the effect on the gantry.

A5.4 Holding Down Arrangement

19. When foundations are constructed, it is essential the contractor uses a template provided by the supplier of the superstructure.

20. On contracts where different contractors are responsible for the construction of the base and superstructure, steps must be taken to ensure that the interface between the two elements matches.

A5.5 Optical Alignment

21. When using VMS based on light emitting technology, it is particularly important to ensure correct optical alignment of the sign with the carriageway. Design requirements, and the method to be applied on site are given in Drawing MCX 0069.

A5.6 Ordering of Equipment

22. A request for Financial Approval and Equipment Order shall be made according to MCH 1286.

23. Reference should be made to Highway Construction Drawings MCX 0590 and MCX 0591, which show the equipment configuration for VMS outstation sites.

A6. GLOSSARY OF TERMS

Continuous Sign

A VMS that appears to be made up of solid characters or symbols. The sign face is changed by removing one set of symbols/characters and replacing them with another, or by having a multiple face that can rotate.

Discontinuous Sign

A VMS in which the sign face is made up of individual elements having at least two states. By changing the state of the individual elements, different characters and symbols can be created within the same sign area.

Driver Information Legends

Give the motorist information of a tactical and strategic nature, but also with messages relating to conditions on the network that may affect expected journey times. This may include information on major events eg. shows, sports events etc. and inter network connections such as ferries, tolled roads and crossings.

Fixed Text Message Sign (FTMS)

A type of VMS able to display a limited number of fixed messages. Signs for strategic applications use a mechanical rotating prism as the mechanism for changing the sign legend.

NMCS

The Highways Agency's National Motorway Communications System.

Sign

A device carrying directional or other informational message, eg. route information at the approach to a junction.

Signal

A device used to give advisory or mandatory instructions, e.g. stop or 30 mph speed restriction.

Strategic Traffic Management Systems (STMS)

Give the motorist information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

Tactical Control Systems

Provide supplementary information to complement matrix signals and other traffic control signs for local management of incidents or occurrences.

Variable Message Sign (VMS)

A generic term for a sign that can display multiple legends or messages.

Both Motorway Signals Mk3 (MS3) and Fixed Text Message Signs (FTMS) are different types of VMS.

VMS can display text messages and/or symbols using any of the following technologies:

a) Rotating Prism

b) Reflecting Cells

c) Light Emitting Cells.

A7. REFERENCES

Design Manual for Roads and Bridges

BD 2 Technical Approval of Highway Structures (DMRB 1.1.1).

HD 19 Road Safety Audits (DMRB 5.2.2).

TA 74 Motorway Signalling (DMRB 9.4.3).

TA 60 The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads (DMRB 8.2).

TD 33 The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads (DMRB 8.2.1).

TD 46 Motorway Signalling (DMRB 9.1.1).

Department for Transport

The Traffic Signs Regulations and General Directions 2002 (SI 2002 No 3113).

Traffic Signs Manual Chapter 7 – The Design of Traffic Signs.

Traffic Signs Manual Chapter 8 – Traffic Safety Measure and Signs for Road Works and Temporary Situations.

A New Deal for Trunk Roads in England: Guidance on the New Approach to Appraisal.

Highways Agency Specifications

MCH 1286 Request for Financial Approval (Standard and Non-Standard Schemes) and Bulk Purchase Equipment Order.

MCH 1813 System Certification.

TRH 1642 Motorway Signals Mark 3 - Infrastructure Design Guide.

TR 2517 Performance Specification for Electromechanical Variable Message Signs.

TR 2516 Performance Specification for Discontinuous Variable Message Signs.

Highways Construction Details

MCX 0069 Cantilever and Gantry Sign Setting Out and Optical Alignment.

MCX 0582 Installation Drawing NMCS2 Message Signs Outstation Layout.

MCX 0583 Cantilever Structures and Holding Down Arrangements.

MCX 0584 Installation Drawing NMCS2 Message Signs on Portal Gantry - Additional Steelwork.

MCX 0590 Cantilever Site - Typical Arrangement.

MCX 0591 Portal gantry Site - Typical Arrangement.

Other Documents

Department of Environment Circular 18/84 - Crown Land and Crown Development.

HA document - Appraisal of Technology Projects.

VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX B (SCOTLAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

SUMMARY

This new Advice Note TA 83/05 provides guidance for the feasibility study, design, implementation and evaluation of Strategic Traffic Management Systems (STMS) using Variable Message Signs (VMS).

INSTRUCTIONS FOR USE

This is a new document to be incorporated into the Manual.

1. Insert TA 83/05 Annex B as Part 6 of Volume 9, Section 4.

2. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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TA 83/05 ANNEX B (SCOTLAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

Contents

Chapter

B1. INTRODUCTION

B1.1 General

1. This Annex describes the specific requirements for the use and siting of variable message signs in Scotland.

DMRB Structure

2. Section 1 of Volume 9 the Design Manual for Roads and Bridges (DMRB) contains Technical Directives (TD) which detail the Standards of Provision.

3. Section 2 onwards contains Technical Advice (TA) Notes which reflect current practice in the field of motorway communications and control.

Design Loop

4. Figure B1.1 shows the 'Design Loop' illustrating the general sequence in the iterative process which starts with the design for emergency telephones and signals followed by transmission and control office designs. Last in the cycle is the design of the infrastructure that will be required to support all communications equipment and systems.

Glossary

5. A Glossary of Terms is given in Chapter B6.

Standard Drawings and Specifications

6. Standard drawings and specifications referred to in this guide are those issued by The Scottish Office, National Roads Directorate and by the Highways Agency.

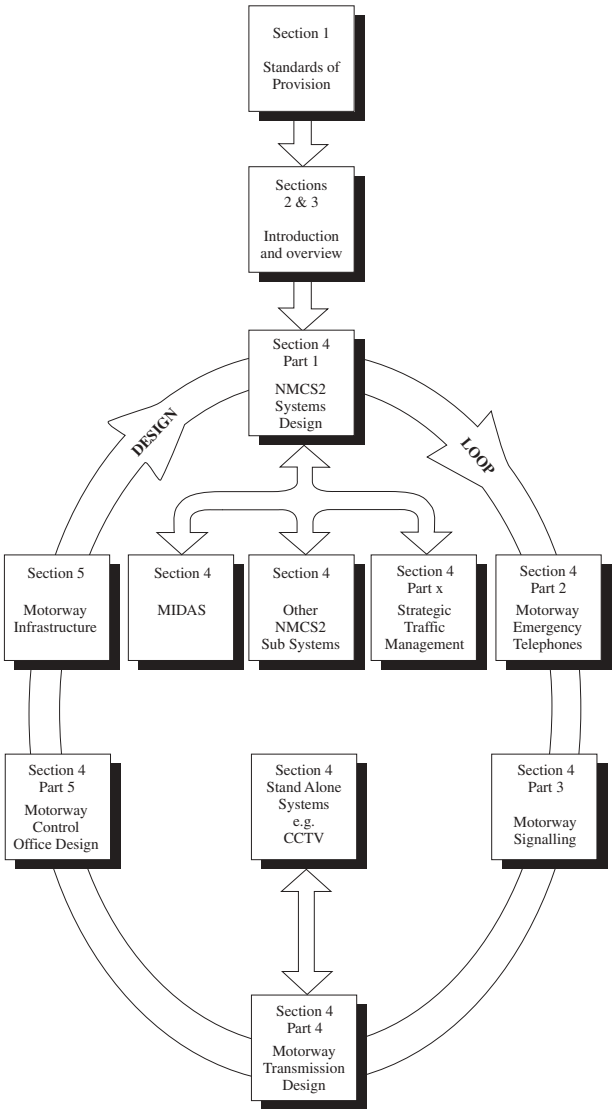


Figure B1.1 Structure of Volume 9 of the Design Manual for Roads and Bridges

B1.2 Related Standards and Advice Notes

7. TD 33/90, 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads', provides criteria affecting the selection, siting and use of all types of Variable Message Signs (VMS) on all purpose and motorway roads. This Advice Note relates purely to light emitting VMSs and TD 33/90 is due to be updated to concord with the advice given in this document. Most VMS currently used for Strategic Traffic Management are based on the light emitting technology.

8. For VMS based on light emitting technologies, the design criteria and performance standards for road applications are given in Highways Agency Specification TR 2136, 'Functional Specification for Continuous or Discontinuous Variable Message Signs'.

9. Highways Agency Specification TR 0154, 'Electromechanical Variable Message Signs - Functional Specification', covers performance requirements for that category of sign. The performance requirements of sign face materials, where appropriate, is found in BS 873.

10. The following current versions of Advice Notes are of general relevance. Reference should be made to the National Roads Directorate as to their specific application in Scotland.

TA 70/97: Introduction - Motorways - DMRB, Volume 9 Section 2, Part 1.

TA 71/97: Design and Implementation (Overview) - DMRB, Volume 9, Section 3, Part 1.

TA 72/97: National Motorway Communications Systems - DMRB, Volume 9, Section 4, Part 1.

TA 74/97: Motorway Signalling - DMRB, Volume 9, Section 4, Part 3.

TA 75/97: Motorway Transmission Design - DMRB, Volume 9, Section 4, Part 4.

TA 76/97: Motorway Control Offices - DMRB, Volume 9, Section 4, Part 5.

TA 77/97: Motorways: Infrastructure Design - DMRB, Volume 9, Section 5, Part 1.

B1.3 Scope

11. The practices and requirements detailed in DMRB, Volume 9, Network - Traffic Control and Communications, relate to the policies implemented by the Overseeing Organisations in the UK.

12. The principles in this Advice Note refer specifically to the needs and practices applicable in Scotland. Other Overseeing Organisations, should refer to Annexes A, C or D as appropriate for advice in line with their Strategic Traffic Management needs.

13. This Advice Note takes precedence in the case of any conflicting direction in TD 33/90 or advice in TA 60/90, or other existing Advice Notes in as far as they relate to Strategic Traffic Management Systems in Scotland.

VMS Applications

14. VMS are provided for Driver Information, Incident Signing, Tactical Control and Strategic Traffic Management. The scope of these applications is as follows:

- **Driver Information** - provides the motorist with information of a tactical and strategic nature, but also with messages relating to conditions pertaining on the network which may affect expected journey times along with safety related messages such as 'KEEP YOUR DISTANCE'.
- **Incident Signing** - normally set by the Police during emergency conditions but can be set from the National Network Control Centre (NNCC) in Glasgow if required.
- **Tactical Control** - provides supplementary information to complement matrix signals and other traffic control signs for management of incidents or occurrences on local roads in the area. Signs set in support of tactical objectives display messages specifically related to achieving improvements on the localised sections of the network, eg 'ACCIDENT/LONG DELAYS'.
- **Strategic Traffic Management** - set by the NNCC and provides the motorist with information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

15. This Advice Note covers the application of VMS to Strategic Traffic Management Systems (STMS) only.

16. Strategic Traffic Management seeks to ensure that a strategic view of network status and conditions is available, and that strategies and decisions which have more than a local impact can be correctly identified and effectively implemented. Signs set in support of these objectives may offer alternative or diversionary route choices.

17. This Advice Note describes the different types of VMS currently available for STMS schemes, and outlines the approach to be adopted for the feasibility study, scheme design, its implementation and the evaluation of any proposed schemes.

B2. SCHEME PROCESS

B2.1 General

1. There are no standard provision criteria for Strategic Traffic Management Systems (STMS) schemes and each must therefore be individually justified by means of a feasibility study incorporating an economic analysis. However, any proposed STMS scheme must be discussed fully with the National Network Control Centre (NNCC) before implementation and shown to be compatible with the existing National Driver Information and Control System (NADICS) system.

2. The Scheme Process is illustrated in Figure A2.1. The implementation of Strategic Traffic Management schemes will generally comprise the following elements:

- Feasibility Study (Chapter B2.2)
- Design and Implementation (Chapter B2.3)
- Scheme Evaluation (Chapter B2.4).

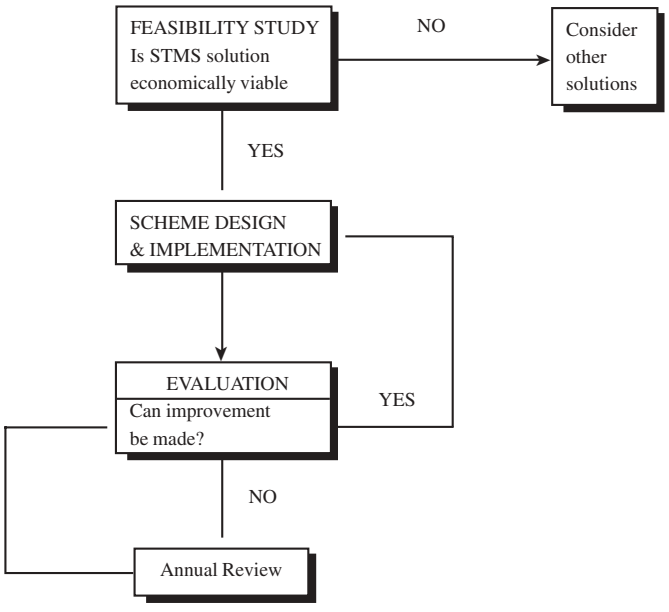


Figure B2.1 Scheme Process

B2.2 Feasibility Study

3. A Feasibility Study is needed to determine the practicality and value for money of STMS schemes. A Feasibility Study report should be produced at the end of the study period and should consider the following:

- review of existing systems, including NADICS and traffic management practices
- operational objectives
- network and traffic analyses
- diversion routes and intervention nodes
- scheme operation and management
- Variable Message Signs (VMS) messages
- sign type selection
- engineering
- economic evaluation
- environmental assessment
- scheme evaluation requirements
- implementation programme
- legislation
- risk assessment/hazard identification.

Review of Existing Systems and Traffic Management Practice

4. The feasibility study should consider the extent of the existing and planned facilities within the area of the proposed scheme. These include:

- NNCC and Police Control Office operational boundaries and their interaction with respect to the control of incidents and traffic management
- institutional issues, policy and codes of practice with respect to the control of incidents and traffic management

- the location, type and objectives of existing and planned VMS schemes where appropriate
- the location and form of existing Fixed Signs, Signals and Gantries
- the existing communications infrastructure and its ability to support new systems
- extent of CCTV coverage at the relevant point of the network
- extent of existing Traffic Data Collection Systems.

Operational Objectives

5. STMS schemes are likely to deal with the management of unusual or unexpected events affecting road traffic rather than day to day congestion. Designers should identify the main objectives of the scheme and these might include:

- provision of information in a timely manner
- achievement of reduction in delay
- achievement of local incident management
- supporting diversion routes and controlling traffic on these routes
- satisfying drivers' needs for reliability and consistency in information and legends
- avoiding an adverse impact on safety and the environment
- consistency with existing and planned VMS schemes on a national basis
- long term viability in terms of meeting other objectives throughout the design life of the system.

Network and Traffic Analysis

6. Designers should classify the road network applicable to the STMS scheme into strategic and non-strategic routes. Aspects to be considered at this stage include:

- the disruptive impact of unusual incidents and planned roadworks on network operation
- the frequency of route diversions by studying historic records of road closures
- traffic characteristics as for network congestion and the capacity of alternative routes to accept diverted traffic
- the impact of potential diversions on alternative routes, especially through towns and villages.

7. A traffic assignment programme may be used to assess and develop strategic control plans that may be used for the STMS. This programme should have the facility to represent traffic diversions that may be applied to the road network, and to evaluate the economic and operational performance of the proposed diversion strategies.

8. The depth and level of the network and traffic analysis should be appropriate to the needs and objectives of the STMS scheme. The output from this analysis should form the basis for the Economic Evaluation.

Diversion Routes and Intervention Nodes

9. Based on the Network and Traffic Analysis, the report should identify the diversion routes, strategic and non-strategic intervention nodes and the recommended locations for the provision of VMS.

10. The current view is that designers should preferably restrict diversion strategies to the Trunk and Motorway Network. Where this is not possible, the views of the National Roads Directorate (NRD), the NNCC, the Road Authorities and the Police, must be sought before the strategy is drawn up.

11. Any existing diversion route agreements developed by the Road Authority and the Police within the scheme area should be considered and reviewed for inclusion in the STMS scheme as local diversion strategies.

Scheme Operation and Management

12. Options for the operation and management of the scheme should be considered. The points to be addressed include:

- integration with the existing NADICS system and any future extension of the system

- integration with the existing management of the strategic network
- the need to supply traffic data to third party organisations and its potential for generating revenue
- the need for consultation to develop effective Codes of Practice.

13. Designers should assess the suitability of using existing control and communications systems for the STMS scheme in consultation with the NRD and the NNCC.

14. Appreciation of the effect of the scheme design on STMS and traffic management schemes elsewhere on the road network is important. It is essential that different systems provide motorists with consistent and accurate information when moving from one area to another.

15. The feasibility study should address the interests of all organisations who may be involved in the operation and management of the proposed STMS scheme. These organisations include:

- the NRD
- the NNCC
- Local Road Authorities
- the Police
- DBFO Concessionaires.

VMS Messages and Sign Type selection

16. The feasibility study should identify the type and size of VMS needed for each location and their appropriate costings should be used in the Economic Evaluation.

17. The type and range of information to be displayed will generally limit the choice of sign technologies, whilst the sign location, road classification and vehicle speeds will affect character heights and therefore the size of the VMS.

18. Deriving a common strategy for VMS signing is important whatever the technology and application. Chapter B1 describes the scope of VMS applications covering Driver Information, Tactical Control and Strategic Traffic Management. The type of VMS and the range of messages used for STMS applications will therefore be influenced by the type and extent of any other VMS signing at a given location.

19. The Feasibility Study must therefore consider in sequence:

(i) the information needed in the VMS legend to meet the scheme objectives

(ii) the content and number of VMS legends for each location

(iii) the VMS technology needed to display the required legends

(iv) the technology used by other VMS on the same section of road

(v) the VMS size and performance level needed for the application, or applications.

20. VMS legends should normally be selected from those given in the Traffic Signs Regulations and General Directions (TSRGD). Any other legends needed for a specific scheme must be authorised by the Scottish Office.

21. The practice for STMS messages is to state the location and cause of the diversion, followed by the suggested alternative route. Research suggests that messages should be restricted to a maximum of eight words, or four units of information. The aim should be to use the shortest message possible.

22. Further reading on VMS legends is given in the VAMOS WHITE BOOK, produced under the European 'Drive' Project VAMOS (VAriable Message Optimised Systems).

23. Where the system will include VMS legends relating to more than one application, eg Tactical and STMS, the hierarchy must be explicit and designers must develop setting resolution rules to decide which legend to use for each specific set of circumstances. This will normally be agreed in conjunction with the NRD via the NNCC, the Police and the Local Authority concerned. The Highways Agency document 'Code of Practice for Operation of Motorway and Trunk Road Signals and Variable Message Signs', prepared in consultation with the Association of Chief Police Officers (ACPO) gives further guidance on this subject.

Sign Types

24. Where the only information to be provided is of a route change, i.e. alternative direction signing, then Fixed Text Message Signs (FTMS) may be adequate. Where the designer requires a wider range of options, discontinuous light emitting signs should be used.

25. For most STMS applications, the most appropriate type of VMS will be the Enhanced Message Sign (EMS), based on light-emitting technology.

26. If Motorway Signals Mark 2, or Tactical EMS type signs are already provided on the approach to a given location, designers must consider meeting the STMS requirements using these signs. If they are shown to be unsuitable, the study should examine alternatives, and identify a solution that meets the needs of all applications.

27. Depending on proposed usage and location a single VMS only is provided on the approach to an Intervention Node. Where they can be justified, two signs may be provided to reinforce the message and to reduce the potential for the VMS to be obscured by high-sided vehicles. Where two VMS are being provided, it is desirable that both signs on the approach to a node show the same legend and use the same technology.

