

Highways Agency

Motorway Communications Services PFI Study

Final Report

Volume 2 - The Report

Author Various

Checker Name Redacted under Sec 40 of the FOIA Exemptions 'Personal Information'

Approver Name Redacted under Sec 40 of the FOIA Exemptions 'Personal Information'

GD00323/RT/E/009-2/C

28 July 2000

This report has been prepared for Highways Agency in accordance with the terms and conditions of appointment for the Motorway Communications Services PFI Study dated 30/03/99. KHHS can not accept any responsibility for any use of or reliance on the contents of this report by any third party.

TABLE OF CONTENTS

TABLE OF CONTENTS	3
LIST OF DEFINITIONS	7
1.0 INTRODUCTION.....	13
1.1 Recommendations	13
1.2 The Motorway Communications Services PFI Study	14
1.3 This Report.....	14
1.4 Scope	15
1.5 Structure of this report.....	17
2.0 CURRENT ARRANGEMENTS.....	21
2.1 Introduction	21
2.2 Background	21
2.3 HA organisation structure	23
2.4 The role of communications within the HA's current activities.....	25
2.5 Motorway communications services	26
2.6 Triple Package.....	33
2.7 HA's business communications network	34
3.0 FUTURE REQUIREMENTS.....	37
3.1 Introduction	37
3.2 HA's short to medium term requirements	37
3.3 TCC.....	40
3.4 Coleshill	45
3.5 NMCS telephone system.....	46
3.6 Longer term MCS requirements.....	47
4.0 THE COMMUNICATIONS NETWORK VISION	49
4.1 Introduction	49
4.2 The HA as network operator	49
4.3 Potential changes to the HA's business.....	50
4.4 The role of communications in delivering the HA's business.....	57
4.5 What role should the HA take in telecommunications?	58
4.6 The requirement for a highways communications network	60
4.7 The target network	62
4.8 Delivering the target network.....	73
5.0 COMMERCIAL OPPORTUNITIES.....	75
5.1 Introduction	75
5.2 Spare network capacity	75
5.3 Facilities management.....	77
5.4 Use of land and structures for telecommunications masts.....	78
5.5 Roadside to vehicle communications	81

6.0	CONSTRAINTS	87
6.1	Introduction	87
6.2	The contracting party's powers	87
6.3	Exercise of Code powers	89
6.4	Delegation of statutory highways functions	90
6.5	Data protection and confidentiality issues	90
6.6	Resolving the legal issues	91
6.7	Policy constraints	93
7.0	APPROACH TO FORMULATING STRATEGIES	97
7.1	Introduction	97
7.2	Approach	97
7.3	The HA's communications requirements	98
7.4	Procurement packages	98
7.5	Procurement methods	100
7.6	Introduction to the Strategies	107
7.7	Project timeline	111
7.8	Matching the Strategies to the HA Options	113
8.0	PFI ISSUES	117
8.1	Introduction	117
8.2	Charging principles	117
8.3	Realising the benefit of third party revenues	120
8.4	Ownership of assets at the end of a PFI contract	121
9.0	STRATEGY 2 - DO MINIMUM	125
9.1	Introduction	125
9.2	Specification	125
9.3	Delivery	126
9.4	Ownership	126
9.5	Third party income possibilities	126
9.6	Timetable and term	126
9.7	Payment	126
9.8	Performance	127
9.9	PSC assumptions	127
9.10	Fit with government policy	127
9.11	Benefits	127
9.12	Disadvantages	127
10.0	STRATEGY 3 - PFI FOR A NATIONAL NETWORK	129
10.1	Introduction	129
10.2	Specification	129
10.3	Delivery	131
10.4	Ownership	131
10.5	Third party income possibilities	132
10.6	Staffing	132

10.7	Timetable and interim arrangements	132
10.8	Payment.....	132
10.9	Performance	133
10.10	PSC assumptions.....	133
10.11	Fit with government policy	134
10.12	Benefits	134
10.13	Disadvantages	134
11.0	STRATEGY 4 - PFI FOR AN ENHANCED NATIONAL NETWORK.....	135
11.1	Introduction	135
11.2	Specification.....	135
11.3	Delivery.....	136
11.4	Ownership	137
11.5	Third party income possibilities	138
11.6	Staffing.....	138
11.7	Timetable and interim arrangements.....	138
11.8	Payment.....	139
11.9	Performance	139
11.10	PSC assumptions.....	139
11.11	Fit with government policy	140
11.12	Benefits	140
11.13	Disadvantages	140
12.0	STRATEGY 5 - DESIGN, PROVISION AND MAINTENANCE OF ROADSIDE EQUIPMENT	141
12.1	Introduction	141
12.2	Existing Arrangements.....	141
12.3	The Opportunity	143
12.4	Strategy 5 in the context of this Study	145
13.0	TRANSITION ISSUES.....	148
13.1	Introduction	148
13.2	Procurement of services under a PFI Scheme	149
13.3	Transition arrangements.....	150
13.4	Interfaces between MCS Co and RMC	152
13.5	Extending the MCS Cloud to roadside devices.....	153
13.6	Legal issues	155
13.7	Interface with the Maintaining Agent and Term Maintenance Contractor.....	156
14.0	FINANCIAL ANALYSIS AND RANKING	160
14.1	Introduction	160
14.2	Wider socio-economic benefits	160
14.3	HA risk adjusted NPV retained costs	161
14.4	Commentary on results.....	162
15.0	NATA	164

15.1	Introduction	164
15.2	New Approach to Appraisal	164
16.0	CONCLUSIONS AND RECOMMENDATIONS	170
16.1	Introduction	170
16.2	The place of telecoms in the HA's strategic vision	170
16.3	Current arrangements for the provision of the HA's communications	171
16.4	Roadside to vehicle communications	172
16.5	Separate provision of devices and the network	172
16.6	Opportunities for private sector involvement	173
16.7	Potential constraints	173
16.8	Advantages of private sector involvement	174
16.9	Recommendations	174
16.10	MCS PFI	174
16.11	Telecommunications mast sites interim measures	176
16.12	Business communications	177
16.13	Existing Triple Package and SDH programmes	178
16.14	Roadside communications devices	179
16.15	APTR	180
17.0	NEXT STEPS	183
17.1	Introduction	183
17.2	Decision on the Study recommendations	183
17.3	Deployment of telecommunications masts	183
17.4	Consultation with industry	183
17.5	Liaison with TCC	183
17.6	Development of ITT	184
17.7	Continued development of existing communications	184
17.8	HA staffing requirements	184
	WORKSHOP PARTICIPANTS AND INTERVIEWEES.....	187
	Attendees at the Options Workshop 1 (London, 2 July 1999)	189
	Attendees at the Options Workshop 2 (Bristol, 9 August 1999)	189
	Attendees at the Options Workshop 3 (Bristol, 8 September 1999)	Error! Bookmark not defined.
	Attendees at the Risk Workshop (Bristol, 2 December 1999)	190
	Interviewees for this report	191

LIST OF DEFINITIONS

ACPO	Association of Chief Police Officers
APTR	All Purpose Trunk Road
AST	Appraisal Summary Table
ATM	Asynchronous Transfer Mode
BIS	HA Business Information Systems Division
BNRR	Birmingham Northern Relief Road
BTS	Base Transceiver Station
CCTV	Closed Circuit TeleVision
CDS	Cellular Design Services Limited
CENLOG	CENtral LOGging facility
CMG	Computer Management Group plc
CO	Control Office
COBA	Cost Benefit Analysis
COBS	Control Office Base Systems
CSR	Comprehensive Spending Review
DBFO	Design, Build, Finance and Operate
DERA	Defence Evaluation and Research Agency
DETR	Department of the Environment, Transport and the Regions
DRC	Dartford River Crossing Concession Company
DSRC	Dedicated Short Range Communications
EMS	Enhanced Message Signs
ERT	Emergency Roadside Telephone
FDM	Frequency Division Multiplexing
Final Report	This report
FS	HA Finance Services Directorate

GLA	Greater London Authority
GPRS	Global Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
GTN	Government Telephone Network
HA	Highways Agency
HA Options	The HA's procurement options for the MCS set out in the Specification
HDSL	High speed Digital Subscriber Line
HRS	HA Human Resources Directorate
IP	Internet Protocol
IPL	Information Processing Limited, a consultant appointed by the HA to carry out a study into future network architecture.
IPO	Initial Public Offering
ISDN	Integrated Services Digital Network
IT	Information Technology
ITS	Information Transport Systems
ITT	Invitation To Tender
KHHS	KPMG, Hyder Consulting, Herbert Smith and The Smith Group
MA	Managing Agent
MCS	Motorway Communications Services
MCS Co	MCS Contractor
MD	MIDAS Detector
MDIS	Midlands Driver Information System
MFO	Maintain, Finance and Operate
MIDAS	Motorway Incident Detection and Automatic Signalling
MO	Maintain and Operate
MOLA	MCONTRAM On-Line Assistant