Engineering

28. The feasibility study should consider the engineering design needed to support the STMS. A variety of engineering solutions should be considered and prioritised to decide the most cost effective approach to each particular scheme. Designers should address the following aspects of engineering design:

(i) Traffic Data Collection

(ii) control system

(iii) signs

(iv) infrastructure and transmission.

29. A key factor for STMS is the collection of accurate real-time traffic information. The feasibility study should consider the means by which this is to be achieved cost effectively, including that on non-motorway roads.

30. The STMS control system as a whole must support the operational and management strategy and any development of that strategy over time. The need for any interlocking reaction with, and interaction to, other existing or planned traffic management and control facilities must be identified and the implications assessed. This will include such elements as the number and type of STMS legends, setting strategies, setting resolution rules between different applications, and the operational Code of Practice.

31. The type(s) of sign should be identified from the guidance in Chapter B3, ‘Strategic VMS Types’. However the study should also consider the engineering aspects related to possible sign locations and the means of installation, ie verge mounted posts or cantilevers, or portal gantries.

32. The requirements for the STMS communications infrastructure should be considered and assessed. It is important to identify how the existing infrastructure can be used to reduce the scheme cost and maximise the return on previous investments. On most motorways the standard infrastructure should be capable of supporting the needs of most STMS applications. Elsewhere a variety of solutions should be considered and prioritised. These will include cabling, radio links and the use of private communication links, ISDN or similar, to more remote or difficult locations.

Economic Evaluation

33. For conventional means of procurement the study must include an evaluation to decide the economic viability of the scheme. The level of detail and the evaluation methodology will be scheme-dependent and should be agreed with the NRD.

34. Whole life costs should be considered which include system development, implementation, staffing, service and maintenance. The study should seek to prove that the provision of an STMS scheme is preferable to alternative traffic solutions.

Environmental Assessment

35. The feasibility study must consider the impact of the STMS on the environment. This should include:

- consideration of the visual impact of signs/ support and ancillary equipment such as cabinets, duct runs and steps, etc viewed from the road itself and from nearby developments and open space

- residential properties and consideration of the land classification of adjacent areas
- consideration of the need to fell or reduce the size of trees on the approach to VMS
- light pollution caused by VMS
- an appreciation of the environmental effects on the roads receiving diverted traffic as for increased congestion, noise and air quality.

36. Designers should agree the scope of the environmental assessment with the NRD and the NNCC.

Scheme Evaluation Requirements

37. The study should identify the objectives that need to be evaluated when the scheme is in operation to assess its effectiveness, optimise performance and confirm that the economic benefits are being attained. The evaluation should generally include considerations of accident reduction, speed changes and traffic volumes leaving the road in response to given messages. The reduction in delay costs and driver frustration leading to risk of accidents should also be considered.

Implementation Programme

38. The above study should identify an implementation programme for the preferred scheme option. The programme should outline the logical steps of implementation, indicate the likely spend profile, and present (where appropriate) the incremental economic benefit for each stage of the programme.

39. The programme should also identify appropriate stages for consulting and agreeing design proposals, the operational and maintenance boundaries and system engineering interfaces.

Legislation

40. Many areas of legislation exist which will apply to the various elements of an STMS scheme. Most are common to all design, procurement and construction projects and guidance is beyond the scope of this Advice Note. However two specific areas of legislation will apply to STMS schemes and these are outlined below.

41. To be legally used all traffic signs, including all VMS legends, must be either prescribed or authorised. Prescribed signs and VMS legends are defined in the TSRGD. Any sign not so prescribed must be authorised for a defined location and period of time by the Scottish Office.

42. VMS which are other than manually operated, will need statutory Type Approval and designers should consult the NRD on this issue.

Risk Assessment/Hazard Identification

43. A Risk/Hazard Assessment should be considered as it relates to the role of the Scottish Office. This makes it necessary to maintain the highway in a safe condition and to secure the safe movement of traffic including pedestrians. The matters to be considered therefore include:

- signs not operating correctly
- reliability
- failure of a legend to appear or the appearance of an incorrect legend
- maintenance.

44. Depending on the outcome of the assessment process, requirements such as message monitoring, interlocking and/or message sequencing rules may need to be developed during the design stage to ensure safety integrity levels are achieved.

B2.3 Scheme Design and Implementation

45. Outline proposals developed during the Feasibility Study should be reviewed, refined and developed into the scheme design. This should take into account not only the requirements for implementation, but for effective maintenance and operational support throughout the operational life cycle.

46. The scheme design should normally commence with a consultation, survey and information collection phase, followed by preparation of a preliminary design to be agreed with the NRD. The preliminary design should detail proposals for:

- traffic data and information collection systems
- VMS types
- VMS site locations

- control system
- communications infrastructure and transmission
- structures, geotechnical and civil engineering
- traffic management.

47. Designers should examine existing site records, data transmission arrangements and control facilities to establish the impact of the scheme on existing systems and the scheme design requirements. This stage will involve consultation with relevant divisions of the NRD, the NNCC, the Police and other organisations having an interest in the STMS scheme.

General Design of the Works

48. The detailed design and preparation of working drawings should not commence until the design proposals have been presented to and agreed with the NRD.

49. The options for collecting accurate real-time traffic data and information identified during the feasibility stage may be developed within the overall scheme. On motorways the provision of CCTV and MIDAS (or some other incident detection system), will normally deliver this data. Where this is not being provided standard designs may need to be developed and modified to provide this data to suit the needs of the scheme.

50. VMS must conform to NRD standards and are normally based on the Highways Agency 'TR' series of specifications. These detail the sign design and performance requirements to be achieved and the standard interfaces to the communications infrastructure. The designer should consult the NRD before placing contracts for VMS procurement as existing contracts may offer benefits in terms of cost savings and approved designs.

51. The control system requirements must be based on current operational and management objectives. They must take into account the need for integration with the existing NADICS system and for NRD planned system expansions. They must also take into account any extension to the functionality or capacity of these systems. The NRD and the Police should be consulted at an early stage and proposals agreed before finalising the design and scope of the STMS contract.

52. Control room and equipment room layouts must be examined to ensure that the proposed system can be accommodated in terms of space for equipment and availability of suitable power supplies, etc.

53. Design of the communications infrastructure should conform to Highways Agency standards defined in the 'MCX' installation drawings, along with any modifications required by the NRD as defined in the NADICS series of drawings.

54. The transmission network should take account of the available capacity of existing systems. For motorways, cable pairs and channel allocations will need to be agreed with the NRD and works arranged to re-configure communications circuits as required. For other locations, the provision of circuits by Private Telecommunications Operators (PTOs) must be planned at an early stage in the design process.

55. The provision and upgrading of power supplies for VMS can be a lengthy process, particularly for remote sites where the Electricity Supply Company (ESC) may need to negotiate wayleaves. Power supply locations should therefore be identified early in the design process and works orders placed accordingly.

56. VMS will normally be installed on posts or cantilever gantries in the roadside verge, or on new or existing portal gantries. Standard arrangements exist for cantilever signs and for modifications to some types of portal gantry. Designs, technical assessments and design checks should be carried out incorporating the requirements as applicable for:

- Post, Cantilever or Portal Gantry sign and superstructure
- foundations and holding down arrangements
- technical assessment/ design modifications to existing gantries
- retaining walls.

57. The design process should include an early desk study of available soil data, to establish whether a contract for a geotechnical investigation is needed to complete the scheme design. Designers should identify any such work early in the programme as it may have major impact on the implementation timescale.

58. Safety barrier must be provided at all locations according to NRD standards. Any existing barrier at or near to the proposed sign location should be upgraded and extended as necessary.

59. Traffic management systems for STMS schemes must conform to Chapter 8 of the Traffic Signs Manual. The NRD, Maintaining Agent and the Police must be consulted to agree local arrangements, lane closure timings and road space bookings etc taking into account other programmed works.

Siting of VMS

60. The locations for VMS should be identified by site survey according to the criteria given in Chapter B4, 'VMS Siting Criteria'. A detailed site survey is required for each of the VMS locations identified during the feasibility study.

61. When locations have been defined, consideration must be given to carrying out an Environmental Impact Assessment study of the STMS scheme.

Notifications

62. If considered necessary by the NRD, notification of the STMS scheme should be sent to the relevant Planning Authority for information. This notification should comprise a package of information describing the scheme, its objectives and show the locations of the signs on a 1:25000 scale map of the area.

Legend Authorisation

63. The recommendations for VMS types and legends identified during the feasibility stage should be reviewed and if necessary further developed.

64. Any messages not included in the TSRGD must be authorised by the NRD as described in Chapter B2.2.

Traffic Modelling and Diversion Strategies

65. The diversion routes and intervention nodes identified during the feasibility stage should be reviewed and developed in consultation with the NRD, NNCC, the Police and the local authorities.

Operational Procedures

66. Procedures should be developed and worked into a Code of Practice for operation of the STMS. Depending on the scope of the scheme, this may involve consultation with the NRD, NNCC, local authorities and the Police.

Safety Audits

67. Safety Audits should be carried out in accordance with the requirements as stated in HD 19/94, 'Road Safety Audits', or as otherwise agreed with the NRD.

As-Built Drawings and Records

68. The designer or contractor should provide as-built drawings and records of the completed works for all contracts. All electrical inspection documentation should be provided at completion of the works and where required, as-built information must be incorporated into the existing communications record drawings. All structural information, both for the signs and their supports, shall be provided on completion of the works.

Detailed Risk Assessment

69. The safety issues considered during the feasibility stage should be reviewed and amended as necessary.

70. The assessment should take into account best practice achieved elsewhere on the road network, and the consequential driver's expectation and reliance on STMS information.

71. Requirements such as message monitoring, interlocking and/or message sequencing rules must be developed at this stage to ensure safety integrity levels are achieved.

72. The hazard identification and risk assessment process should consider among other matters the following:

- the signs not operating or operating incorrectly
- possible conflict with other signing and/or driver information systems
- message priority
- failure of a legend to appear or the appearance of an incorrect legend - this must be done on an individual sign basis, and on a system and sequence basis
- the legends to be displayed and how easily they can be read and understood
- message priority

- failure of real time traffic data sources
- maintenance.

B2.4 Scheme Evaluation

73. Once the scheme is in operation, the STMS should be evaluated to assess its effectiveness and to optimise its performance and to confirm that the economic, operational and other benefits of the scheme are being attained. This evaluation should be presented in the form of a Scheme Evaluation Report.

74. The evaluation requirements initially identified as part of the feasibility study, should be reviewed and if necessary adjusted once the scheme is in operation. If required, elements of the STMS should be modified to ensure maximum benefits are realised.

75. Data from the detection and VMS systems should be collected and analysed to check whether the algorithm or operational rules have selected the most appropriate strategy and to assess the actual diversion benefits achieved. Where appropriate rules or algorithms should be refined.

76. Monitoring should continue whether the initial results show that refinements are needed or not, so that changes in conditions and driver responses over time can be met with the most appropriate system responses.

B2.5 System Certification

77. The system certification procedures specified in MCH 1813 : System Certification Specification, shall normally be followed, but this requirement should be clarified with the NRD or the NNCC.

B3. STRATEGIC VMS TYPES

B3.1 Introduction

1. Variable Message Signs (VMS) for Strategic Traffic Management Systems (STMS) applications may be of the Enhanced Message Sign (EMS) or the Fixed Text Message Sign (FTMS) types.

2. All Strategic VMS should be fitted with flashing amber lanterns. The lanterns should flash in synchronous horizontal pairs alternating top and bottom to draw the attention of drivers to the message displayed on the VMS. Lantern design and operational requirements must comply with the Traffic Sign Regulations and General Directions (TSRGD). In Scotland only road information related messages require the operation of the amber flashers.

B3.2 VMS Technologies and Types

Enhanced Message Signs

3. EMS are active light emitting signs and two main technologies are used in such signs, these are Light Emitting Diode (LED) and Optical Fibre. A third variety uses a combination of a retro reflective disc with light emitting technology.

4. The arrangements of text most frequently used for display purposes are:

- two lines of twelve characters (2x12)
- two lines of sixteen characters (2x16)
- three lines of sixteen characters (3x16)
- three lines of 18 characters (3x18).

This is not an exclusive list and other arrangements may be considered.

5. Each character should have a nominal character height applicable to the speed of the road, or as otherwise approved by the Scottish Office. EMS 2 x 12 signs on gantries use a nominal character size of 320mm.

6. EMS are normally installed on Cantilever or Portal Gantries or on mounting posts installed in the verge.

Fixed Text Message Signs

7. FTMS are any type of VMS that display two or more fixed legends (or a blank display and one or more legends). There are currently a number of technologies used in such signs, the more common being light emitting, flexible roller blind and rotating plank or prism. The latter two normally being electro mechanical. Of these the rotating plank or prism type is most suitable for strategic use.

8. The rotating plank or prism sign consists of a series of planks or prisms that are aligned to form a required message. When required to show a different message, the planks or prisms are realigned. Either the whole sign face can be changed or only those parts of the sign face that need to be changed and in this way the number of legend options available can be increased.

9. The arrangement of text used for display purposes on rotating plank or prism signs must be as prescribed in the TSRGD.

10. FTMS are normally mounted on posts installed in the verge, or on Portal Gantries.

B3.3 Applications of Strategic VMS

Enhanced Message Signs

11. It is accepted that under normal visibility conditions, EMS type signs may be less legible than conventional fixed traffic signs, but this factor must be balanced against their ability to display many different legends. However, under poor conditions, provided they comply with character height and optical performance requirements, they may actually be more legible. This performance under poor conditions may influence the choice of technology for a given application.

12. Strategic EMS should be provided at the approach to key junctions on the network, upstream of associated Advance Direction Signs. Positions are selected to suit individual site requirements, such as speed of the road, local topography and environmental considerations.

13. EMS with three lines of eighteen 420mm high characters (3x18) are preferred for most applications. However EMS with other formats can also be used, provided that the feasibility study identifies that such signs are suitable for the legends needed at a particular location.

Fixed Text Message Signs

14. FTMS are more commonly used for diversion routeing and local traffic management where there are a low number of route options. They may most effectively be used to display messages linked to predetermined diversion routes, marked by symbols, eg 'Follow M8 for Edinburgh'.

15. Other FTMS applications include tunnel/bridge maintenance requiring lane or road closures, weighbridges, tidal flow operations, level crossings and bus lane management and Park and Ride facilities.

16. The use of FTMS for Strategic Traffic Management is more likely to be on roads approaching intersections with motorways, rather than on motorways themselves. However, around major urban areas it may be necessary to use FTMS instead of EMS along certain sections of motorway to achieve a satisfactory level of signing.

17. Unlike EMS, FTMS normally complement the existing Advance Direction Signing (ADS), where the normal ADS sign face will be incorporated as one of the faces of the FTMS. Diversion destinations shall appear in black legends on a yellow background, as set out in Chapter 7 of the Traffic Signs Manual. When the diversionary route is displayed, flashing amber lanterns, as referred to in B3.1.2 shall be used.

B4. VMS SITING CRITERIA

B4.1 General

1. The siting criteria to be used when identifying Variable Message Sign (VMS) locations depends on the sign type and size selected during the feasibility and design stages.

2. For Fixed Text Message Signs (FTMS) type signs the criteria to be applied are the same as for Advance Direction Signing (ADS). Such signs will normally replace or complement the existing ADS and be installed on posts in the verge or on portal gantries as appropriate to the scheme design.

3. When siting Enhanced Message Sign (EMS) type signs, it is important that the EMS is positioned so that the motorist can relate any message with the associated ADS downstream of the VMS.

4. The advice given in Chapter B4.2 should be followed to determine appropriate locations for EMS type signs.

B4.2 Siting Criteria for EMS Type Signs

5. The following information should be read in conjunction with the advice given in Chapter B2 of this guide, particularly in relation to the selection of VMS sign and legend types.

6. By definition, EMS for Strategic Traffic Management Systems (STMS) purposes need to be on the approaches to road junctions that can be broadly categorised as either All-Purpose Road/Motorway or Motorway/Motorway. Whereas the standards for these with regard to their type of signing and signalling are quite different, the general arrangement of the ADS is usually at one mile, followed by half mile (or two-thirds mile and one-third mile respectively on dual two lane motorways) with a final confirmation ADS.

7. In deciding locations for EMS it is necessary to consider and balance the following needs:

- all types of information and directional signing and any signals must be in a position where they can be clearly seen and read by drivers
- sign clutter and information overload must be avoided. In this respect, the maximum number of units of information presented to the driver in any message should not exceed eight
- STMS signs should be positioned so the driver can associate the EMS message with the route information on fixed directional signing
- the siting needs of other VMS applications such as for tactical control purposes.

8. The following points should be considered when selecting sign locations:

- the separation between strategic EMS and the one mile or half mile ADS should be 200m minimum, 300m desirable and 400m maximum. However, the downstream EMS should not be closer than 200m to either the upstream or downstream ADS
- a protected uninterrupted sightline to the EMS of 225m minimum and 400m is desirable.

B4.3 Siting Considerations for VMS

9. Factors that need to be taken into consideration when locating the VMS include other structures and environmental considerations. These are discussed below.

Location Relative to Structures

10. VMS should be positioned to ensure that bridges and other structures, including signs and signals, do not mutually obstruct visibility. Equally important is to ensure that VMS do not obstruct the visibility of other signs and signals, the detection field of Fog Detectors, or the view from CCTV surveillance cameras.

11. VMS installed adjacent to existing structures should not be located closer than a distance of at least twice the height of the proposed VMS. Where it is necessary to place a VMS downstream of an overbridge, the resultant sightline should be carefully checked to ensure that the protected sightline requirements are satisfied.

Location Relative to Lighting Columns

12. Where road lighting is in the verge, the VMS should be located at least one column length away from the nearest lighting column. This is to prevent damage being sustained by the sign in the event of the lighting column being knocked down by a vehicle. Where a VMS has to be sited between two lighting columns, it shall be placed immediately upstream of a column wherever possible, but without affecting the sightline requirements.

Environmental Considerations

13. All VMS structures should be assessed for their visual impact at each sign location. Consideration should be given to the design and location of these structures to take account of the local setting in terms of landscape, townscape character and conservation designations such as National Parks and special landscape areas.

14. For new roads and motorways consideration of the type, location and degree of visual intrusion caused by the VMS structures, should be included in the Environmental Assessment under Landscape Effects.

Other siting considerations

15. Other design considerations for siting of VMS include:

- proximity of power supplies
- availability of communication services
- available space for communications and power cabinets including paved areas, access steps and where necessary retaining walls
- access for maintenance including a possible need for an off-road parking site
- on link roads it is essential that VMS are correctly oriented so that they can be clearly distinguished from main carriageway VMS. This may be achieved be means of louvres or narrow angle emitters.