MS	Message Sign
MT	MIDAS Transponder
MVNO	Mobile Virtual Network Operators (organisations which offer mobile subscription and call services, but do not have an allocation of radio spectrum)
NATA	New Approach to Appraisal
NCS	HA Network and Customer Services Directorate
NCP	Network Communications Programme
NERA	National Economic Research Associates Limited
NMCS	National Motorway Communication System
NPI	Network Management Interface
NPV	Net Present Value
NSPF	HA's Network Strategy and Private Finance Division
NTCIP	National Transportation Communications for ITS Protocol
NTMC	National Transmission Maintenance Contract
NTWC	National Transmission Works Contract
OFTTEL	Office of Telecommunications
PABX	Private Automatic Branch eXchange
PCM	Pulse Coded Modulation
PCO	Police Control Office
PDH	Plesiochronous Digital Hierarchy
PFI	Private Finance Initiative
PPP	Public Private Partnership
PS	HA Project Services Directorate
PSC	Public Sector Comparator
PSTN	Public Switched Telephone Network
PTO	Public Telecommunications Operator

QS	HA Quality Services Directorate
RA	Radiocommunications Agency
RCC	Regional Communications Controller
Report 1	KHHS's first report in accordance with the Specification entitled <i>Existing Arrangements for the Provision and Maintenance of the HA's Communications Services</i>
Report 2	KHHS's second report in accordance with the Specification entitled <i>Future Requirements of the HA's Motorway Communications Network</i>
Report 3A	KHHS's third report in accordance with the Specification entitled <i>Assets Available for Exploitation</i>
Report 3B	KHHS's fourth report in accordance with the Specification entitled <i>Telecommunications Market Survey Report</i>
RMC	Regional Maintenance Contractor
RMCMC	Regional Maintenance Contractor Management Consultant
RO	Regional Office
Roads Review	The Government's statement of policy on trunk roads, <i>A New Deal for Trunk Roads in England</i>
RPA	Royal Parks Agency
RSI	Radio Spectrum International Limited
SCADA	Supervisory Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SIM	Subscriber Identification Module (the card that goes in a GSM phone which gives it its person specific characteristics)
SMDS	Switched Multimegabit Data Service
Specification	HA's document MCF 2379A, <i>Motorway Communications Services PFI Study, Specification of Consultants Duties</i>
SPV	Special Purpose Vehicle
SSAP	Statement of Standard Accounting Practice
Strategy(ies)	Strategies 1 to 5, being the principal procurement options identified and reviewed by KHHS
Study	Motorway Communications Services PFI Study

TAF	Task Authorisation Forms
TCC	Traffic Control Centre
TCC Co	The TCC contractor
TCCI	Traffic Control Centre Interface
Telephone Study	A Study into the Future of the NMCS Telephone System undertaken by KHHS as an additional task to this Study. (Task KHHS002)
TETRA	Terrestrial Enhanced Trunk Radio
TPI	Targeted Programme of Improvement (projects)
TMC	Term Maintenance Contractor
TS	Transmission Station
TSS	HA Traffic Systems and Signing Division
UMTS	Universal Mobile Telecommunications System
URECA	Urban Economic Appraisal, a computer programme used by DETR to estimate the costs and benefits of urban road schemes.
VMS	Variable Message Signs
WAN	Wide Area Network

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 INTRODUCTION

1.1 Recommendations

1.1.1 This report makes the following six recommendations:

Recommendation 1

1.1.2 The HA develops an ITT for the PFI procurement of a national motorway communications network up to the roadside verge, with a variant requirement to provide a roadside to vehicle link.

1.1.3 As part of this procurement, the private sector bidder be provided with the right to exploit surplus fibre capacity in the network for commercial services and the obligation to develop a managed telecommunications mast sharing service.

Recommendation 2

1.1.4 The HA establishes a plan for progressing interim arrangements for the letting of telecommunications mast sites on its property.

Recommendation 3

1.1.5 The provision both of an ATM-based office WAN service and, separately, the provision of business telephony service over the WAN, be offered as a variant requirement in any ITT for the PFI procurement in Recommendation 1.

Recommendation 4

1.1.6 The existing Triple Package programmes be continued, and reviews of the scope, planning and prioritisation of Triple Package schemes and the method of their procurement be carried out.

Recommendation 5

1.1.7 The existing proposal for a new (SDH) transmission network be progressed, but a review of the relative costs and functionality of different choices of transmission technology be carried out.

Recommendation 6

1.1.8 The HA continues to review on a project by project basis the purchase of its roadside equipment with a view to introducing whole life cost principles into its design, purchase, integration, assembly, storage, provision and maintenance through the use of PPP and PFI type arrangements.

1.2 The Motorway Communications Services PFI Study

1.2.1 KPMG, Hyder Consulting, Herbert Smith, and The Smith Group (“KHHS”) are assisting the Highways Agency (“HA”) in its study (“Study”) into the procurement and provision of motorway communication services (“MCS”). The scope of work carried out by KHHS as part of the Study is contained in the HA’s document MCF2379A, *Motorway Communications Services PFI Study, Specification of Consultants Duties* (“Specification”).

1.2.2 In summary, the Specification requires KHHS to review and recommend on the following:

- a) new ways of procuring existing services to support and maintain the HA’s motorway communications network;
- b) new ways of procuring motorway communications infrastructure and transmission networks;
- c) opportunities for the commercial exploitation of the HA’s communication assets on the HA’s core and non-core road networks; and
- d) new ways of procuring the communications services which support the running of the HA’s business.

1.2.3 The HA’s objectives for the Study and any subsequent contract(s) are to:

- a) obtain better value for money for the provision of communication services;
- b) enable the expansion of the HA’s communications networks to meet expected demands for increased bandwidth;
- c) defray the cost and risk of developing the HA’s communications networks by means of public private partnerships (“PPP”s); and
- d) inform judgement on the Traffic Control Centre (“TCC project”).

1.3 This Report

1.3.1 This report (“Final Report”) is the final deliverable which KHHS have been appointed to prepare under Part A of the Study. It sets out and advises on the procurement options (the “Strategies”) for delivery of the HA’s communications requirements, and also develops the Strategies and Public Sector Comparators (“PSC”s) in accordance with sections 3.4 and 3.5 of the Specification.

1.3.2 The Final Report has been compiled by KPMG with inputs from Herbert Smith, Hyder Consulting and The Smith Group in their respective areas of expertise. Strategies and relevant PSCs have been developed and financially assessed and conclusions drawn on their technical, operational and legal feasibility, and the value for money they may deliver. KHHS have provided their recommendation on the procurement Strategies which they consider should be taken forward in Part B of the project, the implementation.

1.3.3 The Final Report has been produced for the benefit of, and is addressed to, the HA for use in connection with the Study. No responsibility or liability or duty of care is or will be accepted by KHHS to any other party. If the HA distribute, circulate or otherwise disseminate this Report to any other entity or person, it shall draw their attention to this paragraph.

1.4 Scope

1.4.1 KHHS carried out their duties under the Specification in four stages: review, strategy development, financial assessment, and report and conclusion.

Review

1.4.2 KHHS carried out extensive review work of the circumstances surrounding the Study, and this review work is recorded in four reports as follows:

- a) Existing Arrangements for the Provision and Maintenance of HA's Communication Services ("Report 1");
- b) Future Requirements of the HA's Motorway Communications Network and of the HA's Business Communications ("Report 2");
- c) Assets Available for Exploitation ("Report 3A"); and
- d) Telecommunications Market Survey Report ("Report 3B").

1.4.3 These reports provide the essential background detail necessary to understand the HA's existing operations and the range of viable opportunities open to the HA and to the private sector. They enabled KHHS to identify the opportunities available to the HA and the private sector in the provision of the HA's communications requirements and the constraints on the exploitation of these opportunities.

Strategy development

1.4.4 Through interviews and workshops within the KHHS team and with HA senior management, KHHS identified the HA's minimum short term future communications requirements and its potential longer term requirements. These longer term requirements have been termed the HA's "Communications Network Vision". By matching the HA's future requirements against private sector opportunities, KHHS identified a number of procurement options or Strategies to be developed and reviewed by the Study team.

Strategy assessment

- 1.4.5 KHHS reviewed the Strategies for technical and financial viability and against these identified legal and policy constraints. As part of this review, KHHS developed financial models for each Strategy to analyse the range of the HA's retained risk adjusted costs over a period of assessment, so enabling the range of potential net present value ("NPV") costs of each option to be compared.
- 1.4.6 Where a Strategy advocates private sector provision through a Private Finance Initiative ("PFI") or PPP arrangement, a PSC was developed that assumes the provision of the same functionality as the PFI option but through conventional public sector procurement.
- 1.4.7 Also at this stage in the project, the issues that would have to be developed during implementation of the Strategies were identified, particularly looking at transition from the existing arrangements to proposed new arrangements.

Report and conclude

- 1.4.8 This final stage of the Study has been to report on the analysis, draw conclusions and make recommendations as to the next steps to be taken. In so doing the outcome of the financial assessment has been considered, together with an assessment of the commercial, technical and legal circumstances of each Strategy. The results of this work and the conclusions and recommendations are provided in this Final Report.

Sources of information

- 1.4.9 This Final Report is based on:
- a) the findings of the review work carried out in the course of the Study as documented in Reports 1, 2, 3A and 3B;
 - b) data and observations gathered in the course of interviews (or telephone conversations where an interview was not merited or practical) with:
 - HA personnel responsible for the management of developments in road network and traffic management and control which have associated communications requirements;
 - HA personnel responsible for the management and development of business communications services;
 - HA legal advisers; and
 - senior management and directors of telecommunications operators (both fixed and mobile), telecommunications equipment manufacturers and operators, service industry organisations, telecommunications infrastructure providers, utilities telecommunications providers, external suppliers of motorway communications equipment and services, and relevant regulatory bodies;

- c) reviews of HA databases, drawings, project related documents and relevant reports where available;
- d) reviews of reports and conferences on telecommunications technologies and markets;
- e) review of the legal framework within which any private sector participation would take place, including certain of the HA's existing contractual arrangements;
- f) consultation with all the HA Directorates (Network and Customer Services ("NCS"), Project Services ("PS") and Quality Services ("QS")) as well as HA specialists dealing with lands, environment and structures;
- g) KHHS's understanding of the HA's infrastructure and facilities gained in the course of previous work carried out for the HA;
- h) data on the cost of current operations provided by the HA; and
- i) discussions with HA's project manager for this study.

1.4.10 The reader's attention is drawn to the limitations on the scope of our work set out in section 1 of Reports 1, 2, 3A and 3B. These describe, among others, difficulties in obtaining some of the necessary information, omissions in legal documentation made available to KHHS and alterations made to the scope of our work in the interests of materiality. In addition, it should be noted that KHHS have relied on representations made by HA management and third parties as to the accuracy and validity of information provided to us. KHHS have, however, sought to ensure, where possible, that this information is consistent with management representations and explanations, our own experience and other information made available to us.

1.5 Structure of this report

1.5.1 This Final Report is provided in four volumes to facilitate its use. The structure of each volume is set out below.

Volume 1 – Executive Summary

1.5.2 Volume 1 provides a summary of the key observations, conclusions and recommendations contained in Volumes 2 and 3. It is intended to provide the reader with an overview of the findings of the Study. It must be read in conjunction with the full report contained in Volume 2 - Final Report, and Volume 3 – Financial Analysis, and must not be relied upon on its own.

Volume 2 – The Report

1.5.3 This Volume 2 forms the main report, and the remaining sections of this Volume are as follows:

- a) Section 2 **Current arrangements.** This section provides the background to the Study and a description of the current arrangements for the provision of the HA's motorway and business communications services.
- b) Section 3 **Future requirements.** This section sets out the HA's immediate minimum future requirements, the requirements derived from the Traffic Control Centre ("TCC") project, and the HA's potential longer term requirements.
- c) Section 4 **The Communications Network Vision.** This section sets out a vision of the HA's potential future communications network requirements based on the key observations and conclusions of the four previous reports. It provides the basis for the procurement Strategies that have been developed.
- d) Section 5 **Commercial opportunities.** This section sets out the commercial opportunities which may exist for the private sector associated with the provision of MCS.
- e) Section 6 **Constraints.** This section highlights a number of key legal, policy and operational issues associated with the exploitation of the commercial opportunities outlined in section 5.
- f) Section 7 **Approach to formulating the Strategies.** This section sets out KHHS's approach to identifying relevant, viable and feasible procurement Strategies.
- g) Section 8 **PFI issues.** This section provides an analysis of three key PFI issues facing the project.
- h) Section 9 to 12 **Strategies 2, 3, 4 and 5.** These sections provide a description of each Strategy and, where relevant, their associated PSCs.
- i) Section 13 **Transition issues.** This section describes the transitional issues for the HA associated with the Strategies.
- j) Section 14 **Financial analysis and ranking.** This section summarises the results of the financial analysis, providing comparable NPV costs to the HA in respect of each Strategy, and its PSC where relevant.
- k) Section 15 **NATA.** This section provides an initial assessment of the Strategies against New Approach to Appraisal ("NATA") criteria.

- l) Section 16 **Conclusions and recommendations.** This section sets out a brief synopsis of the main issues, the procurement Strategies considered, the results of the financial analysis and a commentary with recommendations on the Strategies which KHHS believe should be developed in Part B of the project, the implementation phase.
- m)Section 17 **Next steps.** This section provides an outline of the steps and actions to be taken in Part B.

Volume 3 – Financial Analysis

- 1.5.4 Volume 3 provides a detailed summary of the financial analysis carried out in support of the Study.

Volume 4 - Appendices

- 1.5.5 Volume 4 contains detailed support and output documentation from the financial modelling exercise in a series of Appendices.

Business case

- 1.5.6 This report covers the HA's requirements to provide a business case in the format set out in the Specification as follows:
- a) objectives – sections 3, 4 and 5;
 - b) options – sections 6 – 12.
 - c) appraisal of options – sections 14 and 15 – See also Volume 3
 - d) selection of preferred option – sections 13, 14, 15 and 16.

THIS PAGE INTENTIONALLY LEFT BLANK

2.0 CURRENT ARRANGEMENTS

2.1 Introduction

- 2.1.1 This section provides a description of the role, management, provision and maintenance of motorway communications and business communications within the HA. Its purpose is to establish the starting point from which analysis of future requirements and options for motorway communications can be developed. Readers already familiar with the current arrangements may miss out section 2.

2.2 Background

The HA and its objectives

- 2.2.1 The HA, an executive agency of the Department of the Environment, Transport and the Regions ("DETR"), is responsible, on behalf of the Secretary of State, for the maintenance, operation and improvement of the trunk road network in England. The trunk road network comprises 6,500 miles of trunk roads, which includes 2,000 miles of motorway.
- 2.2.2 The roles and responsibilities of DETR, the HA and other Government Offices are set out in a *Framework Document* published by the HA in July 1999. Prominent among a list of key objectives for the HA is for it to develop its role as trunk road network operator by implementing traffic management, network control and other measures aimed at making best use of the existing infrastructure and facilitating integration with other transport modes. Other objectives relevant to this Study are included also, such as those to:
- a) take action to reduce congestion and increase the reliability of journey times;
 - b) improve safety for all road users and contribute to the Government's new safety strategy and targets for 2010; and to
 - c) promote choice and information to travellers, monitoring and publishing information about the performance and reliability of the network.
- 2.2.3 These objectives embrace a common need to communicate information about the state of the network from the roadside to control points, and to communicate alerts and advice from the control points back to the road user.

The HA's motorway communications network

- 2.2.4 HA owns and operates a motorway communications network covering the motorways in England and certain all purpose trunk roads. The communications network is made up of multi-paired copper cable and fibre optic cable and associated equipment, and supports a number of MCS such as those for emergency roadside telephones ("ERT"s), closed circuit television ("CCTV"), fog and other environmental detectors, variable message signs ("VMS") and Motorway Incident Detection and Automatic Signalling ("MIDAS") equipment.

- 2.2.5 The MCS are currently operated by county police forces from 32 Police Control Offices (“PCO”s) across the country. Information about the current status of the motorway network is collected from roadside devices, and is supplemented by reports from police patrols, telephone calls from members of the public and similar oral reports. Advice and alerts are provided through matrix signals installed in the central reservation or on gantries above the carriageway, and, increasingly, through roadside enhanced message signs (“EMS”), capable of displaying text messages of two or more lines of up to eighteen characters. Information is also provided to motorists in the form of public radio broadcasts.
- 2.2.6 The existing motorway communications network has evolved in parallel with the development of the motorway network in England over the past forty years. The current network includes much equipment that is obsolete, is expensive to maintain, requires significant reconfiguration to support evolving requirements, and has insufficient capacity available to meet known firm future requirements.
- 2.2.7 In addition to motorways, the HA is responsible for the operation of all purpose trunk roads (“APTR”). For the purposes of this Study, the extent of APTR is that which will remain after the proposed ‘detrunking’ exercise, detailed in the Government’s statement of policy on trunk roads, *A New Deal for Trunk Roads in England* (the “Roads Review”), has been completed. It is noted that the motorway communications network does not extend to APTR except in a few locations. The principal MCS provided in trunk roads is emergency phones. These are by no means ubiquitous and are, for the most part, connected via public telephone services.
- 2.2.8 To be able to fulfil its role as network operator, the HA has recognised the need to look closely at its communications requirements and to take steps to ensure it is well positioned to meet these requirements. It has initiated this Study to recommend a procurement strategy that allows its requirements for MCS to be met in a manner that gives value for money, consistent with Government policy for increased participation of the private sector in public sector initiatives.
- 2.2.9 The HA operates through 11 main offices in various locations throughout the country. In common with many other organisations that operate from diverse locations and are responsible for a wide geographic area, the HA makes use of voice, data, video conferencing and homeworking communications services in support of the day to day running of its business. While looking primarily at motorway communications services, the Study also addresses the requirements for communications services on trunk roads and the possible inclusion of HA’s business communications services in any recommended solution.

The remainder of this section

- 2.2.10 The purpose of this section is to provide the reader with a full understanding of the HA’s internal organisation, its existing motorway and business communications requirements, and to explain their current provision, operation and maintenance.

2.3 HA organisation structure

- 2.3.1 The HA is an executive agency of DETR and operates through a Chief Executive Officer and five directorates. HA's organisation structure is shown in Figure 2.1, which also indicates the main areas of responsibility for each directorate. The following paragraphs provide a brief explanation of the particular responsibilities of each directorate for motorway and business communications services considered under this Study.