FLOW CHART TO DETERMINE SIGN/SUPPORT ARRANGEMENT AND SITING OF VMS RELATIVE TO ADS

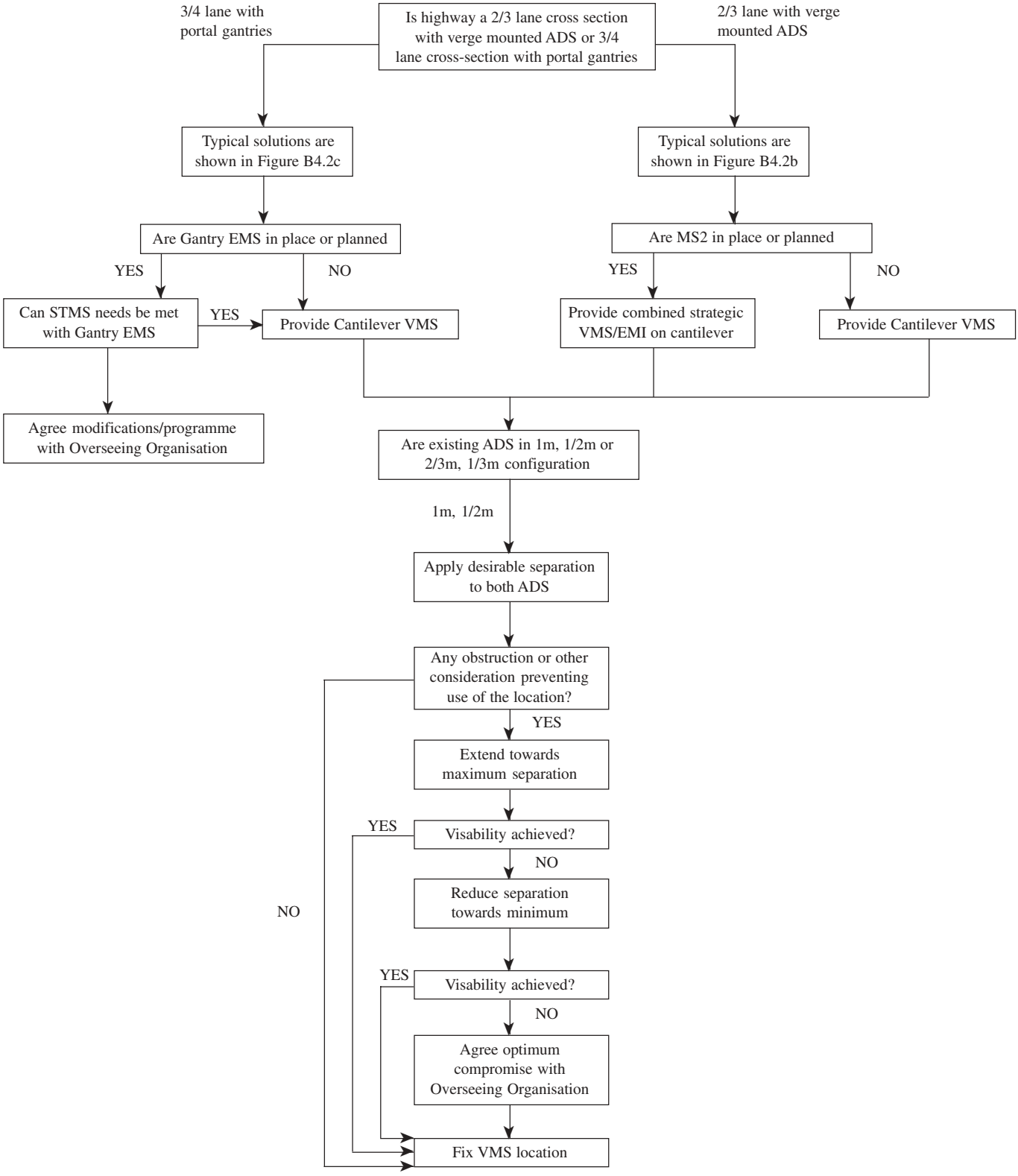


Figure B4.2a

B5. VMS INFRASTRUCTURE

B5.1 Control Systems

1. Most Variable Message Signs (VMS) can be controlled by all current motorway control systems. Designers should assess the suitability of using existing control and communications systems for the Strategic Traffic Management Systems (STMS) scheme in consultation with the National Roads Directorate (NRD) and the National Network Control Centre (NNCC).

2. Reference should be made to the NRD to determine if the existing communications infrastructure can support proposed STMS applications

B5.2 Roadside Infrastructure

General

3. On motorways, the existing communications infrastructure should support the majority of STMS applications. Where new STMS schemes are to be introduced within existing sections of motorway the infrastructure works should therefore be limited to civil engineering works and local modifications to existing cabling and power supplies.

4. In other areas, it will be necessary to develop the solutions identified during the feasibility study, such as cabling to the site and radio paths, private lines, or similar links to remote locations.

Enhanced Message Signs

5. The infrastructure for a typical Enhanced Message Sign (EMS) site comprises:

(i) a foundation and plinth fitted with a standard holding down arrangement to support the cantilever structure and EMS enclosure

or

a Portal Gantry suitably modified to provide support for the EMS and Enclosure

(ii) communications cabinet Type 600 and Power Supply Cabinet with associated cabling and ducts

(iii) safety fencing - double height Open Box Beam

(iv) paving, handrails and retaining walls as required by site conditions.

6. For typical Cantilever and Portal Gantry EMS Outstation Layouts for use in Scotland designers should contact the NRD or the NNCC.

Fixed Text Message Signs

7. The infrastructure for a typical Fixed Text Message Signs (FTMS) site comprises:

(i) a foundation, either a reinforced concrete block with no holding down arrangement where the FTMS post fixings are drilled into this foundation or a similar block with appropriate post holes

(ii) Communication Cabinet Type 600 and a Power Cabinet with associated cabling and ducts

(iii) safety fencing to suit location

(iv) paving, handrails and retaining walls as required by site conditions.

B5.3 Technical Approval

Cantilever Structures

8. Cantilever gantries are designed as two elements:

(i) foundation

(ii) superstructure.

9. The foundation comprises a reinforced concrete plinth incorporating a standard holding down arrangement for the superstructure. Details are given in Drawings MCX 0583.

10. Technical Approval must be sought from the appropriate Technical Approval Authority. If the foundation and superstructure are designed independently, or by different design organisations, a Technical Approval submission must be made for each element.

11. Cantilever foundations and superstructures are classed as Category II structures and, as such will require independent checks of the design.

Existing Gantries

12. Existing gantries should already be certified to BD 2/89. Technical Approval is therefore required for the addition of VMS sign enclosures and mounting equipment and the effect of these additions on the gantry structure.

13. Detailed designs already exists for the additional steelwork to support 320mm EMS to be mounted on certain 'standard' gantries. This design and where it can be applied is shown on Drawing No. MCX 0584.

14. Where VMS signs other than the 320mm are to be installed, a new design must be developed specifically for each situation.

15. The gantry designers should be asked to carry out checks to ensure there is adequate reserve structural capacity to support the VMS, and to establish whether the gantry loading on the foundations is exceeded.

16. The Technical Approval submission must refer to the structure number for the existing gantry. Design and check certificates must be produced for the additions, and a separate check certificate must be produced by the gantry designer for the effect on the gantry.

B5.4 Holding Down Arrangement

17. When foundations are constructed, it is essential the contractor uses a template provided by the supplier of the superstructure.

18. On contracts where different contractors are responsible for the construction of the base and superstructure, steps must be taken to ensure that the interface between the two elements is agreed and the template supplied by the superstructure supplier is used to mark off the gantry's final orientation.

B5.5 Optical Alignment

19. When using VMS based on light emitting technology, it is particularly important to ensure correct optical alignment of the sign with the carriageway. Design requirements, and the method to be applied on site are given in Drawing MCX 0069.

B6. GLOSSARY OF TERMS

1. A glossary of general terms applying to Motorway Communications is given in TA 70/97.

2. Definitions for additional terms used in the context of this Advice Note are as follows:

Cantilever

An overhead structure which extends from the verge. It comprises a single column and an arm supporting an Enhanced Message Sign (EMS) or Motorway Signal Mark 2.

Continuous Sign

A VMS that appears to be made up of solid characters or symbols. The sign face is changed by removing one set of symbols/characters and replacing them with another, or by having a multiple face that can rotate.

Discontinuous Sign

A Variable Message Signs (VMS) in which the sign face is made up of individual elements having at least two states. By changing the state of the individual elements, different characters and symbols can be created within the same sign area.

Driver Information Systems

Gives the motorist information of a tactical and strategic nature, but also displays messages relating to conditions on the network that may affect expected journey times.

Enhanced Message Sign

A type of VMS based on light emitting technology. The EMS can display a variety of legends that may be configured and controlled remotely from an instation.

Fixed Text Message Sign

A type of VMS able to display a limited number of fixed messages. VMS for strategic applications use a mechanical rotating prism as the mechanism for changing the sign legend.

Intervention Node

A road junction that offers alternative routes, where VMS legends can be used to intervene and modify or block the normal journey route as shown on fixed directional signing.

Portal Gantry

An overhead structure that spans the carriageway and is used to support combinations of signals, variable message signs and conventional fixed signs.

Sign

A device carrying directional or other informational message, eg route information at the approach to a junction.

Signal

A device used to give advisory or mandatory instructions, eg stop or 30 mph speed restriction.

Strategic Traffic Management Systems

Give the motorist information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

Tactical Control Systems

Provide supplementary information to complement matrix signals and other traffic control signs for local management of incidents or occurrences.

Variable Message Sign

A generic term for a sign that can display multiple legends or messages.

Both EMS and FTMS are different types of VMS.

VMS can display text messages and/or symbols using any of the following technologies:

(a) Rotating Prism

(b) Reflecting Cells

(c) Light Emitting Cells.

NMCS

The Highways Agency's National Motorway Communications System (NMCS) which in Scotland has been adopted in a slightly modified form for use in the National Driver Information and Control System (NADICS) system.

NADICS

The National Driver Information and Control System.

NNCC

The National Network Control Centre (NNCC) in Glasgow which operates the NADICS system on behalf of the NRD.

B7. REFERENCES

Design Manual for Roads and Bridges

BD 2/89: Technical Approval of Highway Structures on Motorways and Other Trunk Roads. Part 1: General Procedures – DMRB, Volume 1, Section 2, Part 2.

HD 19/94: Road Safety Audits – DMRB, Volume 5, Section 2, Part 2.

TA 60/90: The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads – DMRB, Volume 8, Section 2, Part 1.

TA 70/97: Introduction - Motorways – DMRB, Volume 9, Section 2, Part 1.

TA 71/97: Design and Implementation (Overview) – DMRB, Volume 9, Section 3, Part 1.

TA 72/97: National Motorway Communications Systems – DMRB, Volume 9, Section 4, Part 1.

TA 74/97: Motorway Signalling – DMRB, Volume 9, Section 4, Part 3.

TA 75/97: Motorway Transmission Design – DMRB, Volume 9, Section 4, Part 4.

TA 76/97: Motorway Control Offices – DMRB, Volume 9, Section 4, Part 5.

TA 77/97: Motorways: Infrastructure Design – DMRB, Volume 9, Section 5, Part 1.

TD 33/90: The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads – DMRB, Volume 8, Section 2, Part 1.

Department of Transport/Scottish Office

Traffic Signs Regulations and General Directions (TSRGD).

Traffic Signs Manual.

Highways Agency Specifications

TR 0154: Electromechanical Variable Message Signs - Functional Specification

TR 2136: Functional Specification for Continuous or Discontinuous Variable Message Signs

Highways Agency NMCS Installation Drawings (TRH 1239)

MCX 0069: Cantilever and Gantry Sign Setting Out and Optical Alignment.

MCX 0583: Cantilever Structures and Holding Down Arrangements.

MCX 0584: EMS on Portal Gantry - Additional Steelwork.

Other Publications

Department of Environment Circular 18/84 - Crown Land and Crown Development.

European Drive Project VAMOS (VAriable Message Optimised Systems) - VAMOS White Book.

VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX C (WALES ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

SUMMARY

This new Advice Note TA 83/05 provides guidance for the feasibility study, design, implementation and evaluation of Strategic Traffic Management Systems (STMS) using Variable Message Signs (VMS).

INSTRUCTIONS FOR USE

This is a new document to be incorporated into the Manual.

1. Insert TA 83/05 Annex C as Part 6 of Volume 9, Section 4.

2. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX C (WALES ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

Contents

Chapter

C1. INTRODUCTION

C1.1 General

1. This Annex is for the specific requirements of motorway communications in Wales.

DMRB Structure

2. Section 1 of Volume 9 the Design Manual for Roads and Bridges (DMRB) contains Technical Directives (TD) which detail the Standards of Provision.

3. Section 2 onwards contains Technical Advice (TA) Notes which reflect current practice in the field of motorway communications and control.

Design Loop

4. Figure C1.1 shows the 'Design Loop' illustrating the general sequence in the iterative process which starts with the design for emergency telephones and signals followed by transmission and control office designs. Last in the cycle is the design of the infrastructure that will be required to support all communications equipment and systems.

Glossary

5. A Glossary of Terms is given in Chapter C6.

Standard Drawings and Specifications

6. Standard drawings and specifications referred to in this guide are issued by the Welsh Office and/or the Traffic Systems and Signing (TSS) Division of the Highways Agency.

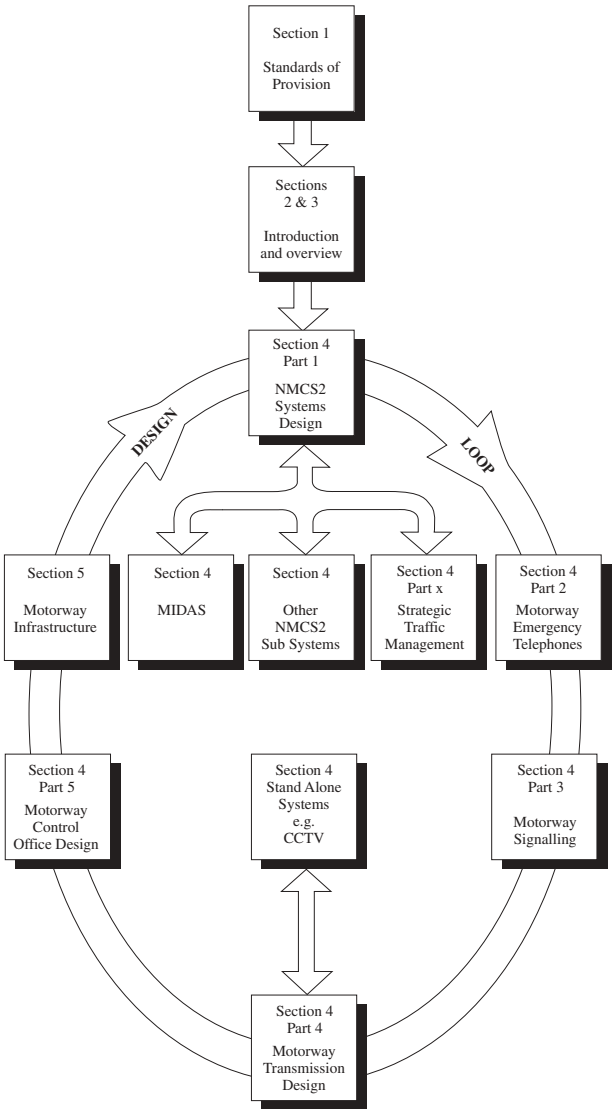


Figure C1.1 Structure of Volume 9 of the Design Manual for Roads and Bridges

C1.2 Related Standards and Advice Notes

7. TD 33/90, 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads', provides criteria affecting the selection, siting and use of all types of Variable Message Signs (VMS) on all purpose and motorway trunk roads. This Advice Note relates purely to light emitting VMS and TD 33/90 is due to be updated to concord with the advice given in this document. Most VMS currently used for Strategic Traffic Management are based on light emitting technology.

8. For VMS based on light emitting technologies, the design criteria and performance standards for road applications are given in Highways Agency Specification TR 2136, 'Functional Specification for Continuous or Discontinuous Variable Message Signs'.

9. Highways Agency Specification TR 0154, 'Electromechanical Variable Message Signs - Functional Specification', covers performance requirements for that category of sign. The performance requirements of sign face materials, where appropriate, is found in BS 873.

10. Enhanced Message Signs (EMS) and Motorway Signals Mark 2 are defined in Highways Agency Specification TR 2141 'Motorway Signals Mark 2, Requirements for Signal Equipment'.

11. The following current versions of Advice notes are of relevance to motorways:

TA 70/97: Introduction - Motorways - DMRB, Volume 9 Section 2, Part 1.

TA 71/97: Design and Implementation (Overview) - DMRB, Volume 9, Section 3, Part 1.

TA 72/97: National Motorway Communications Systems - DMRB, Volume 9, Section 4, Part 1.

TA 74/97: Motorway Signalling - DMRB, Volume 9, Section 4, Part 3.

TA 75/97: Motorway Transmission Design - DMRB, Volume 9, Section 4, Part 4.

TA 76/97: Motorway Control Offices - DMRB, Volume 9, Section 4, Part 5.

TA 77/97: Motorways: Infrastructure Design - DMRB, Volume 9, Section 5, Part 1.

C1.3 Scope

12. The practices and requirements detailed in DMRB, Volume 9, Network - Traffic Control and Communications relate to the policies implemented by Overseeing Organisations in the UK.

13. The principles in this Advice Note may not be entirely applicable to Strategic Traffic Management Schemes of other Overseeing Organisations.

14. This Advice Note takes precedence in the case of any conflicting advice given in Advice Note TA 60/90, or other existing Advice Notes in as far as they relate to Strategic Traffic Management Systems (STMS).

VMS Applications

15. VMS are provided for Driver Information, Tactical Control and Strategic Traffic Management. The scope of these applications are:

- **Driver Information Systems** - provide the motorist with information of a tactical and strategic nature, but also with messages relating to conditions on the network which may affect expected journey times. This may include information on major events, eg shows, sports events, etc and inter network connections such as ferries, tolled roads and crossings.

- **Tactical Control** - provides supplementary information to complement matrix signals and other traffic control signs for management of incidents or occurrences on local roads in the area. Signs set in support of tactical objectives display messages specifically related to achieving improvements on the localised sections of the network eg 'ACCIDENT/LONG DELAYS'.

- **Strategic Traffic Management** - provide the motorist with information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

16. This Advice Note covers the application of VMS to STMS only.

17. Strategic Traffic Management seeks to ensure that a strategic view of network status and conditions is available, and that strategies and decisions which have

more than a local impact can be identified correctly and implemented effectively. Signs set in support of these objectives offer alternative or diversionary route choices.

18. This Advice Note also describes the different types of VMS currently available for STMS schemes, and outlines the approach to the feasibility study, scheme design, implementation and evaluation.

C2. SCHEME PROCESS

C2.1 General

1. There are no standard provision criteria for Strategic Traffic Management Systems (STMS) schemes and each must therefore be individually justified by means of a feasibility study incorporating an economic analysis.

2. The Scheme Process is illustrated in Figure C2.1. The implementation of Strategic Traffic Management schemes will generally comprise the following elements:

- Feasibility Study (Chapter C2.2)
- Design and Implementation (Chapter C2.3)
- Scheme Evaluation (Chapter C2.4).

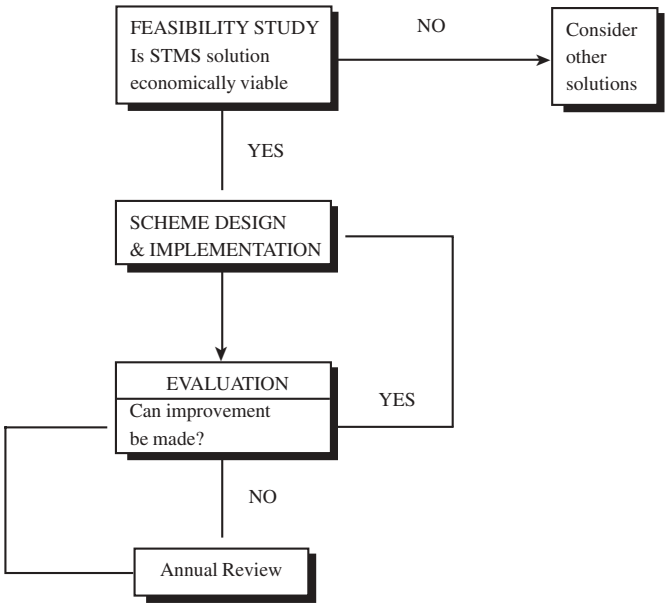


Figure C2.1 Scheme Process

C2.2 Feasibility Study

3. A feasibility study is needed to determine the practicality and value for money of STMS schemes. A Feasibility Study Report should be produced at the end of the study period and consider the following:

- review of existing systems and traffic management practice
- operational objectives
- network and traffic analyses
- diversion routes, junctions and nodes
- scheme operation and management
- Variable Message Signs (VMS) legends and sign type selection
- sign types
- engineering
- future maintenance
- economic evaluation
- environmental assessment
- scheme evaluation requirements
- implementation programme
- legislation
- risk assessment/hazard identification.

Review of Existing Systems and Traffic Management Practice

4. The feasibility study should consider the extent of the existing and planned facilities within the area of the proposed scheme. These include:

- Control Office operational boundaries and their interaction with respect to the control of incidents and traffic management

- institutional issues, policy and codes of practice with respect to the control of incidents and traffic management
- the location, type and objectives of existing and planned VMS schemes including, where appropriate, local authority initiatives
- the location and form of existing Fixed Signs, Signals and Gantries
- the NMCS Infrastructure and its capability to support new systems
- extent of CCTV coverage at the relevant point of the network
- extent of existing Traffic Data Collection Systems.

Operational Objectives

5. STMS schemes are likely to deal with the management of unusual or unexpected events affecting road traffic rather than with day to day congestion. Designers should identify the main objectives of the scheme. These might include:

- provision of information in a timely manner
- achievement of reduction in delay
- achievement of local incident management
- supporting diversion routes and controlling traffic on these routes
- satisfying drivers' needs for reliability and consistency in information and legends
- avoiding an adverse impact on safety and the environment
- consistency with existing and planned VMS schemes on a national basis
- long term viability in terms of meeting other objectives throughout the design life of the system.

Network and Traffic Analysis

6. Designers should classify the road network applying to the STMS scheme into strategic and non-strategic routes. Aspects to be considered at this stage include:

- the disruptive impact of unusual incidents and planned roadworks on network operation
- the frequency of route diversions by studying historic records of motorway and trunk road closures
- traffic characteristics as for network congestion and the capacity of alternative routes to accept diverted traffic
- the impact of potential diversions on alternative Routes, especially through towns and villages.

7. A traffic assignment programme should be used to assess and develop strategic control plans that may be used for the STMS. This programme should have the facility to represent traffic diversions that may be applied to the road network and to evaluate the economic and operational performance of the proposed diversion strategies.

8. The depth and level of the network and traffic analysis should be appropriate to the needs and objectives of the STMS scheme. The output from this analysis should form the basis for the Economic Evaluation.

Diversion Routes, junctions and nodes

9. Based on the Network and Traffic Analysis, the report should identify the diversion routes, strategic and non-strategic intervention nodes and the recommended locations for the provision of VMS.

10. The current view is that designers should preferably restrict diversion strategies to the Trunk and Motorway Network. Where this is not possible, the views of Police and Highway Authorities likely to be affected must be sought before the strategy is drawn up.

11. Any existing diversion route agreements developed by the Police and Highway Authorities within the scheme area should be considered and reviewed for inclusion in the STMS scheme as local diversion strategies.

Scheme Operation and Management

12. Options for the operation and management of the scheme should be considered. The points to be addressed include:

- integration with existing and planned control and communications systems and any necessary extension in capability of those systems
- integration with the existing management of the strategic network
- implementation of a management structure taking into account longer term proposals for Regional Traffic Control Centres
- the need to publish traffic data to third party organisations and the potential for generating revenue
- the need for consultation to develop effective Codes of Practice.

13. Designers should assess the suitability of using existing control and communications systems for the STMS scheme in consultation with the Overseeing Organisation. Existing or planned systems used for VMS control include:

- NMCS2 - Message Sign subsystem
- NMCS2 - Traffic Management subsystem
- Stand Alone Control Systems.

14. Considering the effect of the scheme design on STMS and other traffic management schemes elsewhere on the road network is important. It is essential that different systems provide motorists with accurate and consistent information when moving from one area to another.

15. The feasibility study should address the interests of all organisations who may be involved in the operation and management of the proposed STMS and where relevant, other existing or planned traffic management and control facilities. These organisations will include:

- divisions of the Overseeing Organisation
- the Police
- Highway Authorities
- DBFO Concessionaires
- members of the M4NTAIS CYMRU Traffic Control Centre Consortium.

VMS Legend and Sign Type selection

16. The feasibility study should identify the type and size of VMS needed for each location and appropriate costings should be used in the Economic Evaluation.

17. The type and range of information to be displayed will generally limit the choice of sign technologies, whereas the sign location, road classification and vehicle speeds will all affect character heights and therefore the size of the VMS.

18. Deriving a common strategy for VMS signing is important, whatever the technology and application. Chapter C1 describes the scope of VMS applications covering Driver Information, Tactical Control and Strategic Traffic Management. The type of VMS and the range of messages used for STMS applications will therefore be influenced by the type and extent of any other VMS signing at a given location.

19. The Feasibility Study must therefore consider in sequence:

(i) the information needed in the VMS legend to meet the scheme objectives

(ii) the content and number of VMS legends for each location

(iii) the VMS technology needed to display the required legends

(iv) the technology used by other VMS on the same section of road

(v) the VMS size and performance level needed for the application or applications.

20. VMS legends should normally be selected from those given in the Traffic Signs Regulations and General Directions (TSRGD). Any other legends needed for a specific scheme must be authorised by the Overseeing Organisation.

21. The practice for STMS messages is to state the location and cause of the diversion, followed by the suggested alternative route. Research suggests that messages should be restricted to a maximum of seven words, or four units of information. The aim should be to use the shortest message possible. Examples currently used for STMS applications are:

M4 CLOSED
USE A48

M4 CLOSED
LEAVE AT J41

22. Further reading on VMS legends is given in the VAMOS WHITE BOOK, produced under the European Drive Project VAMOS (VAriable Message Optimised Systems).

23. Where the system will include VMS legends relating to more than one application, ie Tactical and STMS, the hierarchy must be explicit and designers must develop setting resolution rules to decide which legend to use for each specific set of circumstances. The Highways Agency document 'Code of Practice for Operation of Motorway and Trunk Road Signals and Variable Message Signs', prepared with consultation with the Association of Chief Police Officers (ACPO) gives further guidance on this subject.

Sign Types

24. If the only information to be provided is a route change, ie alternative direction signing, Fixed Text Message Signs (FTMS) may be adequate. Where the designer requires a wider range of options, discontinuous light emitting variable message signs should be used.

25. For STMS applications in Wales, the usual type of VMS is the Enhanced Message Sign (EMS), based on light-emitting technology and comprising 2 lines of 12 characters. However, EMS of other sizes such as 3x18, 2x16, 3x16, etc may also be used.

26. If Motorway Signals Mark 2, or Tactical EMS type signs are already provided on the approach to a given location, designers must consider meeting the STMS requirements using these signs. If they are shown to be unsuitable, the study should examine alternatives, and identify a solution that meets the needs of all applications.

27. VMS will normally be provided in pairs on the approach to a junction or node and it is preferable that both these signs show the same legend. This is to reinforce the legend and to reduce the chance of drivers missing the information presented due to obscuration of a sign by high-sided vehicles. To allow identical legends to be displayed, both signs must use the same technology and design and this must be borne in mind when selecting the sign type.

Engineering

28. The feasibility study should consider the engineering design needed to support the STMS. A variety of engineering solutions should be considered and prioritised to decide the most cost effective approach to each particular scheme. Designers should address the following aspects of engineering design:

(i) Traffic Data Collection

(ii) control system

(iii) signs

(iv) infrastructure and transmission.

29. A key factor for STMS is the collection of accurate real-time traffic information. The study should consider the means by which this is to be achieved cost effectively, including on non-motorway roads.

30. The STMS control system as a whole must support the operational and management strategy and any development of that strategy over time. The need for any interlocking reaction to, and interaction with, other existing or planned traffic management and control facilities must be identified and the implications assessed. This will include elements such as the number and type of STMS legends, setting strategies, setting resolution rules between different applications, and the operational Code of Practice.

31. The type(s) of sign should be identified from the guidance in Chapter C3, 'Strategic VMS Types'. However the study should also consider the engineering aspects related to possible sign locations and the means of installation, ie verge mounted posts/cantilevers or portal gantries.

32. The requirements for the STMS infrastructure and transmission should be considered and assessed. It is important to identify how the existing infrastructure can be used to reduce the scheme cost, and maximise the return on previous investments. The standard NMCS motorway infrastructure should support the needs for most STMS applications. Elsewhere, a variety of solutions should be considered and prioritised. These will include cabling, followed by radio and the use of private lines, ISDN or similar links to more remote or difficult locations.

Economic Evaluation

33. For conventional means of procurement the study must include an evaluation to decide the economic viability of the scheme. The level of detail and the evaluation methodology will be scheme-dependent and should be agreed with the Overseeing Organisation beforehand.

34. Whole life costs to be considered should include system development, implementation, staffing, service and maintenance. The study should seek to prove that the provision of a STMS scheme is preferable to an alternative traffic solution.

Environmental Assessment

35. The feasibility study must consider the impact of the STMS on the environment. This should include:

- consideration of the visual impact of signs/ support and ancillary equipment such as cabinets, duct runs and steps, etc viewed from the road itself and from nearby developments and open space
- residential properties and consideration of the land classification of adjacent areas
- consideration of the need to fell or reduce the size of trees on the approach to VMS
- light pollution caused by VMS
- an appreciation of the environmental effects on the roads receiving diverted traffic with regard to increased congestion, noise and air quality.

36. Designers should agree the scope of the environmental assessment with the Overseeing Organisation beforehand.

Scheme Evaluation Requirements

37. The study should identify the objectives that need to be evaluated when the scheme is in operation to assess its effectiveness, optimise performance and confirm that the economic benefits are being attained. The evaluation should generally include considerations of accident reduction, speed changes and traffic volumes leaving the road in response to given messages. The reduction in delay costs and driver frustration leading to risk of accidents should also be considered. Quantifiable performance indicators that may be used to demonstrate the effectiveness of the STMS might include:

- reduced number of incidents
- reduced number of congestion events notified
- regular/reduced average journey time
- increased traffic throughput
- increased number of visits to M4NTAIS CYMRU website (could be deemed to indicate increase in public's faith in the system).

Implementation Programme

38. The above study should identify an implementation programme for the preferred scheme option. The programme should outline the logical steps of implementation, indicate the likely spend profile and present (where appropriate) the incremental economic benefit for each stage of the programme.

39. The programme should also identify appropriate stages for consulting and agreeing design proposals, operational and maintenance boundaries and system engineering interfaces.

Legislation

40. Many areas of legislation exist which will apply to the various elements of an STMS scheme. Most are common to all design, procurement and construction projects and guidance is beyond the scope of this Advice Note. However two specific areas of legislation will apply to STMS schemes and these are outlined below.

41. To be legally placed on the highway in Wales all signs, including all VMS legends must be either prescribed or authorised. Prescribed signs and VMS legends are defined in the TSRGD. Any sign not so prescribed must be authorised by the Overseeing Organisation.

42. VMS which are other than manually operated will also need statutory Type Approval. Designers should consult the Overseeing Organisation on this issue.

Risk Assessment/Hazard Identification

43. A Risk/Hazard Assessment should be considered as it relates to the role of the Highway Authority. This makes it necessary to maintain the highway in a safe condition and to secure the safe movement of traffic including pedestrians. The matters to be considered therefore include:

- signs not operating correctly
- reliability
- failure of a legend to appear or the appearance of an incorrect legend
- maintenance.

44. Depending on the outcome of the assessment process, requirements such as message monitoring, interlocking and/or message sequencing rules may need to be developed during the design stage to ensure that safety integrity levels are achieved.

C2.3 Scheme Design and Implementation

45. Outline proposals developed during the Feasibility Study should be reviewed, refined and developed into the scheme design. This should take into account the requirements not only for implementation but for effective maintenance and operational support throughout the operational life cycle.

46. The scheme design should normally commence with a consultation, survey and information collection phase, followed by preparation of preliminary design to be agreed with the Overseeing Organisation. The preliminary design should detail proposals for:

- traffic data and information collection systems
- VMS types
- VMS site locations
- control system
- communications infrastructure and transmission
- structures, geotechnical and civil engineering
- traffic management.

47. Designers should examine existing site records, transmission arrangements and control facilities to establish the impact of the scheme on existing systems and the scheme design requirements. This stage will involve consultation with relevant divisions of the Overseeing Organisation, the Police and other organisations having an interest in the STMS scheme.

General Design of the Works

48. The detailed design and preparation of working drawings should not commence until the design proposals have been presented to and agreed with the Overseeing Organisation.

49. The options for collecting accurate real-time traffic data and information identified during the feasibility stage may be developed into the overall scheme. On motorways the provision of MIDAS and CCTV will normally deliver this data. On other roads and motorways where MIDAS and CCTV are not being provided, the standard designs may need to be developed and modified to provide additional data and information collection sites at key locations to suit the needs of the scheme.

50. VMS must conform to the Overseeing Organisation's standards and will normally be based on the Highways Agency 'TR' series of specifications. These detail the sign design and performance requirements to be achieved and standard interfaces to the NMCS infrastructure. The designer should consult the Overseeing Organisation before placing new contracts for VMS procurement as existing contracts may offer benefits in terms of cost savings and approved designs.

51. The definition of the control system requirements must be based on the operational and management objectives, taking into account the need for integration with existing and planned systems and any extension to the functionality or capacity of these systems. The Overseeing Organisation and the Police should be consulted at an early stage and proposals agreed before finalising the design and scope of the STMS contract.

52. Control room and equipment room layouts must be examined to ensure the proposed system can be accommodated in terms of space for equipment and power supplies etc.

53. Design of the communications infrastructure should conform to the Welsh Office standards and drawings available, as supplemented by the Highways Agency standards defined in the 'MCX' installation drawings series.

54. The transmission network should take account of the capacity of existing systems. For motorways, the cable pairs and channel allocations on the PCM network (where applicable) will need to be agreed with the Overseeing Organisation beforehand and works should be arranged to re-configure and provide additional communications circuits as required. For other locations, the provision of circuits by Private Telecommunications Operators (PTOs) must be planned at an early stage in the design process.

55. The provision and upgrading of power supplies for VMS can be a lengthy process, particularly for remote sites where the Electricity Supply Company (ESC) may need to negotiate wayleave. Power supply locations should therefore be identified early in the design process and works orders placed accordingly.

56. VMS will normally be installed on posts or cantilever gantries in the roadside verge or on new or existing portal gantries. Standard arrangements exist for sign cantilevers and for modifications to some types of portal gantry. Designs, technical assessments and design checks should be carried out incorporating the requirements as applicable for:

- Post, Cantilever or Portal Gantry sign and superstructure
- foundations and holding down arrangements
- technical assessment/design modifications to existing gantries
- retaining walls.

57. The design process should include an early desk study of available soils data, to establish whether a contract for an additional geotechnical investigation is needed to complete the scheme design. Designers should identify any such work early in the programme as it may have major impact on the implementation timescale.

58. Safety barrier must be provided at all locations according to the Overseeing Organisation's standards. Any existing barrier at or near to the sign location should be upgraded and extended as necessary.

59. Traffic management systems for STMS schemes must conform to Chapter 8 of the Traffic Signs Manual. The Overseeing Organisation, Maintaining Agent and the Police must be consulted to agree local arrangements, lane closure timings and road space bookings, etc taking into account other programmed works.

Siting of VMS

60. The locations for VMS should be identified by site survey according to the criteria given in Chapter C4, 'VMS Siting Criteria'. A detailed site survey is required for each of the VMS locations identified during the feasibility study.

61. When locations have been defined, consideration must be given to carrying out an Environmental Impact Assessment study of the STMS scheme.

Notifications

62. If considered necessary by the Overseeing Organisation, notification of the STMS scheme should be sent to the Planning Authority for information and comment. This notification should comprise a package of information, describing the scheme and its objectives and showing the locations of the signs on a 1:25000 scale map of the area.

Legend Authorisation

63. The recommendations for VMS types and legends identified during the feasibility stage should be reviewed and if necessary further developed.

64. Again any messages not included in the TSRGD must be authorised by the Overseeing Organisation as described in Chapter C2.2.

Traffic Modelling and Diversion Strategies

65. The diversion routes, junctions and nodes identified during the feasibility stage should be reviewed and developed in consultation with the Police and Highway Authority.

Operational Procedures

66. Procedures should be developed and worked into a Code of Practice for operation of the STMS. Depending on the scope of the scheme, this may involve consultation with the Overseeing Organisation and the Police including representatives of the relevant ACPO committee.

Safety Audits

67. Safety Audits should be carried out in accordance with the Highways Agency's specific requirements stated in HD 19/94.

As-Built Drawings and Records

68. The designer should provide as-built drawings and records of the completed works for all contracts. All electrical inspection documentation should be provided at completion of the works. Where required, 'As-Built' information must be incorporated into the existing NMCS record drawings. All structural information, both for the signs themselves and the supports, should be provided on completion of the works.

Detailed Risk Assessment

69. The safety issues considered during the feasibility stage should be reviewed and amended as necessary.

70. The assessment should take into account best practice achieved elsewhere on the road network and the driver's consequential expectation and reliance on STMS information.

71. Requirements such as message monitoring, interlocking and/or message sequencing rules must be developed at this stage to ensure safety integrity levels are achieved.

80. The hazard identification and risk assessment process should consider among other matters the following:

- the signs not operating or operating incorrectly
- possible conflict with other signing/signalling and/or other driver information systems
- legend priority
- failure of a legend to appear or the appearance of an incorrect legend (this must be done with regard to an individual sign, the message plan affected and the system as a whole)
- the legends to be displayed and how easily they can be read and understood
- failure of real time traffic data sources
- maintenance.

C2.4 Scheme Evaluation

81. When the scheme is in operation, the STMS should be continuously evaluated to assess its effectiveness, optimise performance, and confirm that the economic, operational and other benefits of the scheme are being attained. The evaluation should be presented in the form of a Scheme Evaluation Report, including the performance indicators detailed above wherever possible.

82. The evaluation requirements, initially identified as part of the feasibility study, should be reviewed and if necessary adjusted when the scheme is in operation. If required, elements of the STMS should be modified to ensure maximum benefits are realised.

83. Data from the detection and VMS systems should be collected and analysed to check whether the algorithm or operational rules select the appropriate strategy and to assess the actual diversion achieved. Where appropriate, rules or algorithms should be refined.

84. Monitoring should continue whether the initial results show that refinements are needed or not, so that changes in conditions and driver responses over time can be met with appropriate system responses.

C2.5 System Certification

85. The system certification procedures specified in MCH 1813 : System Certification Specification, should be followed.

C3. STRATEGIC VMS TYPES

C3.1 Introduction

1. Variable Message Signs (VMS) for Strategic Traffic Management Systems (STMS) applications may be of the Enhanced Message Sign (EMS) or the Fixed Text Message Sign (FTMS) types.

2. All Strategic VMS should be fitted with flashing amber lanterns. The lanterns should flash in synchronous horizontal pairs alternating top and bottom to draw the attention of drivers to the message displayed on the VMS. Lantern design requirements must comply with the Traffic Signs Regulations and General Directions (TSRGD).

C3.2 VMS Technologies and Types

Enhanced Message Signs

3. EMS are active light emitting signs. Two main technologies are used in such signs: these are Light Emitting Diode (LED) and Optical Fibre (OF). A third variety uses the combination of a reflective disc with light emitting technology.

4. The arrangements of text most frequently used for display purposes are:

- two lines of twelve characters (2x12)
- two lines of sixteen characters (2x16)
- three lines of sixteen characters (3x16)
- three lines of 18 characters (3x18).