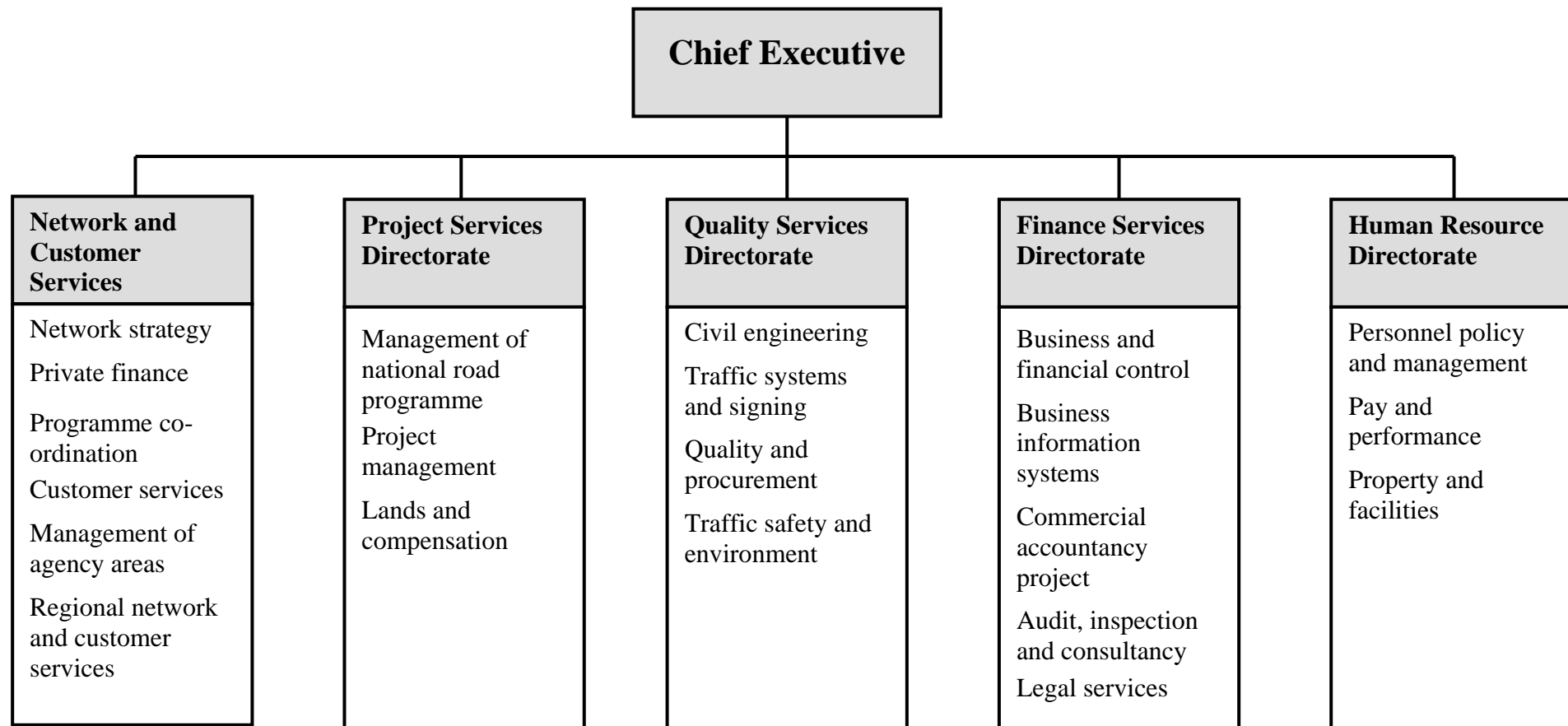


Figure 2.1: HA's Organisation Structure

- 2.3.2 NCS manages ‘routes’ (each route comprising trunk roads in twenty geographic areas) through staff based in seven Regional Offices (“RO”s). NCS also has particular responsibilities where trunk roads are covered by Design, Build, Finance and Operate (“DBFO”) contracts or other private operation arrangements. NCS identifies and commissions programmes of work on these routes such as major road improvement schemes, which may include motorway communications services. It also identifies and commissions other communications schemes (replacement or upgrades) for inclusion in a Network Communications Programme (“NCP”).
- 2.3.3 PS is the HA’s project delivery organisation and implements communications schemes identified by NCS and included in the NCP, once relevant approvals have been obtained and funds allocated. PS staff based in ROs have responsibility for management of Regional Maintenance Contractors (“RMC”s), either directly or via RMC Management Consultants (“RMCMC”s). In this respect, PS provides a service to NCS as route manager.
- 2.3.4 QS is responsible for maintaining the HA’s best business practice approach to the procurement, design, maintenance and operation of trunk roads. The HA Traffic Systems and Signalling Division (“TSS”), which initiated and manages this Study, is part of QS and has most responsibility for MCS. It sets standards for equipment and systems and is responsible for management of HA’s research and development strategy to encourage innovation and the introduction of new ideas, e.g. MCONTRAM On-Line Assistant (“MOLA”), Road Traffic Advisor project and controlled motorways. TSS is also responsible for design, implementation, configuration and maintenance of the national transmission network. To this end, TSS staff manage the National Transmission Maintenance Contract (“NTMC”) contractor, the National Transmission Works Contract (“NTWC”) contractor and leased services contracts. TSS also provides advice and assistance to other directorates in matters relating to motorway communications, particularly NCS and PS in relation to the design and implementation of schemes.
- 2.3.5 The Finance Services Directorate (“FS”) includes the Business Information Systems Division (“BIS”), which is responsible for the HA’s inter-office Wide Area Network (“WAN”) and data links to the Maintaining Agents and depots.
- 2.3.6 The Human Resources Directorate (“HRS”) is responsible for office telephony services and additional leased facilities for home-working and video conferencing.

2.4 The role of communications within the HA’s current activities

Motorway communications

- 2.4.1 The HA requires communications services in order to discharge its role as a road network operator and to meet certain policy obligations relating to motorway class roads (specifically, the provision and maintenance of emergency roadside telephones). These requirements are expected to continue into the foreseeable future.

- 2.4.2 There are four categories of MCS which are currently supported by the motorway communications network. They are:
- a) traffic data collection and incident detection (roadside to centre communications, including the emergency roadside telephones);
 - b) signals, control and sign setting (centre to roadside communications);
 - c) CCTV for condition monitoring, incident management and enforcement (video transmission from roadside to centre);
 - d) driver and traveller information provision (broadcasting and narrowcasting from the centre into the vehicle).
- 2.4.3 A fifth category of MCS which is the area expected to grow most dramatically in future is that of vehicle to centre communications (for applications such as motorway tolling, traffic data collection and advisory services, and the Automated Highway System).
- 2.4.4 The means by which these various communications needs are met, in terms of the structure of the motorway network, are described in section 2.5 below.

Business communications

- 2.4.5 Business communications embrace both telephony services and data networking, although it is really the latter which has significantly changing requirements. The data networking service includes the WAN which connects the 11 HA offices around the country, communications links between the HA and Maintaining Agents and a link providing access to the public Internet. Further details are given in section 2.7 below.

2.5 Motorway communications services

- 2.5.1 Motorway communications services include:
- a) roadside devices, such as ERTs, matrix indicators, CCTV, environmental sensors, MIDAS equipment and enhanced message signs;
 - b) copper and fibre optic cables installed adjacent to the motorway;
 - c) transmission equipment for voice, video and data; and
 - d) control office base systems (“COBS”), instation computer systems installed in Police Control Offices.
- 2.5.2 Figure 2.2 below provides a graphical illustration of the existing MCS.

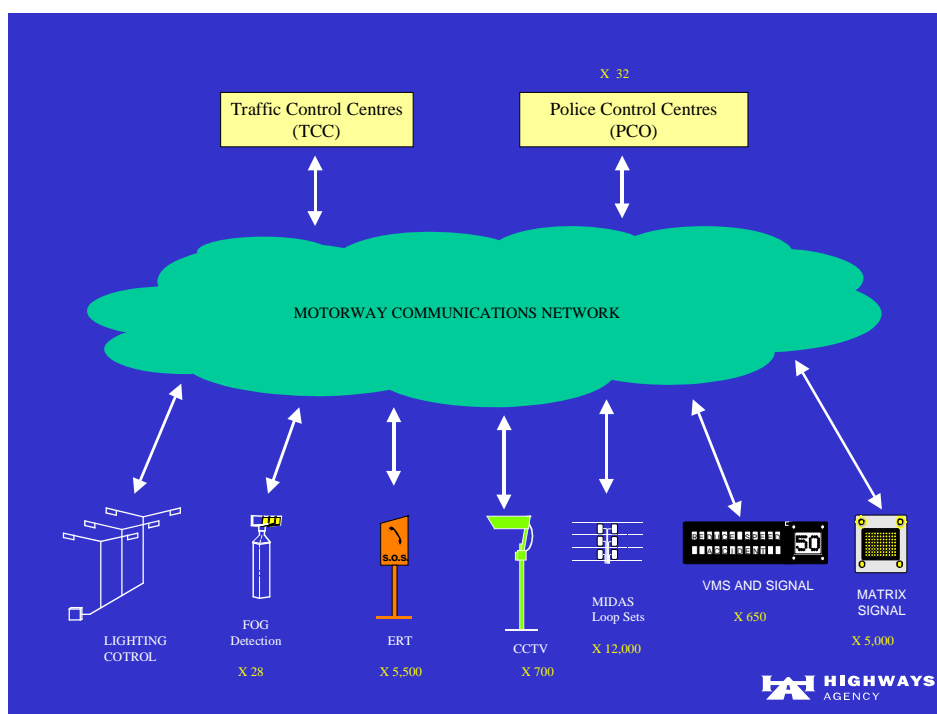


Figure 2.2: The HA's existing MCS

Control Office areas

- 2.5.3 At a functional level, the motorway network is best considered as being divided into areas, which are determined by geographic limits of responsibility of police forces. Each motorway/trunk road area is controlled from one of 32 PCOs, sometimes referred to as a Control Office ("CO"). The PCO communicates locally to the roadside equipment, and regionally via a Regional Communications Controller ("RCC") to other PCOs, and nationally to central logging facilities.
- 2.5.4 PCOs are linked together by the transmission network to share information across area boundaries. The national transmission network also supports centralised logging of operations. This facility, called the Central Logging facility ("CENLOG"), collates information from all PCOs and provides central monitoring, fault logging and records.
- 2.5.5 Locally, PCOs have both voice and data links to the roadside. The voice links are used by the emergency telephone system to allow Police operators to talk to motorists in need of assistance. Data links are typically used for communications with matrix signals, CCTV control, MIDAS equipment, EMS, and meteorological monitoring equipment.