5. Each character is formed from a matrix of display cells 5 wide and 7 deep and has a nominal character height of either 320mm or 420mm, depending on the application. EMS installed on all purpose roads may have characters of smaller dimensions, in accordance with TD 33/90.

6. EMS are usually installed on Cantilever or Portal Gantries.

Fixed Text Message Signs

7. FTMS are any type of VMS that display two or more fixed legends (or a blank display and one or more legends). There are currently a number of technologies used in such signs, the more common being active light emitting (as above), flexible roller blind and rotating plank or prism, the latter two normally being electro-mechanically operated. Of these type the rotating plank or prism is most suitable for strategic use.

8. The rotating plank or prism sign normally consists of a series of planks or prisms that align to form a flat sign face. When required to show a different aspect, the planks or prisms rotate and realign to present a different sign face. Either the whole sign face can be changed in this way, or only those parts of the sign face that need to be changed. In this way the number of legend options available can be increased.

9. The arrangement of text used for display purposes on rotating plank or prism signs must be as prescribed in the TSRGD.

10. FTMS are normally mounted on posts installed in the motorway verge, or on Portal Gantries.

C3.3 Applications of Strategic VMS

Enhanced Message Signs

11. It is accepted that under conditions of normal visibility, EMS type signs are less easily legible than conventional fixed traffic signs. This is a factor that must be balanced against their ability to display many different legends. However, if they comply with character height and optical performance requirements, they may actually be more easily legible than conventional fixed text signs under poor visibility conditions. This performance under poor conditions may influence the choice of technology for a given application.

12. Experience suggests that strategic EMS on motorways should be provided at the approach to key junctions on the network, upstream of associated one mile and half mile Advance Direction Signs (ADS). (_ mile and _ mile respectively on dual two lane motorways).

13. EMS with two lines of twelve characters (2x12) are preferred for most motorway applications. However EMS with 2x16, 3x16 or 3x18 characters can also be used, provided that the feasibility study identifies that such signs are necessary for the legends required at a particular location. EMS with smaller characters may also be used, depending on the type of road and the particular application. In such cases, the character eight should be determined from the guidelines given in TD 33/90.

Fixed Text Message Signs

14. FTMS are more commonly used for diversion routeing and local traffic management where there are a low number of route options. They may most effectively be used to display messages linking to a predetermined diversionary route marked by symbols, eg 'Follow _ for London'.

15. Other FTMS applications include tunnel/bridge maintenance requiring lane or road closures, weighbridges, tidal flow operations, level crossings and bus lane management.

16. The use of FTMS for Strategic Traffic Management is more likely to be on roads approaching intersections with motorways, rather than on motorways themselves. However, around major urban areas it may be necessary to use FTMS instead of EMS along certain sections of motorway to achieve a satisfactory level of signing.

17. Unlike EMS, FTMS normally replace existing ADS as the normal sign face contained on the ADS will be incorporated as one of the faces of the FTMS. Diversion destinations, when shown, shall appear in black legends on yellow background, designed to the same rules as set out in Chapter 7 of the Traffic Signs Manual. When the diversionary route is displayed, flashing amber lanterns, as referred to in C3.1.2 shall be used.

C4. VMS SITING CRITERIA

C4.1 General

1. The siting criteria to be used when identifying Variable Message Sign (VMS) locations depends on the sign type selected during the feasibility and design stages.

2. For Fixed Text Message Sign (FTMS) type signs the criteria to be applied are the same as for Advance Direction Signing (ADS) on motorway and trunk roads. Such signs will normally replace the existing ADS and be installed on posts in the verge or on portal gantries as appropriate to the scheme design.

3. When siting Enhanced Message Sign (EMS) type signs, it is important that the EMS is positioned so that the motorist can correlate the legend displayed with the associated ADS downstream of the EMS.

4. The advice given in Chapter C4.2 should be followed to determine appropriate locations for EMS type signs.

C4.2 Siting Criteria for EMS Type Signs

5. Figures C4.2 a, b and c cover the general decision process and siting arrangements for EMS on motorway. The use of cantilevers indicated in Figure C4.2b assumes signs of 3 lines of 18 characters as standard, which are too large to accommodate on portal gantries. However, where signs of 2 lines of 12 characters are to be used, portal gantries should be used in preference to cantilevers, as described in TD 33/90 and MCH 1643. The information should be read in conjunction with the advice given in Chapter C2 of this guide, particularly in relation to the selection of VMS sign and legend types.

6. By definition, EMS for Strategic Traffic Management Systems (STMS) purposes need to be on the approaches to road junctions that can be broadly categorised as either All-Purpose Road/Motorway or Motorway/Motorway. Whereas the standards for these with regard to the type of signing and signalling are quite different, the general arrangement of the direction signs is usually one mile, followed by half mile (_ mile and _ mile respectively on dual two lane motorways) and a final ADS.

7. In deciding locations for EMS it is necessary to consider and balance the following needs.

- all types of information and directional signing and any signals must be in a position where they can be seen and read by drivers
- sign clutter and information overload must be avoided. In this respect, the maximum number of units of information presented to the driver should not exceed seven
- STMS signs should be positioned so the driver can associate the EMS message with the route information on directional signing
- the siting needs of other VMS applications such as for tactical control purposes.

8. Figures C4.2 a, b and c set out in general terms how this balance might best be achieved in a given location. If however a particular situation is not defined, reference should be made to the Overseeing Organisation.

9. Sign legends should be duplicated to reinforce the information or instructions given. Therefore, two EMS should generally be provided on the approach to the key junctions within any Strategic Traffic Management Scheme.

10. It is recommended that the following parameters be used in conjunction with Figures C4.2 a, b and c:

- EMS with 420mm (nominal) character height on cantilevers or 320mm (nominal) character height on gantries
- separation distances as described in MCH 1643
- a protected sightline to the EMS of 225m minimum and 400m desirable.

C4.3 Siting Considerations for VMS

11. Factors that need to be taken into consideration when locating the VMS include other structures, environmental and other considerations. These are discussed below.

Location Relative to Structures

12. VMS should be positioned to ensure that bridges and other structures do not obstruct visibility. Equally important is to ensure that VMS do not obstruct the visibility of other signs and signals, the detection field of Fog Detectors, or the view from CCTV surveillance cameras.

13. VMS installed adjacent to existing structures should not be located closer than a distance of at least twice the height of the proposed VMS. Where it is necessary to place a VMS downstream of an overbridge, the resultant sightline should be carefully checked to ensure that the protected sightline requirements are satisfied.

Location Relative to Lighting Columns

14. Where road lighting is in the verge, VMS should be located at least one column length away from the nearest lighting column. This is to prevent damage being sustained by the sign in the event of the lighting column being knocked down by a vehicle. Where a VMS has to be sited between two lighting columns, it shall be placed immediately upstream of a column wherever possible.

Environmental Considerations

15. All VMS structures should be assessed for their visual impact at each sign location. Consideration should be given to the design and location of these structures to take account of the local setting in terms of landscape, townscape character and conservation designations such as National Parks and special landscape areas.

16. For new roads and motorways, consideration of the type, location and degree of visual intrusion caused by the strategic VMS structures, should be included in the Environmental Assessment under Landscape Effects.

17. The procedures set out in Department of the Environment Circular 18/84 - Crown Land and Crown Development do not apply to the provision of VMS within the existing highway boundary. However when siting signs, due consideration should be given to assessing and reducing their visual impact.

Other siting considerations

18. Other design considerations for siting of VMS include:

- proximity of power supplies
- available space for communications and power cabinets including paved areas, access steps and where necessary retaining walls
- access for maintenance including a possible need for an off-road parking site
- on link roads it is essential that VMS are correctly oriented so that they can be clearly distinguished from main carriageway VMS: this may be achieved be means of louvres or narrow angle emitters.

FLOW CHART TO DETERMINE SIGN/SUPPORT ARRANGEMENT AND SITING OF VMS RELATIVE TO ADS

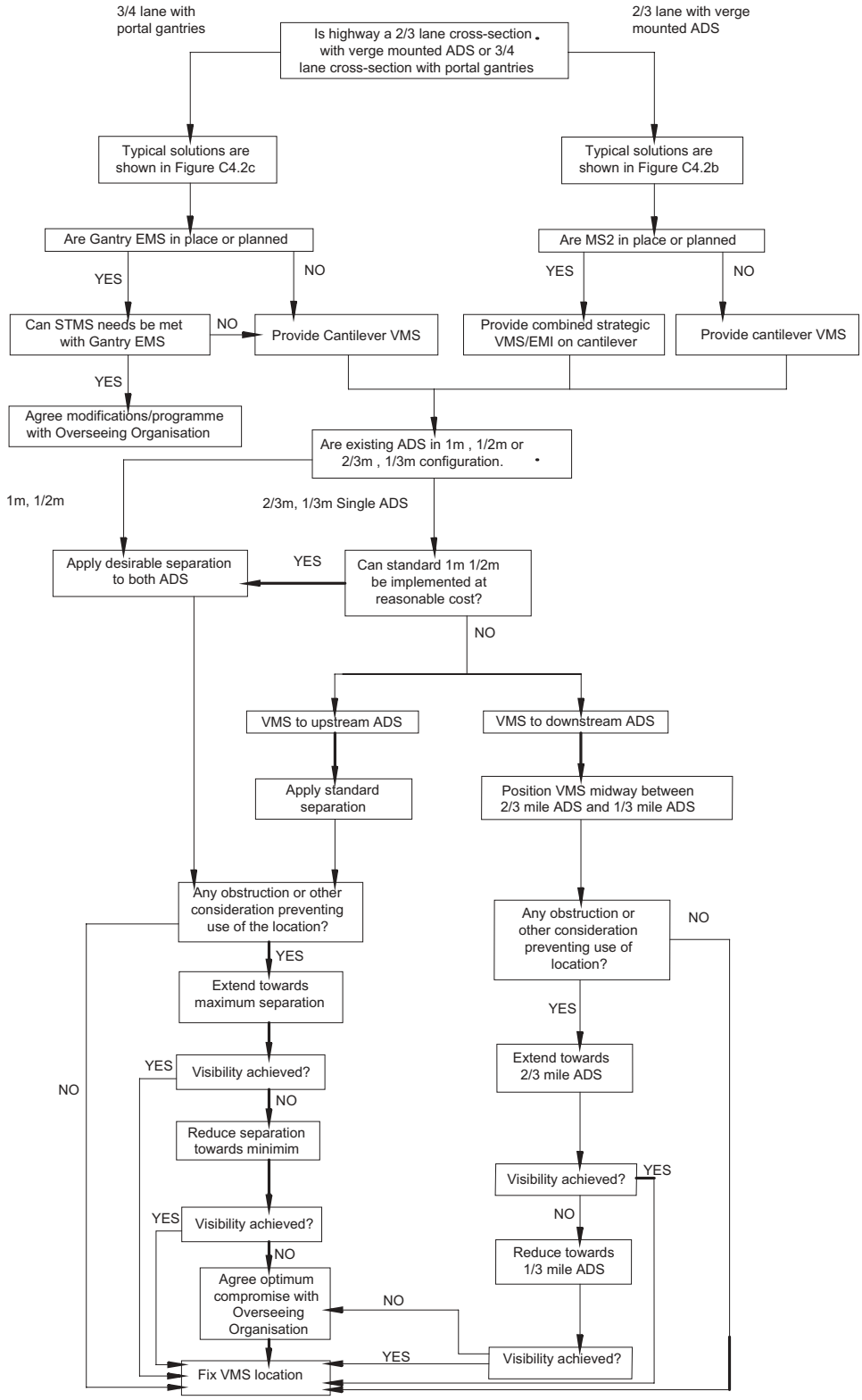
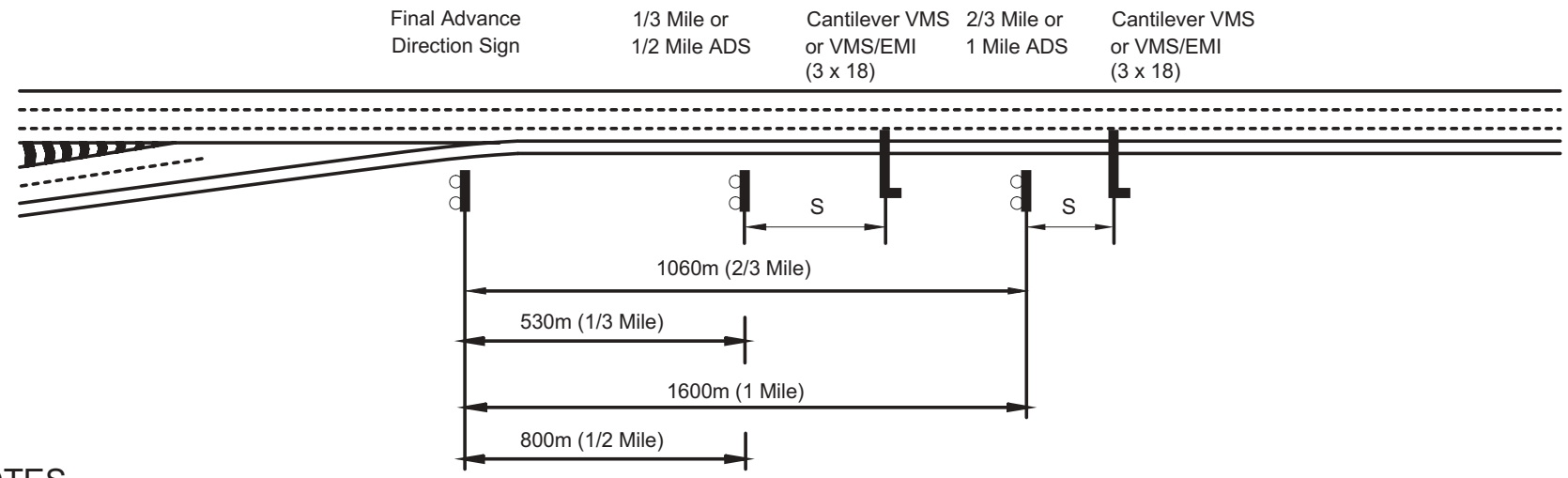


Figure C4.2a



NOTES

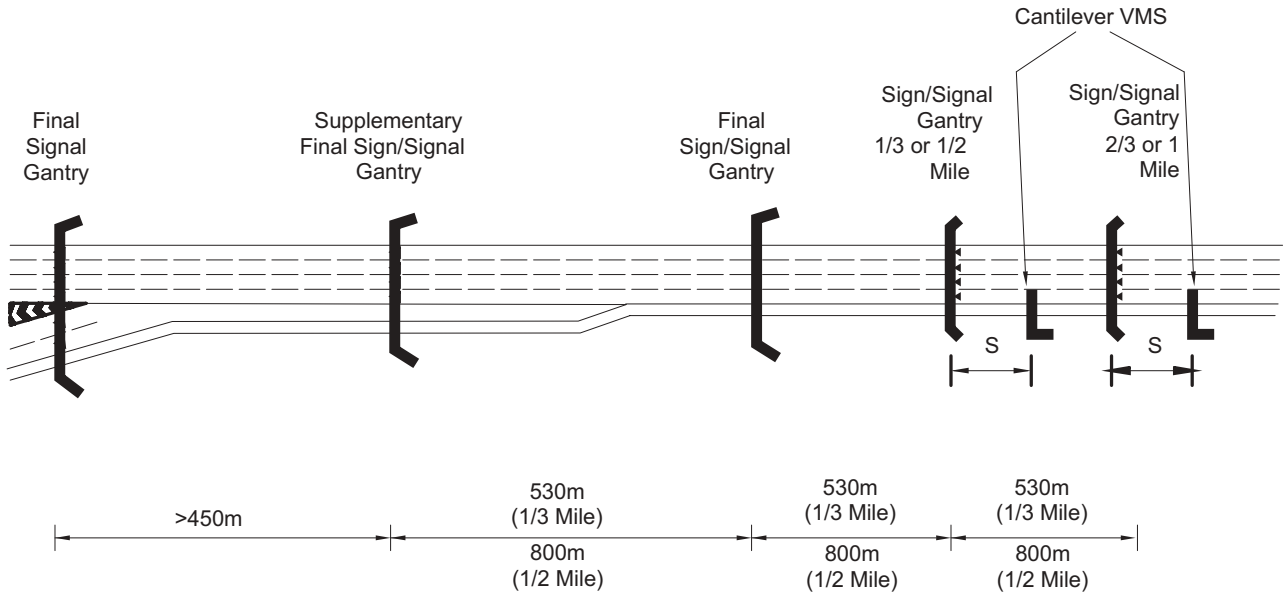
1. To determine separation distance S refer to Paragraph C4.2 and Figure C4.2a

2. For sections of motorway with portal gantry signals/ADS the strategic VMS solution should be similar to that shown on Figure C4.2c

3. On sections of motorway where MS2 is in place or planned a combined strategic cantilever VMS/EMI should be provided, otherwise a VMS only is required.

PROVISION OF STRATEGIC VMS ON D2/3 ALL PURPOSE TRUNK ROADS AND MOTORWAYS WITH VERGE MOUNTED ADS

Figure C4.2b



NOTES

1. The layout and separation for the sign/signal gantries is taken from DMRB Vol9, Section 4, Part 3 TA74/97. MOTORWAY SIGNALLING.

2. To determine the separation distance 'S' refer to Paragraph C4.2 and Figure C4.2a.

3. The diagram shown is for a parallel deceleration lane. However a similar relationship between the strategic EMS and sign/signal gantries will apply to other diverge arrangements.

4. The sign/signal granties should comprise lane signal matrices supported by 2x12 EMS (320mm character height) plus ADS.

5. The cantilever VMS should comprise 3x18 400mm characters. If it comprises an integral matrix, this facility should be disabled.

PROVISION OF STRATEGIC EMS ON ALL PURPOSE TRUNK ROADS AND MOTORWAYS WITH SIGN/SIGNAL PORTAL GANTRIES

Figure C4.2c

C5. VMS INFRASTRUCTURE

C5.1 Control Systems

1. Variable Message Signs (VMS) can be controlled by all current motorway control systems. Designers should assess the suitability of using existing control and communications systems for the Strategic Traffic Management Systems (STMS) scheme in consultation with the Overseeing Organisation. Existing or planned systems used for VMS control include:

- NMCS2 - Message Sign subsystem
- NMCS2 - Traffic Management subsystem
- Stand Alone Control System.

2. The communications infrastructure needed to support either an NMCS2 or Stand Alone Control arrangement is fully described in TRH 1642, 'Motorway Signals Mark 2, Infrastructure Design Guide'.

C5.2 Roadside Infrastructure

General

3. On motorways, the existing NMCS infrastructure should be able to support the majority of STMS applications. Where new STMS schemes are introduced within existing sections of motorway, infrastructure works should therefore be limited to civils work and local modifications to existing cabling and powers supplies.

4. On other roads it will be necessary to develop the solutions identified during the feasibility study such as cabling to the motorway, or radio/private lines/ISDN/ similar links to more remote locations.

Enhanced Message Signs

5. The infrastructure for a typical Enhanced Message Signs (EMS) site comprises:

(i) a foundation and plinth fitted with a standard holding down arrangement to support the cantilever structure and EMS enclosure

or

a Portal Gantry suitably modified to provide support for the EMS and Enclosure

(ii) Communications Cabinet Type 600 and Power Cabinet Type 609 with associated cabling and ducts

(iii) safety fencing - double height Open Box Beam

(iv) paving, handrails and retaining walls as required by site conditions.

6. A typical Cantilever EMS Outstation Layout is shown on Drawing MCX 0582.

7. A Portal Gantry Outstation Layout is shown on Drawing MCX 0800. This shows the arrangement where a ducted cable network is provided. At all other locations, the cables between the gantry and equipment cabinets will be directly buried.

8. Further guidance is given in Specification TRH 1642, 'Motorway Signals Mark 2, Infrastructure Design Guide'.

Fixed Text Message Signs

9. The infrastructure for a typical Fixed Text Message Signs (FTMS) site comprises:

(i) a foundation (either a reinforced concrete block with no holding down arrangement where the FTMS post fixings are drilled into this foundation or a similar block with appropriate post holes)

(ii) Communication cabinet Type 600 and a Power Cabinet Type 609 with associated cabling and ducts

(iii) safety fencing to suit location

(iv) paving, handrails and retaining walls as required by site conditions.

C5.3 Technical Approval

Cantilever Structures

10. Cantilever gantries are designed as two elements:

(i) foundation

(ii) superstructure.

11. The foundation comprises a reinforced concrete plinth incorporating a standard holding down arrangement for the superstructure. Details are given in Drawings MCX 0583.

12. Technical Approval must be sought from the appropriate Technical Approval Authority. If the foundation and superstructure are designed independently, or by different design organisations, a Technical Approval submission must be made for each element.

13. Cantilever foundations and superstructures are classed as Category II structures and, as such, will require independent checks of the design.

14. Note that, in Wales, offset tee cantilevers have been used in place of full cantilevers. The amount of offset is defined for individual contracts.

Existing Gantries

15. Existing gantries should already be certified to BD 2/89. Technical Approval is therefore required for the addition of VMS sign enclosures and mounting equipment and the effect of these additions on the gantry structure.

16. Detailed designs already exist for the additional steelwork to support 320mm EMS to be mounted on certain “standard” gantries. This design and where it can be applied is shown on Drawing No MCX 0584.

17. Where VMS signs with character sizes other than 320mm are to be installed, a new design must be developed specifically for each situation.

18. The gantry designers should be asked to carry out checks to ensure there is adequate reserve structural capacity to support the VMS, and to establish whether the gantry loading on foundations is exceeded.

19. The Technical Approval submission must refer to the structure number for the existing gantry. Design and check certificates must be produced for the additions, and a separate check certificate must be produced by the gantry designer for the effect on the gantry.

C5.4 Holding Down Arrangement

20. When foundations are constructed, it is essential the contractor uses a template provided by the supplier of the superstructure.

21. On contracts where different contractors are responsible for the construction of the base and superstructure, steps must be taken to ensure that the interface between the two elements matches.

C5.5 Optical Alignment

22. When using VMS based on light emitting technology, it is particularly important to ensure correct optical alignment of the sign with the carriageway, so as to present the optimum viewing time to drivers. Design requirements and the method to be applied on site are given in Drawing MCX 0069.

C5.6 Ordering Equipment

23. Requests for Welsh Office issued equipment for specific schemes should be made in accordance with the current procurement procedures in place at the time.

C6. GLOSSARY OF TERMS

1. A glossary of general terms applying to Motorway Communications is given in TA 70/97.

2. Definitions for additional terms used in the context of this Advice Note are as follows:

Cantilever

An overhead structure which extends from the verge. It comprises a single column and an arm supporting an Enhanced Message Sign (EMS) or Motorway Signal Mark 2.

Continuous Sign

A Variable Message Signs (VMS) that appears to be made up of solid characters or symbols. The sign face is changed by removing one set of symbols/characters and replacing them with another, or by having a multiple face that can rotate.

Discontinuous Sign

A VMS in which the sign face is made up of individual elements having at least two states. By changing the state of the individual elements, different characters and symbols can be created within the same sign area.

Driver Information Systems

Systems which give the motorist information of a tactical and strategic nature, but also with messages relating to conditions on the network that may affect expected journey times. This may include information on major events, eg shows, sports events, etc and inter network connections such as ferries, tolled roads and crossings.

Enhanced Message Sign

A type of VMS based on light emitting technology. The EMS can display a variety of legends that may be configured and controlled remotely from an instation.

Fixed Text Message Sign

A type of VMS able to display a limited number of fixed messages. Signs for strategic applications use a mechanical rotating prism as the mechanism for changing the sign legend.

Portal Gantry

An overhead structure that spans the carriageway and is used to support combinations of signals, variable message signs and conventional fixed signs.

Sign

A device carrying directional or other informational message, eg route information at the approach to a junction.

Signal

A device used to give advisory or mandatory instructions, eg stop or 30 mph speed restriction.

Strategic Traffic Management Systems

Systems which give the motorist information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

Tactical Control Systems

Systems which provide supplementary information to complement matrix signals and other traffic control signs for local management of incidents or occurrences.

Variable Message Sign

A generic term for a sign that can display multiple legends or messages.

EMS and Fixed Text Message Signs (FTMS) are different types of VMS.

VMS can display text messages and/or symbols using any of the following technologies:

(a) Rotating Prism

(b) Reflecting Cells

(c) Light Emitting Cells.

NMCS

The Highways Agency's National Motorway Communications System.

C7. REFERENCES

Design Manual for Roads and Bridges

TA 70/97: Introduction - Motorways – DMRB, Volume 9, Section 2, Part 1.

TA 71/97: Design and Implementation (Overview) – DMRB, Volume 9, Section 3, Part 1.

TA 72/97: National Motorway Communications Systems – DMRB, Volume 9, Section 4, Part 1.

TA 74/97: Motorway Signalling – DMRB, Volume 9, Section 4, Part 3.

TA 75/97: Motorway Transmission Design – DMRB, Volume 9, Section 4, Part 4.

TA 76/97: Motorway Control Offices – DMRB, Volume 9, Section 4, Part 5.

TA 77/97: Motorways: Infrastructure Design – DMRB, Volume 9, Section 5, Part 1.

Department of Transport

Traffic Signs Regulations and General Directions (TSRGD).

Chapter 8 of the Traffic Signs Manual.

Highways Agency Specifications and Standards

MCH 1286: Request for Financial Approval: Standard and Non-Standard Schemes.

MCH 1288: Request for Financial Approval for Bulk Purchase Equipment only.

MCH 1643: Motorway Signals Mark 2 - Design Guide

MCH 1813: System Certification Specification.

TRH 1642: Motorway Signals Mark 2 and Enhanced Message Signs - Infrastructure Design Guide.

TR 0154: Electromechanical Variable Message Signs - Functional Specification

TR 2136: Functional Specification for Continuous or Discontinuous Variable Message Signs

TR 2141: Motorway Signals Mark 2, Requirements for Signal Equipment

TA 33/90: The Use of Variable Message Signs on All Purpose and Motorway Trunk Roads

Highways Agency NMCS Installation Drawings (TRH 1239)

MCX 0069: Cantilever and Gantry Sign Setting Out and Optical Alignment.

MCX 0582: EMS Outstation Layout.

MCX 0583: Cantilever Structures and Holding Down Arrangements.

MCX 0584: EMS on Portal Gantry - Additional Steelwork.

MCX 0590: Cantilever Site - Typical Arrangement.

MCX 0591: Portal gantry Site - Typical Arrangement.

Other Publications

Department of Environment Circular 18/84 - Crown Land and Crown Development

VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION
SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX D (NORTHERN IRELAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

SUMMARY

This issue of Annex D incorporates an amended first bullet point to clause D1.2.14.

INSTRUCTIONS FOR USE

This is a new document to be incorporated into the Manual.

1. Insert TA 83/05 Annex D as Part 6 of Volume 9, Section 4.

2. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

VOLUME 9 NETWORK - TRAFFIC CONTROL AND COMMUNICATION

SECTION 4 SYSTEMS DESIGN

PART 6

TA 83/05 ANNEX D (NORTHERN IRELAND ONLY)

GUIDE TO THE USE OF VARIABLE MESSAGE SIGNS FOR STRATEGIC TRAFFIC MANAGEMENT ON TRUNK ROADS AND TRUNK ROAD MOTORWAYS

Contents

Chapter

D1. INTRODUCTION

D1.1 General

1. This Annex is for the specific requirements of motorway communications in Northern Ireland.

DMRB Structure

2. Section 1 of Volume 9 the Design Manual for Roads and Bridges (DMRB) contains Technical Directives (TD) which detail the Standards of Provision.

3. Section 2 onwards contains Technical Advice (TA) Notes which reflect current practice in the field of motorway communications and control.

Design Loop

4. Figure D1.1 shows the 'Design Loop' illustrating the general sequence in the iterative process which starts with the design for emergency telephones and signals followed by transmission and control office designs. Last in the cycle is the design of the infrastructure that will be required to support all communications equipment and systems.

Glossary

5. A Glossary of Terms is given in Chapter D6.

Standard Drawings and Specifications

6. Standard drawings and specifications referred to in this guide are issued by Roads Service.

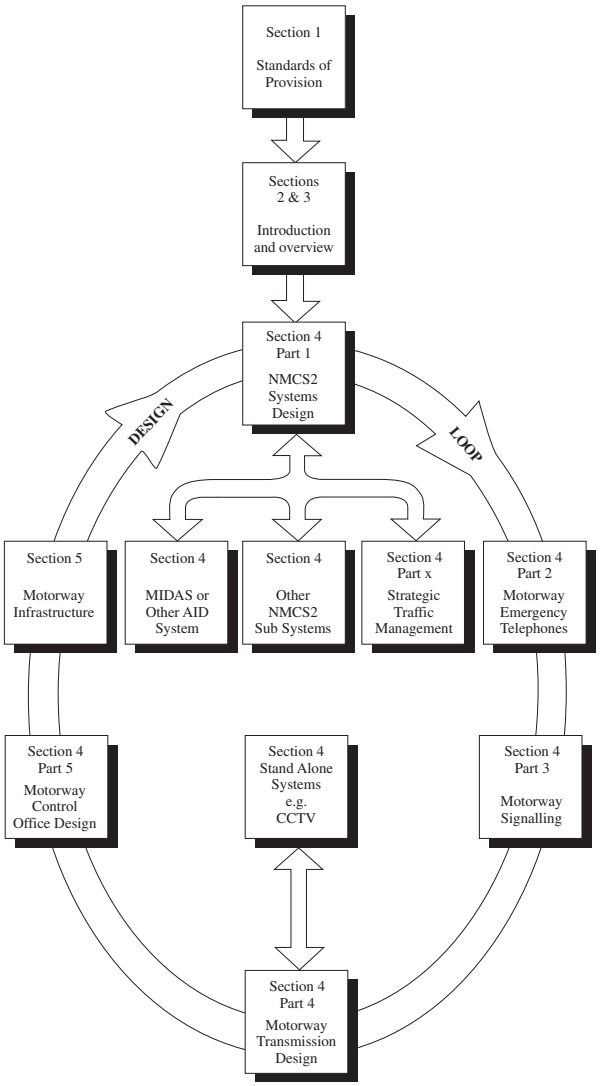


Figure D1.1 – Structure of Volume 9 of the Design Manual for Roads and Bridges

D1.2 Related Standards and Advice Notes

7. TD 33/90, 'The Use of Variable Message Signs on All-Purpose and Motorway Trunk Roads', provides criteria affecting the selection, siting and use of all types of Variable Message Signs (VMS) on all purpose and motorway trunk roads. This Advice Note relates purely to light emitting VMS and TD 33/90 is due to be updated to concord with the advice given in this document. Most VMS currently used for Strategic Traffic Management are based on light emitting technology.

8. For VMS based on light emitting technologies, the design criteria and performance standards for road applications are given in Highways Agency Specification TR 2136, 'Functional Specification for Continuous or Discontinuous Variable Message Signs'.

9. Highways Agency Specification TR 0154, 'Electromechanical Variable Message Signs - Functional Specification', covers performance requirements for that category of sign. The performance requirements of sign face materials, where appropriate, is found in BS 873.

10. The following current versions of Advice Notes are of general relevance to motorways. Reference should be made to Roads Service as to their specific application in Northern Ireland.

TA 70/97: Introduction - Motorways - DMRB, Volume 9 Section 2, Part 1.

TA 71/97: Design and Implementation (Overview) - DMRB, Volume 9, Section 3, Part 1.

TA 72/97: National Motorway Communications Systems - DMRB, Volume 9, Section 4, Part 1.

TA 74/97: Motorway Signalling - DMRB, Volume 9, Section 4, Part 3.

TA 75/97: Motorway Transmission Design - DMRB, Volume 9, Section 4, Part 4.

TA 76/97: Motorway Control Offices - DMRB, Volume 9, Section 4, Part 5.

TA 77/97: Motorways: Infrastructure Design - DMRB, Volume 9, Section 5, Part 1.

D1.3 Scope

11. The practices and requirements detailed in DMRB, Volume 9, Network - Traffic Control and Communications relate to the policies implemented by Overseeing Organisations in the UK.

12. The principles in this Advice Note refer specifically to the needs and practices applicable in Northern Ireland. Other Overseeing Organisations, should refer to annexes A, B or C, for advice in line with their Strategic Traffic Management needs.

13. This Advice Note takes precedence in the case of any conflicting direction in TD 33/90 or advice in TA 60/90, or other existing Advice Notes in as far as they relate to Strategic Traffic Management Systems (STMS).

VMS Applications

14. VMS are provided for Driver Information, Tactical Control and Strategic Traffic Management. The scope of these applications is:

- **Driver Information Systems** - provide the motorist with information of a tactical and strategic nature, but also with messages relating to conditions on the network which may affect expected journey times.
- **Tactical Control** - provides supplementary information to complement matrix signals and other traffic control signs for management of incidents or occurrences on local roads in the area. Signs set in support of tactical objectives display messages specifically related to achieving improvements on the localised sections of the network, eg 'ACCIDENT/LONG DELAYS'.
- **Strategic Traffic Management** - provide the motorist with information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

15. This Advice Note covers the application of VMS to STMS only.

16. Strategic Traffic Management seeks to ensure that a strategic view of network status and conditions is available, and that strategies and decisions which have

more than a local impact can be identified correctly, and effectively implemented. Signs set in support of these objectives offer alternative or diversionary route choices.

17. This Advice Note also describes the different types of VMS currently available for STMS schemes, and outlines the approach to the feasibility study, scheme design, implementation and evaluation.

D2. SCHEME PROCESS

D2.1 General

1. There are no standard provision criteria for Strategic Traffic Management Systems (STMS) schemes and each must therefore be individually justified by means of a feasibility study which may incorporate an economic analysis.

2. The Scheme Process is illustrated in Figure D2.1 The implementation of Strategic Traffic Management schemes will generally comprise the following elements:

- Feasibility Study (Chapter D2.2)
- Design and Implementation (Chapter D2.3)
- Scheme Evaluation (Chapter D2.4).

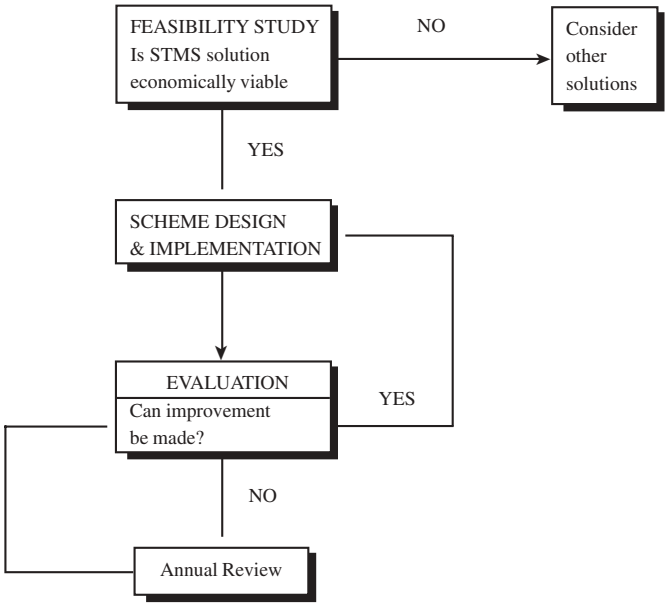


Figure D2.1 Scheme Process

D2.2 Feasibility Study

3. A feasibility study is needed to determine the practicality and value for money of STMS schemes. A Feasibility Study Report should be produced at the end of the study period and consider the following:

- review of existing systems and traffic management practice
- operational objectives
- network and traffic analyses
- diversion routes and intervention nodes
- scheme operation and management
- Variable Message Signs (VMS) messages and sign type selection
- engineering
- future maintenance
- economic evaluation
- environmental assessment
- scheme evaluation requirements
- implementation programme
- legislation
- risk assessment/hazard identification.

Review of Existing Systems and Traffic Management Practice

4. The feasibility study should consider the extent of the existing and planned facilities within the area of the proposed scheme. These include:

- Control Office operations with respect to the control of incidents and traffic management
- institutional issues, policy and codes of practice with respect to the control of incidents and traffic management

- the location, type and objectives of existing and planned VMS schemes where appropriate
- the location and form of existing Fixed Signs, Signals and Gantries
- the motorway communications infrastructure and its capability to support new systems
- extent of CCTV coverage at the relevant point of the network
- extent of existing Traffic Data Collection Systems.

Operational Objectives

5. STMS schemes are likely to deal with the management of unusual or unexpected events affecting road traffic rather than day to day congestion. Designers should identify the main objectives of the scheme. These might include:

- provision of information in a timely manner
- achievement of reduction in delay
- achievement of local incident management
- supporting diversion routes and controlling traffic on these routes
- satisfying drivers' needs for reliability and consistency in information and legends
- avoiding an adverse impact on safety and the environment
- consistency with existing and planned VMS schemes on a national basis
- long term viability in terms of meeting other objectives throughout the design life of the system.

Network and Traffic Analysis

6. Designers should classify the road network applying to the STMS scheme into strategic and non-strategic routes. Aspects to be considered at this stage include:

- the disruptive impact of unusual incidents and planned roadworks on network operation
- the frequency of route diversions by studying historic records of motorway and trunk road closures
- traffic characteristics as for network congestion and the capacity of alternative routes to accept diverted traffic
- the impact of potential diversions on alternative routes, especially through towns and villages.

7. A traffic assignment programme may be used to assess and develop strategic control plans that may be used for the STMS. This programme should have the facility to represent traffic diversions that may be applied to the road network, and to evaluate the economic and operational performance of the proposed diversion strategies.

8. The depth and level of any network and traffic analysis should be appropriate to the needs and objectives of the STMS scheme. The output from this analysis should form the basis for any Economic Evaluation that may be required.

Diversion Routes and Intervention Nodes

9. Based on the Network and Traffic Analysis, the report should identify the diversion routes, strategic and non-strategic intervention nodes and the recommended locations for the provision of VMS.

10. The current view is that designers should preferably restrict diversion strategies to the Trunk and Motorway Network. Where this is not possible, the views of Roads Service and the Police, must be sought before the strategy is drawn up.

11. Any existing diversion route agreements developed by Roads Service and the Police within the scheme area should be considered and reviewed for inclusion in the STMS scheme as local diversion strategies.

Scheme Operation and Management

12. Options for the operation and management of the scheme should be considered. The points to be addressed include:

- integration with existing and planned control and communications systems and any necessary extension in capability of those systems

- integration with the existing management of the strategic network
- implementation of a management structure taking into account longer term proposals of a Regional Traffic Control Centre
- the need to publish traffic data to third party organisations and the potential for generating revenue
- the need for consultation to develop effective Codes of Practice.

13. Designers should assess the suitability of using existing control and communications systems for the STMS scheme in consultation with Roads Service. Existing or planned systems used for VMS control include:

- Motorway Control System
- Urban Traffic Control subsystem
- Automatic Incident Detection Subsystem
- Ramp Metering Systems
- Remote Monitoring Systems
- Other Stand Alone Systems.

14. Considering the effect of the scheme design on STMS and other traffic management schemes elsewhere on the road network is important. It is essential that different systems provide motorists with accurate and consistent information when moving from one area to another.

15. The feasibility study should address the interests of all organisations who may be involved in the operation and management of the proposed STMS and where relevant, other existing or planned traffic management and control facilities. These organisations will include:

- Roads Service
- the Police
- DBFO Concessionaires.