Longitudinal cabling

- 2.5.6 Main longitudinal cabling is installed in the verge adjacent to one carriageway of the entire motorway network. The type and number of cables varies depending on the standard to which it was installed and the functions to be supported. A non-armoured 40-pair copper cable is installed where ducted infrastructure is provided. Older, first generation National Motorway Communications System ("NMCS") Mark 1 installations use an armoured 20-pair copper cable, which is directly buried in the verge. Longitudinal copper cables for early second generation NMCS Mark 2 installations were direct buried, 30-pair armoured type. This type of cable is currently the most prevalent type of installed cable.
- 2.5.7 Optical fibre cable is installed in the verge adjacent to one carriageway of approximately 50% of the motorway network. A 24-fibre, non-armoured optical fibre cable is included where ducted infrastructure is provided. Older style 'optical' cables are of the hybrid type. They are of armoured construction for direct burial and have 12 fibres and 11 copper pairs.
- 2.5.8 In addition to the longitudinal cables, local cables are used to connect devices to transponders or responders, and transponders or responders to longitudinal cables. These cables are, for the most part, multi-pair copper, but fibre optic cables are used to connect video signals from CCTV locations. Cables may be either direct buried and armoured or installed in ducts and non-armoured. Cable joints are accessible either in cabinets or chambers where ducted infrastructure is used.

National transmission network

- 2.5.9 A comprehensive transmission network has been established that operates over the cables installed adjacent to carriageways of motorways. Leased services are used to bridge those areas where it is impractical to install cables, e.g. between PCOs and the motorway. The transmission network includes local circuits to connect roadside devices to PCOs, regional circuits to connect adjacent PCOs to each other and national circuits to connect each PCO to a computer centre at Coleshill in the West Midlands.
- 2.5.10 The transmission network includes digital pulse coded modulation ("PCM") over fibre optic cables and an analogue twelve circuit frequency division multiplexing ("FDM") carrier network over copper cables for national and regional circuits. An FDM mini-carrier system is used over copper cables in certain local areas to support the emergency telephone network. The HA has prepared a business case to support the introduction of Synchronous Digital Hierarchy ("SDH") equipment in certain parts of the network, and this is examined further in section 3.
- 2.5.11 Transmission stations ("TS"s) are provided at motorway to motorway interchanges and at nominal intervals of 20 km along the motorway. Most TS comprise a purpose built structure adjacent to the motorway to house transmission equipment, but others comprise a number of external cabinets or pre-fabricated buildings.

- 2.5.12 TS are used as points where the voice and data circuits are amplified or combined together by multiplexing before passing them onto the next leg of the network on the longitudinal cables. CCTV optical fibre transmission equipment may also be contained within TS. TS make suitable connection points for the PCO, either with leased lines or dedicated cables.
- 2.5.13 Figure 2.3 shows the typical device interconnectivity of NMCS Mark 2 communications.

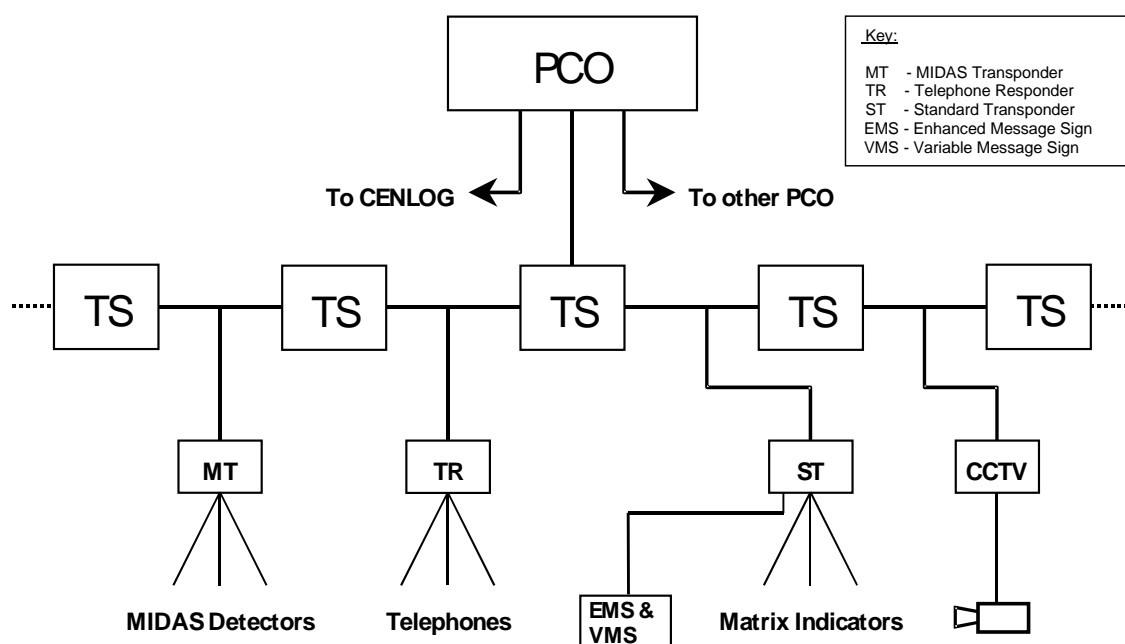


Figure 2.3: Equipment and cable configuration

Provision and maintenance of MCS

- 2.5.14 Implementation of the motorway communications services proceeds by way of defined 'schemes' which typically involve the provision of motorway communications services on a section of motorway within a single PCO. The cornerstone concept behind schemes is the so called 'Triple Package' of measures. Further details of the Triple Package and its programme for implementation are given in section 2.6.
- 2.5.15 Each scheme results in one or more infrastructure provision contracts being awarded. These contracts include elements of the Triple Package. Comprehensive test regimes are specified by HA, and these are carried out at all stages of an infrastructure provision contract. On satisfactory completion of the final commissioning and handover tests for a scheme, the equipment is transferred into maintenance, and responsibility for its continued operation passes to the RMC.

- 2.5.16 The national transmission network operates for the most part over cables installed and tested under infrastructure provision contracts. Procurement of specialised communications equipment for the network can be, for major enhancements or modifications, by way of separate national contracts.

National transmission works contractor

- 2.5.17 Longitudinal NMCS communications circuits along motorways are provided and operated by the HA. The on-motorway circuits, linked through TSs, provide delivery of communications between the various NMCS components as described above. As most PCOs are located away from the motorway, separate leased line circuits are provided to connect PCOs to the on-motorway transmission network.
- 2.5.18 Figure 2.4 shows typical provision of transmission circuits and equipment. Configuration and commissioning of new circuits within the national transmission network is the responsibility of the national transmission works contractor under the NTWC. This contractor may also be required to install transmission equipment, which is either purchased under the NTWC or under a transmission network provision contract. On satisfactory completion of commissioning tests, the equipment will be handed over to the NTMC contractor (see below) for on-going maintenance.

Leased services

- 2.5.19 Where leased facilities, such as private wire circuits, are required to complete the transmission network for a scheme, these are arranged by TSS by way of separate contracts with BT. ROs meet the installation and first year lease charges as part of the scheme costs. After the first year, responsibility for payment of charges for the leased facilities is passed to TSS. The HA is now planning to include all leased facilities in a single pool contract, which would be managed and funded by TSS.

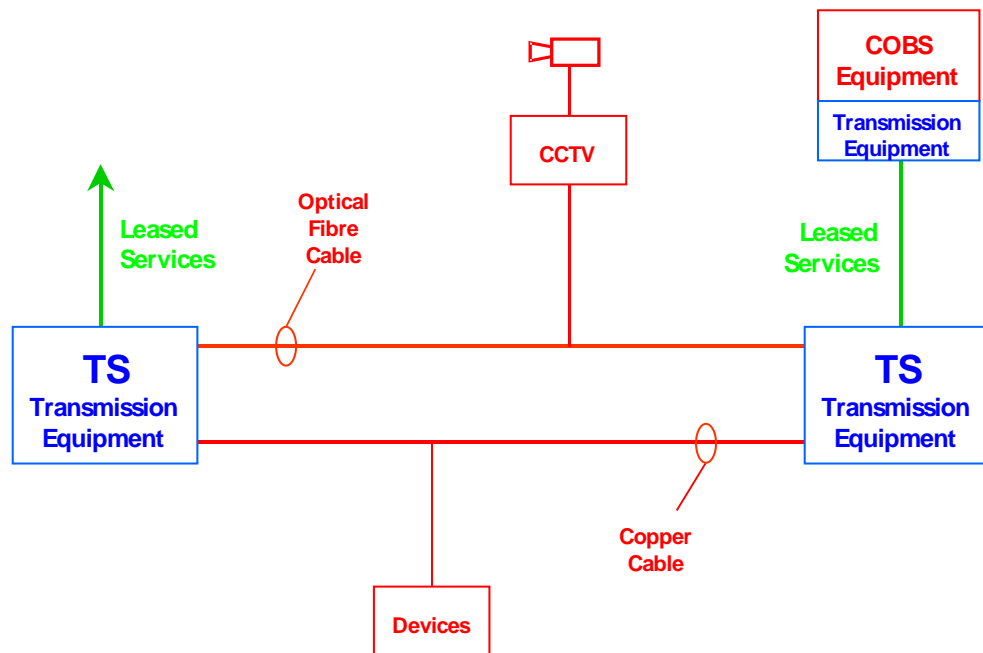


Figure 2.4: Provision of communications circuits and equipment

Maintenance of MCS

- 2.5.20 Maintenance responsibility is divided between regional maintenance contractors and a national transmission maintenance contractor. There are seven RMC contracts awarded by the HA. Each contract covers a geographic area defined by a number of PCO areas. In addition, there is an eighth RMC type contract for the area covered by the Dartford Control Office. This contract is awarded and managed by the Dartford River Crossing Concession Company ("DRC"). The HA pays 50% of the costs of this contract to DRC.
- 2.5.21 The RMC contractor is responsible for maintenance of the following plant within their area:
- COBS computer systems installed in PCOs;
 - telephone systems including telephone line controllers installed in PCOs;
 - motorway signalling systems;
 - CCTV systems;
 - traffic monitoring systems (MIDAS and Midlands Driver Information System ("MDIS"));
 - VMS systems;
 - copper cable infrastructure and cabinets; and
 - transmission systems to the extent they are not included in the NTMC.

- 2.5.22 The NTMC is a single contract for maintenance of the transmission network throughout the country by a dedicated team. Plant maintained under the contract includes:
- specialised telecommunications equipment installed in TSs, COs and computer centres throughout England;
 - fibre optic cables which are either direct buried or installed in cable trough or ducts adjacent to motorways throughout England;
 - Transmission supervisory control and data acquisition (“SCADA”) computer systems installed in two computer centres at Coleshill and West Houghton; and
 - building services within transmission buildings, including ac and dc power supplies and air conditioning plant.

2.5.23 Figure 2.5 shows typical maintenance arrangements for installations where longitudinal copper cable (20 or 30-pair) is installed with composite fibre cable (12 fibres plus 11-pairs). Here the NTMC contractor maintains the transmission equipment and circuits in the optical cable and those circuits in the copper cable which form part of the transmission network (i.e. not the local device communications links). The RMC is responsible for the maintenance of the copper cable (non-NTMC) parts and all equipment, i.e. COBS, CCTV and roadside devices.

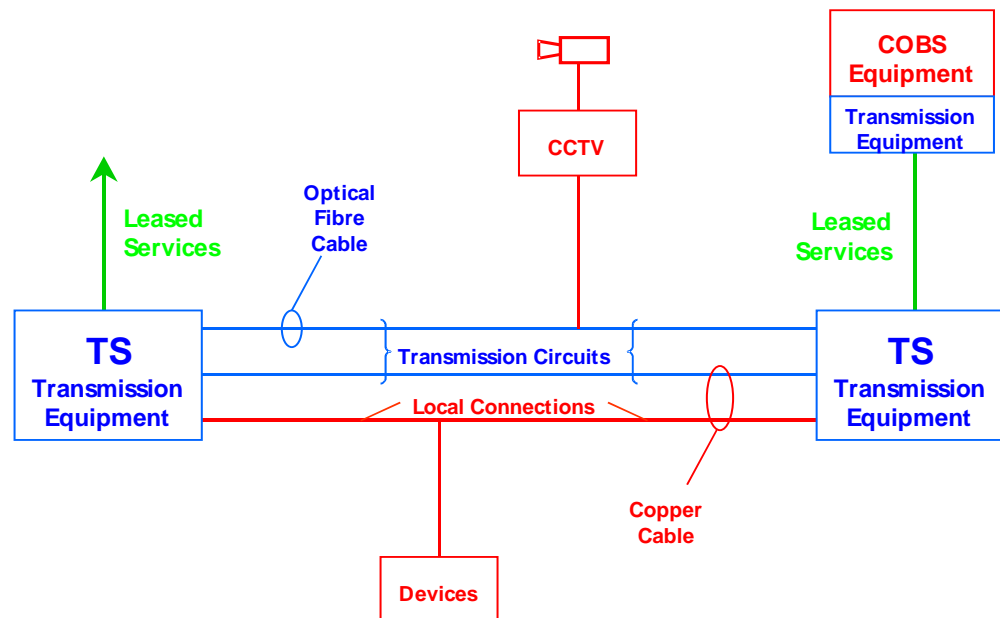


Figure 2.5: Maintenance of communications circuits and equipment

2.5.24 TSS staff, based in Tollgate House in Bristol, manage the NTMC Contractor. Management of the RMC is the responsibility of a RCMCM in the Northern and Southern Regions. The RCMCM is, in turn, managed by staff from PS based in ROs in Leeds and Dorking. In the Midlands Region, management of the RMC Contractors is by HA staff from PS, who are based in ROs in Birmingham and Bedford.

2.6 Triple Package

2.6.1 The HA's strategy for expansion of motorway communications services is based on a 'Triple Package' of measures that are implemented under various 'schemes'. The Triple Package comprises NMCS infrastructure, cantilever signals (Message Signs ("MS")² and MS3) and MIDAS signals.

2.6.2 NMCS infrastructure includes:

- a) construction of a ducted network for cables;
- b) installation and testing of non-armoured, 40-pair copper and 24-strand optical fibre longitudinal cables;
- c) installation and testing of local data communication cables from longitudinal cables to roadside cabinets;
- d) construction of cabinet bases and foundations for sign mounting poles;
- e) installation of cabinets and sign mounting poles; and
- f) installation and testing of power distribution network (cables and cabinets) within the motorway right of way from electricity board interfaces installed within the boundary fence.

2.6.3 Schemes may include variations from elements of the Triple Package. For example, in areas where fibre optic cable is already installed, albeit direct buried armoured cables, only the MS/EMS and MIDAS elements will be required. In other schemes, additional systems, such as CCTV, may be included.

2.6.4 The need for, and scope of, motorway communication schemes on particular sections of motorway is initially determined by NCS staff in the HA's ROs. This need may be determined from reviews of current traffic data and future predictions in growth, requests from the police, implementation of policy or replacement of existing equipment that has become life expired. Schemes may also be identified as part of planned major road improvement schemes. PS staff decide the facilities to be provided with technical advice and general assistance from TSS.

- 2.6.5 The RO puts forward proposed schemes to a central NCP and Strategy Group. Schemes are evaluated and ranked in order of priority for inclusion in the NCP. The evaluation process includes an assessment of the business case for each scheme. The business case may, in part, be justified by a per kilometre benefit based on lives saved, delays avoided and similar factors. There are three levels of priority which, in decreasing order, are: committed; unavoidable; and highly desirable. The highly desirable level is further divided into essential, normal, reserve and policy groupings. Those schemes that are given a 'committed' priority and for which funds are to be made available have been included in the three year Comprehensive Spending Review ("CSR"), the HA's programme of capital expenditure for the financial years 1999/00, 2000/01 and 2001/02.
- 2.6.6 Preliminary and detailed design, tendering and all matters relating to implementation of a scheme are the responsibility of PS. Technical assistance is available from TSS but, in most cases, consultants are appointed to undertake much of the detailed work. Historically, schemes have been fully designed by consultants, and contracts for construction of that design have been awarded by PS in accordance with HA procedures. There is currently a move towards letting contracts on a design and build basis as it is considered that this will put greater focus on the need to complete schemes in the programmed timescale.
- 2.6.7 Definition of schemes by the ROs covers schemes that are envisaged to start within the next five to six years. There does not appear to be a formal national longer term strategic plan, a factor that has become apparent from research carried out by KHHS.
- 2.6.8 HA's current process for evaluation of schemes gives priority for comprehensive upgrade, i.e. implementation of the Triple Package, on the most congested parts of the motorway network in significant work packages, related to PCO coverage.
- 2.6.9 Details of the HA's Triple Package plans for the next three years are provided in section 3.2.
- 2.7 HA's business communications network**
- 2.7.1 Business communications include the data and voice communications used by the Agency in its day to day business, comprising:
- a) the inter-office WAN;
 - b) data links to the Maintenance Agents and some depots;
 - c) the office telephony service; and
 - d) additional Public Switched Telephone Network ("PSTN") and Integrated Services Digital Network ("ISDN") connections for home-working and video conferencing.

- 2.7.2 The main data traffic is between the ten HA offices located around the country and the information systems centre at Jefferson House in Leeds. These systems host the HA's main databases and related applications (such as the Pavement Management System) and also provide the links to the Internet and other external users. Data traffic between offices is mainly generated by e-mail. The inter-office network uses the Switched Multimegabit Data Service ("SMDS") service from BT, configured as shown in Figure 2.6. Data links to the Maintenance Agents use the Government Data Network X.25 service.
- 2.7.3 The HA's telephone service is provided by the Government Telephone Network ("GTN"). The Agency has around 2000 telephones and 300 fax machines. It owns all but one of the private automatic branch exchange ("PABX") systems sited at HA offices. The GTN provides the external telephone links including short-code dialling between telephones within the Agency and other government departments, as well as normal 'outside line' and international line services. Not all the Agency's needs are met by the GTN, and some offices are also connected to the PSTN via local suppliers (for example, COLT for St Christopher's House and Birmingham Cable for Broadway). Some domestic second lines for Agency staff working from home are supplied by BT.