VMS Legend and Sign Type selection

16. The feasibility study should identify the type and size of VMS needed for each location and appropriate costings should be used in the Economic Evaluation.

17. The type and range of information to be displayed will generally limit the choice of sign technologies, whereas the sign location, road classification and vehicle speeds will all affect character heights and therefore the size of the VMS.

18. Deriving a common strategy for VMS signing is important, whatever the technology and application. Chapter D1 describes the scope of VMS applications covering Driver Information, Tactical Control and Strategic Traffic Management. The type of VMS and the range of messages used for STMS applications will therefore be influenced by the type and extent of any other VMS signing at a given location.

19. The Feasibility Study must therefore consider in sequence:

(i) the information needed in the VMS legend to meet the scheme objectives

(ii) the content and number of VMS legends for each location

(iii) the VMS technology needed to display the required legends

(iv) the technology used by other VMS on the same section of road

(v) the VMS size and performance level needed for the application, or applications.

20. VMS legends should normally be selected from those given in the Traffic Signs Regulations (Northern Ireland). Any other legends needed for a specific scheme must be authorised by Roads Service.

21. The practice for STMS messages is to state the location and cause of the diversion, followed by the suggested alternative route. Research suggests that messages should be restricted to a maximum of seven words, or four units of information. The aim should be to use the shortest message possible.

22. Further reading on VMS legends is given in the VAMOS WHITE BOOK, produced under the European 'Drive' Project VAMOS (VAriable Message Optimised Systems).

23. Where the system will include VMS legends relating to more than one application, ie Tactical and STMS, the hierarchy must be explicit and designers must develop setting resolution rules to decide which legend to use for each specific set of circumstances. The Highways Agency document 'Code of Practice for

Operation of Motorway and Trunk Road Signals and Variable Message Signs', prepared with consultation with the Association of Chief Police Officers (ACPO) gives further guidance on this subject.

Sign Types

24. If the only information to be provided is a route change, ie alternative direction signing, Fixed Text Message Signs (FTMS) may be adequate. Where the designer requires a wider range of options, discontinuous light emitting signs should be used.

25. For most STMS applications, the most appropriate type of VMS will be the Enhanced Message Sign (EMS), based on light-emitting technology.

26. If Motorway Signals Mark 2, or Tactical EMS type signs are already provided on the approach to a given location, designers must consider meeting the STMS requirements using these signs. If they are shown to be unsuitable, the study should examine alternatives, and identify a solution that meets the needs of all applications.

27. Depending on proposed usage and location, VMS may be provided in pairs on the approach to an Intervention Node. This is to reinforce the legend, and to reduce the potential for it to be obscured from the driver by high-sided vehicles. In selecting the VMS type it is essential that all signs on the approach to a node show the same legend and therefore both signs must use the same technology and design.

Engineering

28. The feasibility study should consider the engineering design needed to support the STMS. A variety of engineering solutions should be considered and prioritised to decide the most cost effective approach to each particular scheme. Designers should address the following aspects of engineering design:

(i) Traffic Data Collection

(ii) control system

(iii) signs

(iv) infrastructure and transmission

29. A key factor for STMS is the collection of accurate real-time traffic information. The study should consider the means by which this is to be achieved cost effectively, including on non-motorway roads.

30. The STMS control system as a whole must support the operational and management strategy and any development of that strategy over time. The need for any interlocking reaction with, and interaction to, other existing or planned traffic management and control facilities must be identified and the implications assessed. This will include such elements as the number and type of STMS legends, setting strategies, setting resolution rules between different applications, and the operational Code of Practice.

31. The type(s) of sign should be identified from the guidance in Chapter D3, 'Strategic VMS Types'. However the study should also consider the engineering aspects related to possible sign locations and the means of installation, ie verge mounted posts or cantilevers, or portal gantries.

32. The requirements for the STMS infrastructure and transmission should be considered and assessed. It is important to identify how the existing infrastructure can be used to reduce the scheme cost, and maximise the return on previous investments. The standard motorway infrastructure should support the needs for most STMS applications. Elsewhere, a variety of solutions should be considered and prioritised. These will include cabling, followed by radio and the use of private lines, ISDN or similar links to more remote or difficult locations.

Economic Evaluation

33. For conventional means of procurement the study may include an evaluation to decide the economic viability of the scheme. The level of detail and the evaluation methodology will be scheme-dependent and should be agreed with Roads Service.

34. Whole life costs to be considered should include system development, implementation, staffing, service and maintenance. The study should seek to prove that the provision of an STMS scheme is preferable to an alternative traffic solution.

Environmental Assessment

35. The feasibility study must consider the impact of the STMS on the environment. This should include:

- consideration of the visual impact of signs/ support and ancillary equipment such as cabinets, duct runs and steps etc., viewed from the road itself and from nearby developments and open space

- residential properties and consideration of the land classification of adjacent areas
- consideration of the need to fell or reduce the size of trees on the approach to VMS
- light pollution caused by VMS
- an appreciation of the environmental effects on the roads receiving diverted traffic as for increased congestion, noise and air quality.

36. Designers should agree the scope of the environmental assessment with Roads Service.

Scheme Evaluation Requirements

37. The study should identify the objectives that need to be evaluated when the scheme is in operation to assess its effectiveness, optimise performance and confirm that the economic benefits are being attained. The evaluation should generally include considerations of accident reduction, speed changes and traffic volumes leaving the road in response to given messages. The reduction in delay costs and driver frustration leading to risk of accidents should also be considered.

Implementation Programme

38. The above study should identify an implementation programme for the preferred scheme option. The programme should outline the logical steps of implementation, indicate the likely spend profile, and present (where appropriate) the incremental economic benefit for each stage of the programme.

39. The programme should also identify appropriate stages for consulting and agreeing design proposals, operational and maintenance boundaries and system engineering interfaces.

Legislation

40. Many areas of legislation exist which will apply to the various elements of an STMS scheme. Most are common to all design, procurement and construction projects and guidance is beyond the scope of this Advice Note. However two specific areas of legislation will apply to STMS schemes and these are outlined below.

41. To be legally used all Traffic Signs, including all VMS legends must be either prescribed or authorised. Prescribed signs and VMS legends are defined in the Traffic Signs Regulations (Northern Ireland). Any sign not so prescribed must be authorised for a defined location and period of time by Roads Service.

42. VMS which are other than manually operated, will also need statutory Type Approval. Designers should consult Roads Service on this issue.

Risk Assessment/Hazard Identification

43. A Risk/Hazard Assessment should be considered as it relates to the role of Roads Service. This makes it necessary to maintain the highway in a safe condition and to secure the safe movement of traffic including pedestrians. The matters to be considered therefore include:

- signs not operating correctly
- reliability
- failure of a legend to appear or the appearance of an incorrect legend
- maintenance.

44. Depending on the outcome of the assessment process, requirements such as message monitoring, interlocking and/or message sequencing rules may need to be developed during the design stage to ensure safety integrity levels are achieved.

D2.3 Scheme Design and Implementation

45. Outline proposals developed during the Feasibility Study should be reviewed, refined and developed into the scheme design. This should take into account not only the requirements for implementation, but for effective maintenance and operational support throughout the operational life cycle.

46. The scheme design should normally commence with a consultation, survey and information collection phase, followed by preparation of preliminary design to be agreed with Roads Service. The preliminary design should detail proposals for:

- traffic data and information collection systems
- VMS types
- VMS site locations
- control system

- communications infrastructure and transmission
- structures, geotechnical and civil engineering
- traffic management.

47. Designers should examine existing site records, transmission arrangements and control facilities to establish the impact of the scheme on existing systems, and the scheme design requirements. This stage will involve consultation with relevant divisions of Roads Service, the Police and other organisations having an interest in the STMS scheme.

General Design of the Works

48. The detailed design and preparation of working drawings should not commence until the design proposals have been presented to and agreed with Roads Service.

49. The options for collecting accurate real-time traffic data and information identified during the feasibility stage may be developed within the overall scheme. On motorways the provision of MIDAS, or other incident detection systems, and CCTV will normally deliver this data. Where this is not being provided and on other roads, the standard designs may need to be developed and modified to provide additional data and information collection sites at key locations to suit the needs of the scheme.

50. VMS must conform to Roads Service standards and will normally be based on the Highways Agency 'TR' series of specifications. These detail the sign design and performance requirements to be achieved, and standard interfaces to the motorway communications infrastructure. Also, signs may be required to be interfaced to the Urban Traffic Control System. The designer should consult Roads Service before placing contracts for VMS procurement as existing contracts may offer benefits in terms of cost savings and approved designs.

51. The control system requirements must be defined based on the operational and management objectives and taking into account the need for integration with existing and planned systems, and any extension to the functionality or capacity of these systems. Roads Service and the Police should be consulted at an early stage to enable consultations with the police. Proposals should be agreed before finalising the design and scope of the STMS contract.

52. Control room and equipment room layouts must be examined to ensure the proposed system can be accommodated in terms of space for equipment and power supplies, etc.

53. Design of the communications infrastructure should conform to Highways Agency standards defined in the 'MCX' installation drawings series and any modifications required by Roads Service.

54. The transmission network should take account of the capacity of existing systems. For motorways, cable pairs and channel allocations will need to be agreed with Roads Service and works arranged to re-configure and provide additional communications circuits as required. For other locations, the provision of circuits by Private Telecommunications Operators (PTOs) must be planned at an early stage in the design process.

55. The provision and upgrading of power supplies for VMS can be a lengthy process, particularly for remote sites where the Electricity Supply Company (ESC) may need to negotiate wayleaves. Power supply locations should therefore be identified early in the design process, and works orders placed accordingly.

56. VMS will normally be installed on posts or cantilever gantries in the roadside verge, or on new or existing portal gantries. Standard arrangements exist for sign cantilevers and for modifications to some types of portal gantry. Designs, technical assessments and design checks should be carried out incorporating the requirements as applicable for:

- Post, Cantilever or Portal Gantry sign and superstructure
- foundations and holding down arrangements
- technical assessment/design modifications to existing gantries
- retaining walls

57. The design process should include an early desk study of available soils data, to establish whether a contract for an additional geotechnical investigation is needed to complete the scheme design. Designers should identify any such work early in the programme as it may have major impact on the implementation timescale.

58. Safety barrier must be provided at all locations according to Roads Service standards. Any existing barrier at or near to the sign location should be upgraded and extended as necessary.

59. Traffic management systems for STMS schemes must conform to Chapter 8 of the Traffic Signs Manual. Roads Service, Maintaining Agent and the Police must be consulted to agree local arrangements, lane closure timings and road space bookings, etc taking into account other programmed works.

Siting of VMS

60. The locations for VMS should be identified by site survey according to the criteria given in Chapter D4, 'VMS Siting Criteria'. A detailed site survey is required for each of the VMS locations identified during the feasibility study.

61. When locations have been defined, consideration must be given to carrying out an Environmental Impact Assessment study of the STMS scheme.

Notifications

62. If considered necessary, by Roads Service, notification of the STMS scheme should be sent to the Planning Authority for information. This notification should comprise a package of information, describing the scheme and its objectives and showing the locations of the signs on a 1:25000 scale map of the area.

Legend Authorisation

63. The recommendations for VMS types and legends identified during the feasibility stage should be reviewed and if necessary further developed.

64. Again any messages not included in the Traffic Signs Regulations (Northern Ireland) must be authorised by Roads Service as described in Chapter D2.2.

Traffic Modelling and Diversion Strategies

65. The diversion routes and intervention nodes identified during the feasibility stage should be reviewed and developed in consultation with the Police and Roads Service.

Operational Procedures

66. Procedures should be developed and worked into a Code of Practice for operation of the STMS. Depending on the scope of the scheme, this may involve consultation with Roads Service and the Police.

Safety Audits

67. Safety Audits should be carried out in accordance with the requirements as stated in HD 19/94, 'Road Safety Audits', or as otherwise agreed with Roads Service.

As-Built Drawings and Records

68. The designer or contractor should provide as-built drawings and records of the completed works for all contracts. All electrical inspection documentation should be provided at completion of the works. Where required, 'As-Built' information must be incorporated into the existing motorway communications record drawings. All structural information, both for the signs themselves and the supports, should be provided on completion of the works.

Detailed Risk Assessment

69. The safety issues considered during the feasibility stage should be reviewed and amended as necessary.

70. The assessment should take into account best practice achieved elsewhere on the road network, and the consequential driver's expectation and reliance on STMS information.

71. Requirements such as message monitoring, interlocking and/or message sequencing rules must be developed at this stage to ensure safety integrity levels are achieved.

72. The hazard identification and risk assessment process should consider among other matters the following:

- the signs not operating or operating incorrectly
- possible conflict with signing and/or driver information systems
- message priority
- failure of a legend to appear or the appearance of an incorrect legend - (this must be done on an individual sign basis and a system and sequence basis)
- the legends to be displayed and how easily they can be read and understood

- failure of real time traffic data sources
- maintenance.

D2.4 Scheme Evaluation

73. When the scheme is in operation, the STMS should be evaluated to assess its effectiveness, optimise performance, and confirm that the economic, operational and other benefits of the scheme are being attained. The evaluation should be presented in the form of a Scheme Evaluation Report.

74. The evaluation requirements, initially identified as part of the feasibility study, should be reviewed and if necessary adjusted when the scheme is in operation. If required, elements of the STMS should be modified to ensure maximum benefits are realised.

75. Data from the detection and VMS systems should be collected and analysed to check whether the algorithm or operational rules select the appropriate strategy and to assess the actual diversion achieved. Where appropriate rules or algorithms should be refined.

76. Monitoring should continue whether the initial results show that refinements are needed or not, so that changes in conditions and driver responses over time can be met with appropriate system responses.

D2.5 System Certification

77. The system certification procedures specified in MCH 1813 : System Certification Specification, should be followed.

D3. STRATEGIC VMS TYPES

D3.1 Introduction

1. Variable Message Signs (VMS) for Strategic Traffic Management Systems (STMS) applications may be of the Enhanced Message Sign (EMS) or the Fixed Text Message Sign (FTMS) types.

2. All Strategic VMS should be fitted with flashing amber lanterns. The lanterns should flash in synchronous horizontal pairs alternating top and bottom to draw the attention of drivers to the message displayed on the VMS. Lantern design requirements must comply with the Traffic Signs Regulations (Northern Ireland).

D3.2 VMS Technologies and Types

Enhanced Message Signs

3. EMS are active light emitting signs. Two main technologies used in such signs, these are Light Emitting Diode (LED) and Optical Fibre. A third variety uses the combination of a reflective disc with light emitting technology.

4. The arrangements of text most frequently used for display purposes are:

- two lines of twelve characters (2x12)
- two lines of sixteen characters (2x16)
- three lines of sixteen characters (3x16)
- three lines of 18 characters (3x18).

5. Each character is formed from a matrix of display cells 5 wide and 7 deep and has a nominal character height of 420mm or as otherwise approved by Roads Service. EMS 2x12 signs on gantries use a nominal character size of 320mm.

6. EMS are usually installed on Cantilever or Portal Gantries.

Fixed Text Message Signs

7. FTMS are any type of VMS that display two or more fixed legends (or a blank display and one or more legends). There are currently a number of technologies used in such signs, the more common being active light emitting (as above), flexible roller blind and rotating plank or prism, the latter two normally being electro mechanical. Of these type the rotating plank or prism is most suitable for strategic use.

8. The rotating plank or prism sign normally consists of a series of planks or prisms that align to form a flat sign face. When required to show a different aspect, the planks or prisms realign to present a different sign face. Either the whole sign face can be changed in this way, or only those parts of the sign face that need to be changed. In this way the number of legend options available can be increased.

9. The arrangement of text used for display purposes on rotating plank or prism signs must be as prescribed in the Traffic Signs Regulations (Northern Ireland).

10. FTMS are normally post mounted and located in the footway, or the motorway verge, or installed on Portal Gantries.

D3.3 Applications of Strategic VMS

Enhanced Message Signs

11. It is accepted that under conditions of normal visibility, EMS type signs are less easily legible than conventional fixed traffic signs. This is a factor that must be balanced against their ability to display many different legends. However, if they comply with character height and optical performance requirements, they may actually be more easily legible under poor conditions. This performance under poor conditions may influence the choice of technology for a given application.

12. Experience suggests that strategic EMS on motorways should be provided at the approach to key junctions on the network, upstream of associated one mile and half mile or two-thirds mile and one-third mile respectively Advanced Direction Signs as appropriate.

13. EMS with three lines of eighteen 420mm high characters (3x18) are preferred for most applications. However EMS with 2x12, 2x16 or 3x16 characters can also be used, provided that the feasibility study

identifies that such signs are suitable for the legends needed at a particular location.

Fixed Text Message Signs

14. FTMS are more commonly used for diversion routeing and local traffic management where there are a low number of route options. They may most effectively be used to display messages linking to a predetermined diversionary route, marked by symbols, eg 'Follow _ for Belfast'. Symbols incorporated in signs are indicated in the Traffic Signs Regulations (Northern Ireland).

15. Other FTMS applications include tunnel/bridge maintenance requiring lane or road closures, weighbridges, tidal flow operations, level crossings and bus lane management.

16. The use of FTMS for Strategic Traffic Management is more likely to be on roads approaching intersections with motorways, rather than on motorways themselves. However, around major urban areas it may be necessary to use FTMS instead of EMS along certain sections of motorway to achieve a satisfactory level of signing.

17. Unlike EMS, FTMS normally replace existing Advance Direction Signing (ADS) as the normal sign face contained on the ADS will be incorporated as one of the faces of the FTMS. Diversion destinations, when shown, shall appear in black legends on yellow background, designed to the same rules as set out in Chapter 7 of the Traffic Signs Manual. When the diversionary route is displayed, flashing amber lanterns, as referred to in D3.1.2 shall be used.

D4. VMS SITING CRITERIA

D4.1 General

1. The siting criteria to be used when identifying Variable Message Signs (VMS) locations depends on the sign type and size selected during the feasibility and design stages.

2. For Fixed Text Message Signs (FTMS) type signs the criteria to be applied are the same as for Advance Direction Signing (ADS) on motorway and trunk roads. Such signs will normally replace the existing ADS and be installed on posts in the verge or on portal gantries as appropriate to the scheme design.

3. When siting Enhanced Message Signs (EMS) type signs, it is important that the EMS is positioned so that the motorist can relate any message with the associated ADS downstream of the VMS.

4. The advice given in Chapter D4.2 should be followed to determine appropriate locations for EMS type signs.

D4.2 Siting Criteria for EMS Type Signs

5. Figures D4.2a, b and c cover the general decision process and siting arrangements for EMS. The information should be read in conjunction with the advice given in Chapter D2 of this guide, particularly in relation to the selection of VMS sign and legend types.

6. By definition, EMS for Strategic Traffic Management Systems (STMS) purposes need to be on the approaches to road junctions that can be broadly categorised as either All-Purpose Road or Motorway/ Motorway. Whereas the standards for these with regard to the type of signing and signalling are quite different, the general arrangement of the direction signs is usually a one mile and half mile, or two-thirds mile and one-third mile Advanced Direction Signs as appropriate.

7. In deciding locations for EMS it is necessary to consider and balance the following needs:

- all types of information and directional signing and any signals must be in a position where they can be seen and read by drivers
- sign clutter and information overload must be avoided. In this respect, the maximum number of units of information presented to the driver should not exceed seven
- STMS signs should be positioned so the driver can associate the EMS message with the route information on directional signing
- the siting needs of other VMS applications such as for tactical control purposes.

8. Figures D4.2 a, b and c set out in general terms how this balance might best be achieved in a given location. If however a particular situation is not defined, reference should be made to Roads Service.