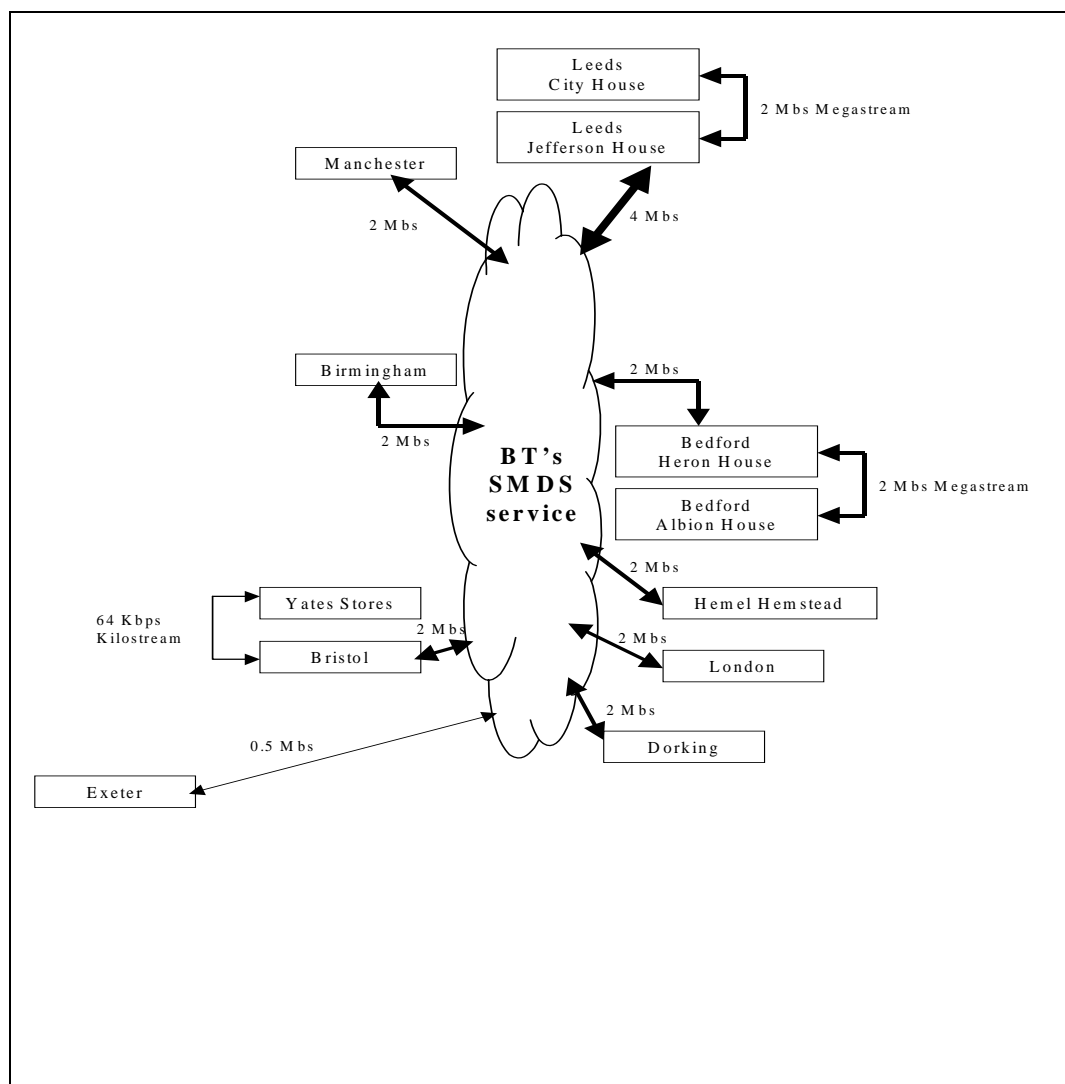


Figure 2.6: HA's business communications network

3.0 FUTURE REQUIREMENTS

3.1 Introduction

3.1.1 This section examines the HA's future communications requirements, both in terms of known, certain, requirements, and looking at its longer term, potential, requirements. We look at both the planned growth in communications in the HA's existing operations, and at the effect of new operations. In this second category, the TCC project is most significant. It introduces some minimum requirements for the MCS, but also a considerable amount of uncertainty concerning the broader applications of the MCS.

3.2 HA's short to medium term requirements

MCS

3.2.1 The HA's future communications requirements are explored in depth in Report 2. A key conclusion of that study is that the HA has relatively few certain requirements for MCS that it *must* meet over the next three years beyond continuation and modest upgrading of the existing services.

3.2.2 The main drivers of the future requirements are as follows. Over the next 3 years, there is a continuing programme of renewal and upgrade of motorway communications assets which will be carried out on a scheme by scheme basis under the NCP. The principal driver behind these plans, which form the basis of Triple Package schemes, is the growth in road traffic and the resulting more frequent and widespread congestion on many sections of motorway.

3.2.3 There is demand from the PCOs for wider coverage of data from incident detection devices (i.e. MIDAS) and CCTV to help with incident assessment and management. Currently MIDAS tends to give the most precise data about a situation, though CCTV provides useful visual confirmation (where both are available).

3.2.4 The HA's principal strategies for addressing these requirements are its Triple Package programme described in section 2.6, and a plan it is developing to upgrade its core transmission network with SDH transmission equipment.

Triple Package

3.2.5 Committed schemes under the Triple Package programme running up to 2001/02 have been identified in the following areas:

- a) motorway box around Greater Manchester, M1 and M62 in West Yorkshire, M6 in Cheshire and M6 in Lancashire in the Northern Region;
- b) M1 in Northamptonshire, M6 in Staffordshire and M6 in the Midlands Region; and
- c) M25, M23 to Gatwick Airport, and M3 and M27 in Surrey and Hampshire in the Southern Region.

- 3.2.6 It is noted that the capital expenditure indicated for motorway communications schemes in year 1999/00 is approximately £38 million. This rises to £68 million in 2000/01, £72 million in 2001/02, £95 million in 2002/03 and £65 million in 2003/04. Thereafter, the estimated capital expenditure decreases significantly in each subsequent year with none being shown for years after 2008/09. The majority of schemes identified include estimates of expenditure for three to five years.
- 3.2.7 KHHS understand that actual capital expenditure in future years may be less than the estimated capital expenditure indicated above. This is due to the current experience of insufficient staff resources or budget for implementation of authorised schemes when planned. This has resulted in schemes being 'reprogrammed' for later years, typically to start just outside of the period covered by the current three year CSR. It is considered that, unless special measures are put in place or an alternative approach to implementation of schemes is adopted, capital expenditure will remain at similar levels to those indicated for 1999/00. This will result in a delay in the implementation of schemes from the timescale indicated by the NCP data. This subject is considered further in sections 7 to 12 on Strategies.

SDH

- 3.2.8 The HA is currently developing a business case for the upgrade of its transmission network using SDH technologies. SDH is the worldwide standard for broadband digital transmission networks, developed by the telecommunications industry as the replacement for plesiochronous digital hierarchy ("PDH") networks.
- 3.2.9 The HA's draft internal business case has been prepared for a proposed SDH network based on three rings around the particularly congested sections of the current motorway communications network, i.e. the Manchester Box, Midlands Box and M25 Ring, with two point-to-point interconnecting links.
- 3.2.10 This design would connect 16 PCOs and one TCC (assumed in the business case to be located at Coleshill). It is intended to provide an upgrade for the local traffic data collection networks around the Manchester and Midland Boxes and M25 Ring and to provide up to 6 x 2 Mbps video circuits between each connected PCO and the TCC. The base case design is shown in Figure 3.1. Variations on this design (including full diverse routing via duplicated links for the point-to-point interconnections) have also been explored in the business case.