9. Where considered necessary by Roads Service, sign legends should be duplicated to reinforce the information or instructions given. Therefore, two EMS may be provided on the approach to the key junctions within any Strategic Traffic Management Scheme.

10. For the purposes of Figures D4.2 a, b and c the following parameters have been assumed:

- EMS with 420mm character height
- for the cases shown in the above figures a separation between strategic EMS and the one mile and half mile ADS (or two-thirds mile and one-third mile ADS as appropriate) of 200m minimum, 300m desirable and 400m maximum. However, the downstream EMS should not be closer than 200m to either the upstream or downstream ADS
- a protected sightline to the EMS of 225m minimum and 400m desirable.

D4.3 Siting Considerations for VMS

11. Factors that need to be taken into consideration when locating the VMS include other structures, environmental and other considerations. These are discussed below.

Location Relative to Structures

12. VMS should be positioned to ensure that bridges and other structures, including signs and signals, do not obstruct visibility. Equally important is to ensure that VMS do not obstruct the visibility of other signs and signals, the detection field of Fog Detectors, or the view from CCTV surveillance cameras.

13. VMS installed adjacent to existing structures should not be located closer than a distance of at least twice the height of the proposed VMS. Where it is necessary to place a VMS downstream of an overbridge, the resultant sightline should be carefully checked to ensure that the protected sightline requirements are satisfied.

Location Relative to Lighting Columns

14. Where road lighting is on the verge, VMS should be located at least one column length away from the nearest lighting column. This is to prevent damage being sustained by the sign in the event of the lighting column being knocked down by a vehicle. Where a VMS has to be sited between two lighting columns, it shall be placed immediately upstream of a column wherever possible.

Environmental Considerations

15. All VMS structures should be assessed for their visual impact at each sign location. Consideration should be given to the design and location of these structures to take account of the local setting in terms of landscape, townscape character and conservation designations such as National Parks and special landscape areas.

16. For new roads and motorways consideration of the type, location and degree of visual intrusion, caused by the strategic VMS structures, should be included in the Environmental Assessment under Landscape Effects.

17. When siting signs, due consideration should be given to assessing and reducing their visual impact.

Other siting considerations

18. Other design considerations for siting of VMS include:

- proximity of power supplies
- available space for communications and power cabinets including paved areas, access steps and where necessary retaining walls
- access for maintenance including a possible need for an off-road parking site
- on link roads it is essential that VMS are correctly oriented so that they can be clearly distinguished from main carriageway VMS. This may be achieved be means of louvres or narrow angle emitters.

FLOW CHART TO DETERMINE SIGN/SUPPORT ARRANGEMENT AND SITING OF VMS RELATIVE TO ADS

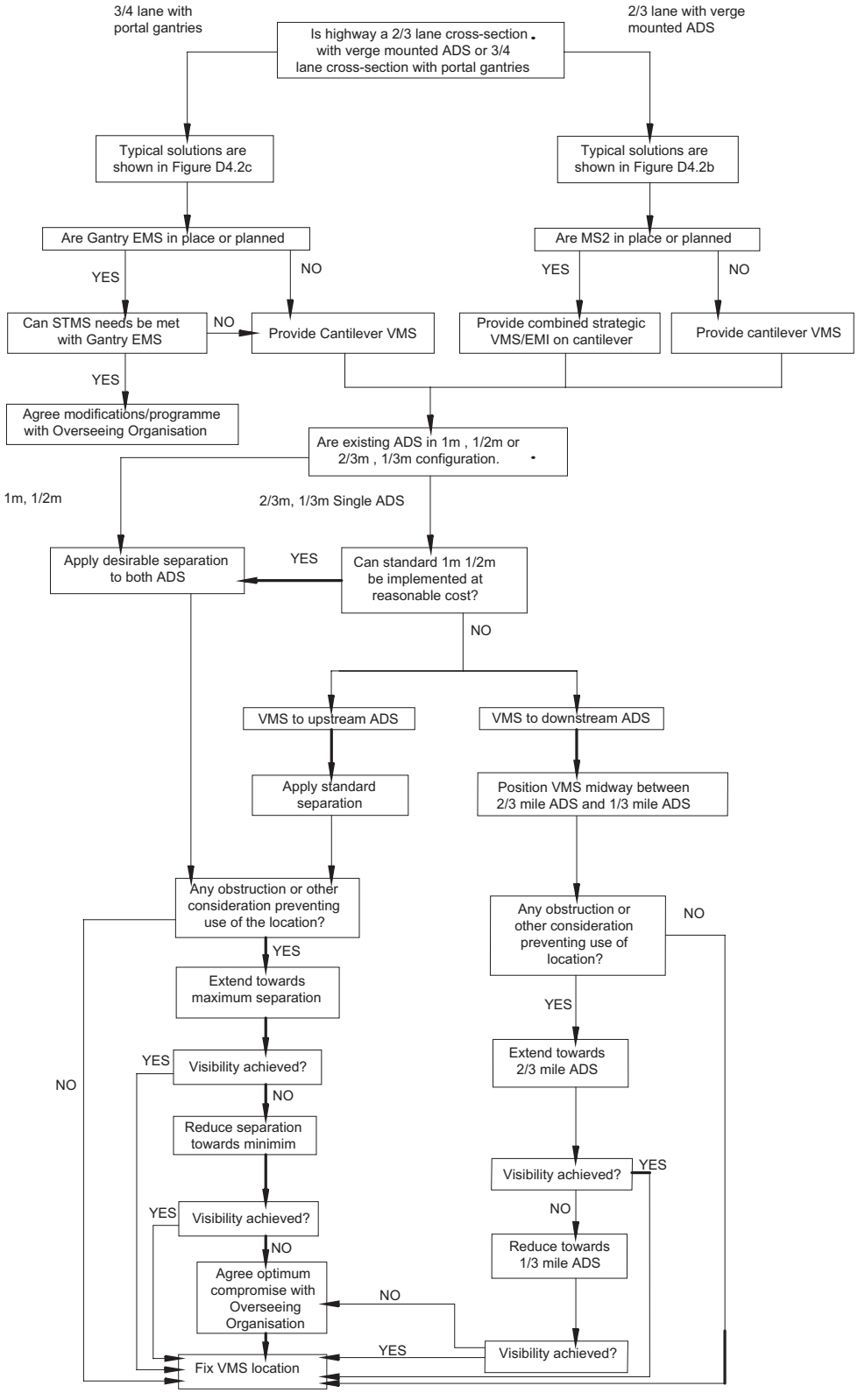
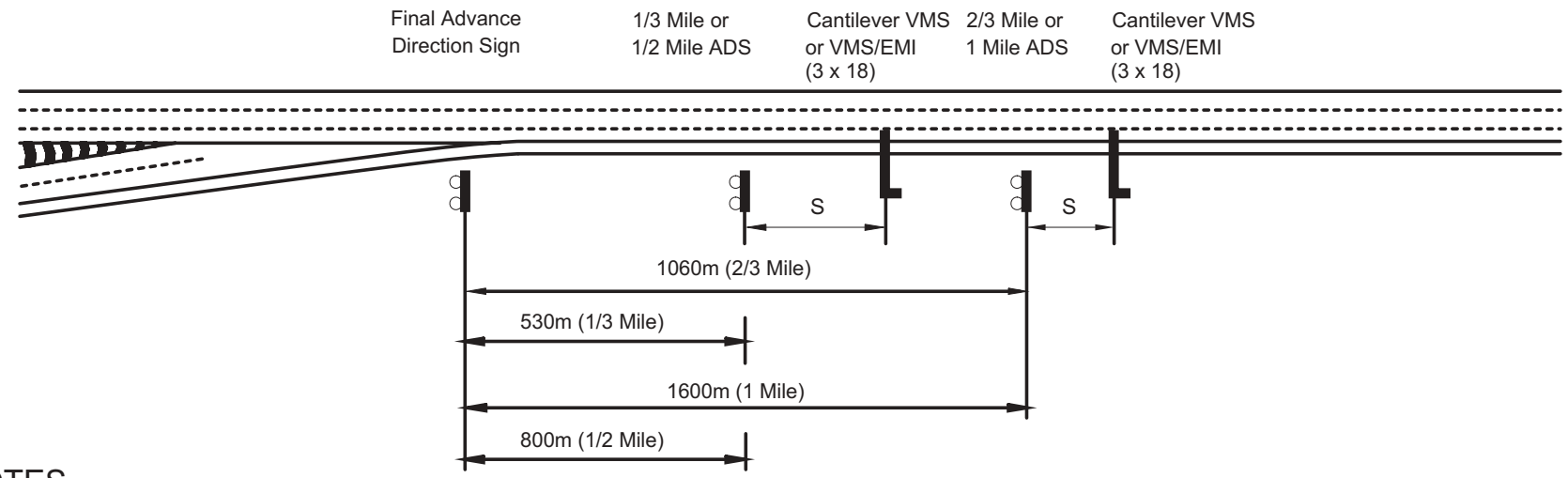


Figure D4.2a



NOTES

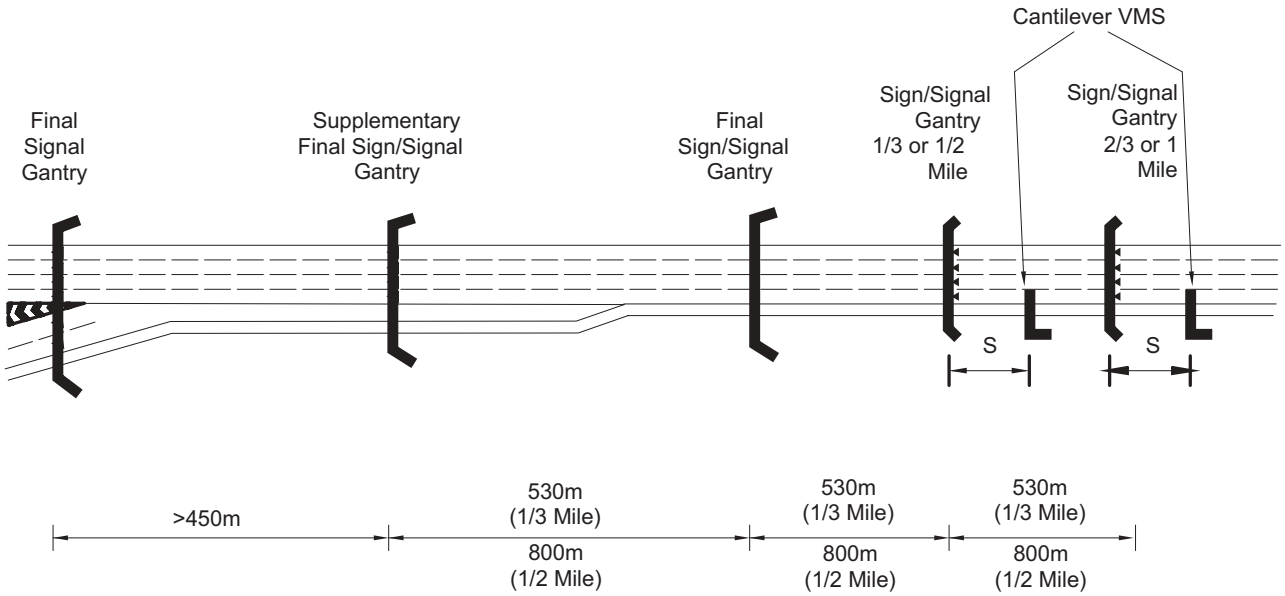
1. To determine separation distance S refer to Paragraph D4.2 and Figure D4.2a

2. For sections of motorway with portal gantry signals/ADS the strategic VMS solution should be similar to that shown on Figure D4.2c

3. On sections of motorway where MS2 is in place or planned a combined strategic cantilever VMS/EMI should be provided, otherwise a VMS only is required.

PROVISION OF STRATEGIC VMS ON D2/3 ALL PURPOSE TRUNK ROADS AND MOTORWAYS WITH VERGE MOUNTED ADS

Figure D4.2b



NOTES

1. The layout and separation for the sign/signal gantries is taken from DMRB Vol9, Section 4, Part 3 TA74/97. MOTORWAY SIGNALLING.

2. To determine the separation distance 'S' refer to Paragraph D4.2 and Figure D4.2a.

3. The diagram shown is for a parallel deceleration lane. However a similar relationship between the strategic EMS and sign/signal gantries will apply to other diverge arrangements.

4. The sign/signal granties should comprise lane signal matrices supported by 2x12 EMS (320mm character height) plus ADS.

5. The cantilever VMS should comprise 3x18 400mm characters. If it comprises an integral matrix, this facility should be disabled.

PROVISION OF STRATEGIC EMS ON ALL PURPOSE TRUNK ROADS AND MOTORWAYS WITH SIGN/SIGNAL PORTAL GANTRIES

Figure D4.2c

D5. VMS INFRASTRUCTURE

D5.1 Control Systems

1. Variable Message Signs (VMS) can be controlled by all current motorway control systems. Designers should assess the suitability of using existing control and communications systems for the Strategic Traffic Management Systems (STMS) scheme in consultation with Roads Service. Existing or planned systems used for VMS control include:

- Motorway Control System
- Urban Traffic Control System.
- Automatic Incident Detection Systems.
- Ramp Metering Systems
- Remote Monitoring Systems
- Other Stand Alone Systems.

2. Reference should be made to Roads Service to determine if the existing communications infrastructure can support proposed STMS applications

D5.2 Roadside Infrastructure

General

3. Roads Service should be consulted to determine whether the existing motorway communications infrastructure can support proposed STMS applications. Where new STMS schemes are to be introduced on sections of motorway with a suitable communications infrastructure, works should be limited to civil works and local modifications to existing cabling and power supplies.

4. In other areas, it will be necessary to develop the solutions identified during the feasibility study such as cabling to the motorway, or radio, private lines, ISDN or similar links to more remote locations.

Enhanced Message Signs

5. The infrastructure for a typical Enhanced Message Signs (EMS) site comprises:

(i) a foundation and plinth fitted with a standard holding down arrangement to support the cantilever structure and EMS enclosure

or

a Portal Gantry suitably modified to provide support for the EMS and Enclosure

(ii) Communications Cabinet Type 600 and Power Cabinet Type 609 with associated cabling and ducts

(iii) safety fencing - double height Open Box Beam

(iv) paving, handrails and retaining walls as required by site conditions.

6. A typical Cantilever EMS Outstation Layout is shown on Drawing MCX 0582.

7. A Portal Gantry Outstation Layout is shown on Drawing MCX 0800. This shows the arrangement where a ducted cable network is provided. At all other locations, the cables between the gantry and equipment cabinets will be directly buried.

8. Further guidance is given in Specification TRH 1642, ‘Motorway Signals Mark 2, Infrastructure Design Guide’.

Fixed Text Message Signs

9. The infrastructure for a typical Fixed Text Message Signs (FTMS) site comprises:

(i) a foundation, either a reinforced concrete block with no holding down arrangement where the FTMS post fixings are drilled into this foundation or a similar block with appropriate post holes

(ii) Communication cabinet Type 600 and a Power Cabinet Type 609 with associated cabling and ducts

(iii) safety fencing to suit location

(iv) paving, handrails and retaining walls as required by site conditions.

D5.3 Technical Approval

Cantilever Structures

10. Cantilever gantries are designed as two elements:

(i) foundation

(ii) superstructure.

11. The foundation comprises a reinforced concrete plinth incorporating a standard holding down arrangement for the superstructure. Details are given in Drawings MCX 0583.

12. Technical Approval must be in accordance with Roads Service procedures. If the foundation and superstructure are designed independently, or by different design organisations, a Technical Approval submission must be made for each element.

13. Cantilever foundations and superstructures are classed as Category II structures and, as such will require independent checks of the design.

Existing Gantries

14. Existing gantries should already be certified to NIRS 7/82. Technical Approval is therefore required for the addition of VMS sign enclosures and mounting equipment and the effect of these additions on the gantry structure.

15. Detailed designs already exist for the additional steelwork to support 320mm EMS to be mounted on certain ‘standard’ gantries. This design and where it can be applied is shown on Drawing No. MCX 0584.

16. Where VMS signs other than the 320mm are to be installed, a new design must be developed specifically for each situation.

17. The gantry designers should be asked to carry out checks to ensure there is adequate reserve structural capacity to support the VMS, and to establish whether the gantry loading on foundations is exceeded.

18. The Technical Approval submission must refer to the structure number for the existing gantry. Design and check certificates must be produced for the additions, and a separate check certificate must be produced by the gantry designer for the effect on the gantry.

D5.4 Holding Down Arrangement

19. When foundations are constructed, it is essential the contractor uses a template provided by the supplier of the superstructure.

20. On contracts where different contractors are responsible for the construction of the base and superstructure, steps must be taken to ensure that the interface between the two elements matches.

D5.5 Optical Alignment

21. When using VMS based on light emitting technology, it is particularly important to ensure correct optical alignment of the sign with the carriageway. Design requirements, and the method to be applied on site are given in Drawing MCX 0069.

D5.6 Ordering of Equipment

22. A request for Financial Approval and Equipment Order shall be made according to MCH 1286. Bulk Purchase Equipment Order and Financial Approval shall be made according to MCH 1288.

23. Reference should be made to Specification TRH 1239, in particular Drawings MCX 0590 and MCX 0591, which show the equipment configuration for EMS outstation sites.

D6. GLOSSARY OF TERMS

1. A glossary of general terms applying to Motorway Communications is given in TA 70/97.

2. Definitions for additional terms used in the context of this Advice Note are as follows:

Cantilever

An overhead structure which extends from the verge. It comprises a single column and an arm supporting an Enhanced Message Sign (EMS) or Motorway Signal Mark 2.

Continuous Sign

A Variable Message Sign (VMS) that appears to be made up of solid characters or symbols. The sign face is changed by removing one set of symbols/characters and replacing them with another, or by having a multiple face that can rotate.

Discontinuous Sign

A VMS in which the sign face is made up of individual elements having at least two states. By changing the state of the individual elements, different characters and symbols can be created within the same sign area.

Driver Information Systems

Give the motorist information of a tactical and strategic nature, but also with messages relating to conditions on the network that may affect expected journey times.

Enhanced Message Sign

A type of VMS based on light emitting technology. The EMS can display a variety of legends that may be configured and controlled remotely from an instation.

Fixed Text Message Sign

A type of VMS able to display a limited number of fixed messages. Signs for strategic applications use a mechanical rotating prism as the mechanism for changing the sign legend.

Intervention Node

A road junction that offers alternative routes, where variable message signs and appropriate legends can be used to intervene traffic, and modify or block the normal journey route as shown on directional signing.

Portal Gantry

An overhead structure that spans the carriageway and is used to support combinations of signals, variable message signs and conventional fixed signs.

Sign

A device carrying directional or other informational message, eg route information at the approach to a junction.

Signal

A device used to give advisory or mandatory instructions, e.g. stop or 30 mph speed restriction.

Strategic Traffic Management Systems

Give the motorist information and advice on the road network ahead. The aim is to improve the performance of the network by redistributing traffic efficiently when congestion occurs on some links and spare capacity is available on others.

Tactical Control Systems

Provide supplementary information to complement matrix signals and other traffic control signs for local management of incidents or occurrences.

Variable Message Sign

A generic term for a sign that can display multiple legends or messages.

Both EMS Fixed Text Message Signs (FTMS) are different types of VMS.

VMS can display text messages and/or symbols using any of the following technologies:

(a) Rotating Prism

(b) Reflecting Cells

(c) Light Emitting Cells.

NMCS

The Highways Agency's National Motorway Communications System.

D7. REFERENCES

Design Manual for Roads and Bridges

BD 2/89: Technical Approval of Highway Structures on Motorways and Other Trunk Roads. Part 1: General Procedures – DMRB, Volume 1, Section 1, Part 1.

HD 19/94: Road Safety Audits – DMRB, Volume 5, Section 2, Part 2.

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