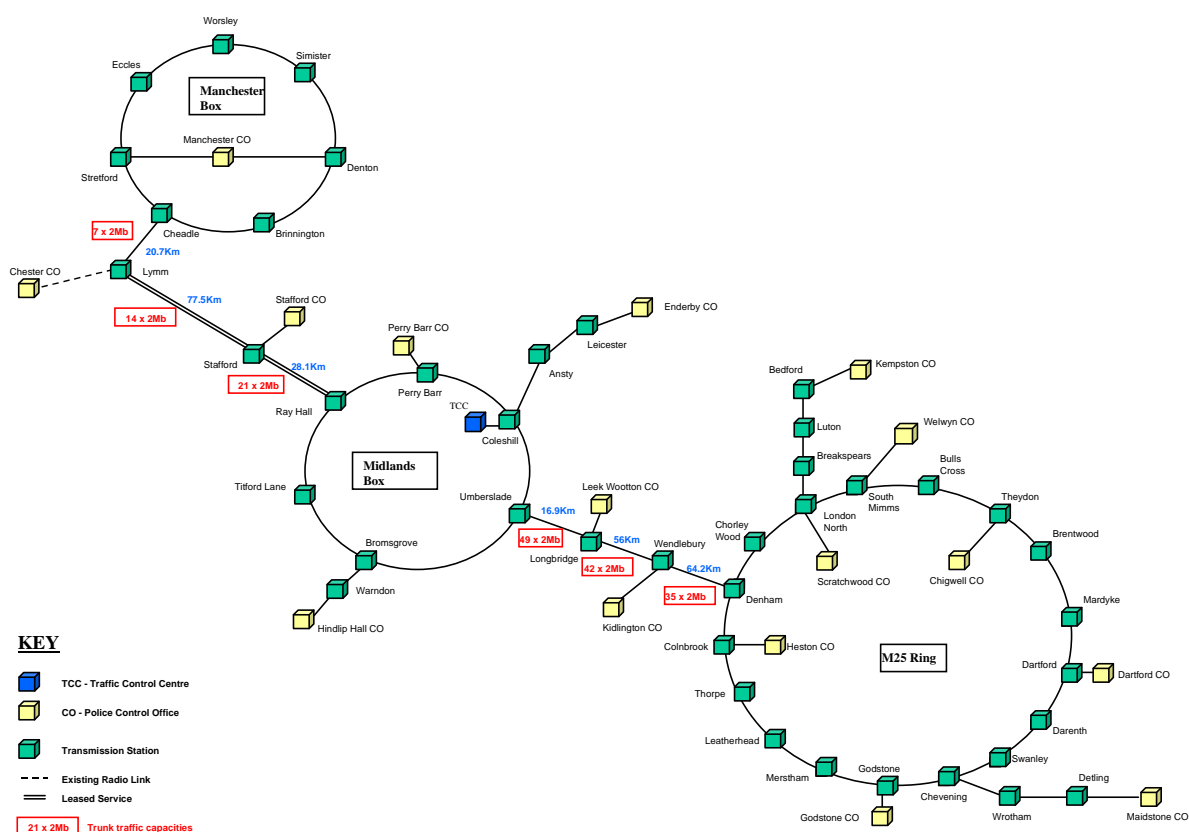


Figure 3.1: SDH network topology (base case)

3.2.11 In the business case, the above network is estimated to cost about £5.5m for supply, installation and operation over a five year period (this includes leased line costs for diverse routing). This is compared with an equivalent network based on private leased circuits at around £19m for the same period. On this evidence, there is an internal investment case for procurement of an SDH network designed to meet the needs of the TCC operation and future traffic data collection requirements.

APTR

3.2.12 The MCS covers only motorways, other than a few devices (notably VMS) on heavily-trafficked major trunk roads which interconnect with the motorways. The HA is currently responsible for around 7000 km of APTR - over twice the length of motorway¹. However, there is no significant HA requirement for extending coverage of data collection, signing or CCTV to the trunk road network. Nor is there a statutory obligation or safety or operations case (given the growing availability of mobile phones) for extending emergency roadside telephone coverage, although it is understood that the HA is studying cost benefits associated with the provision of trunk road emergency telephones.

¹ Though, as a result of the 1998 Roads Review, 30% of the APTR roads are to be 'de-trunked' (passed to local authority control).

Business communications

- 3.2.13 Over the next 10 years and beyond, the HA's business communications requirements will be driven by the growth in office e-mail (including video and audio attachments), Internet usage and client-server computing. The HA's WAN links the 11 HA offices as well as the Maintaining Agents. Other suppliers and partners to the HA could become linked into this 'electronic community' in future.
- 3.2.14 BIS has recently investigated buying-in a high bandwidth data network service² which would provide a scalable, flexible, future-proof solution to this requirement. BIS is in a position to procure this service now. If this need could subsequently be provided more cost-effectively by the MCS (when an upgraded network became available in, we assume, three years time) this would represent a significant and growing demand for communications services. This option is considered further in the Strategy sections 7 to 12 of this Final Report.
- 3.2.15 HRS manages the provision of business telephony services. Demand for voice telephony is not expected to grow significantly nor is there any problem with the existing arrangements which provide reliable and cost-effective services through the public telephone network. But new options are always considered and although new technologies and services offering voice over broadband data networks (based on Asynchronous Transmission Mode ("ATM") or Internet Protocol ("IP") transmission) are emerging, they are not yet mature.
- 3.2.16 It would be technically and commercially very risky to consider moving the HA's business telephony on to ATM now, perhaps as part of a BIS decision to proceed with an ATM-based office WAN service. But, guaranteed service quality will become a reality for voice over broadband data networks over the next two to three years, before any new MCS arrangement is expected to be in place. Thus, business voice telephony services could be included in the MCS requirements. However, there should be no obligation on bidders to carry voice over the motorway communications network. The service must be 100% reliable and there would be uncertainties over the capabilities of the network to meet this requirement and costs associated with setting up voice-over-data service provision.

3.3 TCC

Background

- 3.3.1 TCC is scheduled to start operations in 2002 and will have a significant impact on the way the HA operates. We set out below a brief description of the areas in which the TCC project is expected to impact on MCS. Firstly, however, there is an important distinction to be made between this MCS project and TCC.

² Specifically, a solution based on ATM services has been investigated.

3.3.2 Both the MCS project and the TCC project seek to develop the HA's network operator role and more generally the Government's integrated transport policy for improving the operation of the transportation system in England. The TCC project involves the provision of a **strategic traffic management system** designed to monitor road traffic on the road network and to implement strategic responses to both planned and unplanned events which affect it. The MCS project is concerned with the **communications network** that provides the links between the roadside equipment and the relevant control and dissemination centres. This includes not only the links between the TCC's roadside equipment and control and management centres, but also those between other current roadside equipment such as emergency phones, and potential new equipment such as road user charging devices, and their relevant points of control.

3.3.3 Thus, as a broad distinction between the two projects, the TCC's role primarily is to collect, manage and disseminate traffic information, whereas the MCS project concerns primarily the communication of voice, data and video, including the TCC's traffic data, and the commercial exploitation of the HA's communications assets. However, the precise boundaries between the TCC and MCS projects are not yet fully defined and may change as the TCC project progresses ahead of the MCS project.

Description of TCC project

3.3.4 On 21 June 1999, the HA released instructions and guidance to tenderers for the TCC Project. A draft contract is being prepared for the TCC Project but was not available when this Final Report was prepared. However, a number of issues impacting on the Study, as described below, arise from the proposals contained in the Invitation To Tender ("ITT") for the TCC Project.

3.3.5 The timetable for the TCC Project is:

21 June 1999	ITT released
29 November 1999	Tenders submitted (originally 8 November)
January 2000	Negotiations completed and shortlist drawn up
June 2000	Contract awarded for 10 year duration

3.3.6 As noted in section 2, the Police Service is currently responsible for road safety and certain traffic management activities. These, which are referred to as 'incident management' in the TCC ITT, are primarily the traffic management activities that typically affect only a small part of the motorway network, implemented in response to incidents. Whilst the HA liaises with the Association of Chief Police Officers ("ACPO"), it is understood that it does not have formal contracts in place with the Police Service for the operation, maintenance and use of the NMCS and equipment attached to it.

- 3.3.7 Traffic management in response to incidents is achieved by utilising matrix signals, EMS, police patrols and other methods that do not include use of motorway communications facilities. Operation of matrix signals and EMS is controlled from PCOs via the NMCS. Traffic management in response to an incident can, in most cases, be achieved from one PCO but may, depending on the location of the incident with respect to PCO boundaries, require signals and signs in an adjacent PCO area to be used.
- 3.3.8 The Secretary of State has agreed principles with ACPO relating to the development of the TCC Project. In essence, the police will remain responsible for traffic management in response to incidents while the TCC contractor ("TCC Co") will be responsible for strategic management of long distance traffic movements. The relationship between the police and the HA will be formalised after the TCC Project is introduced. The ITT envisages local agreements being established to regulate the operation of traffic management between the local Police Service and the TCC Co.
- 3.3.9 The TCC ITT also identifies a third category of 'traffic management' which is used to improve the efficiency of traffic movements within a defined area of the road network. The systems used include controlled motorways and ramp metering. These systems operate automatically but under the supervision of the Police Service.
- 3.3.10 TCC Co will be responsible for installing and maintaining equipment to collect data to meet its traffic monitoring obligations. The ITT states that the service requirements will include conditions governing access to the NMCS. The ITT also states that TCC Co "will only be allowed access to the NMCS network:
- a) in areas where there is sufficient spare capacity in the communications network;
 - b) in areas where there is an existing MIDAS instation; and
 - c) where TCC Co equipment meets published interface standards."
- 3.3.11 It will be important to ensure that any commercial exploitation of the NMCS does not conflict with the rights granted to TCC Co under the TCC Contract.
- 3.3.12 TCC Co will install VMS at approximately 100 sites in defined locations around the country. These signs are intended primarily for use in strategic traffic management, although they will be available for use by the police when required, e.g. in response to an incident. The vast majority of these sites are on motorways with the remainder, some six to eight sites, being on trunk roads close to motorway interchanges. The HA will provide TCC Co access to the NMCS where 30 or 40 pair cable is close to the site of these new VMS. However, where the NMCS has only 20 pair longitudinal cable, the HA's obligation is only to 'endeavour' to provide access to NMCS to TCC Co.

- 3.3.13 CCTV pictures are currently transmitted from the camera site to a PCO via the optical fibre cable that forms part of the NMCS. The requirement for TCC Co to utilise CCTV pictures using data transmitted on the NMCS is under review while the HA considers the procurement of an SDH network. It is proposed that TCC Co will make use of the proposed SDH network when it becomes available, for transmission of CCTV images from PCOs to the TCC.
- 3.3.14 TCC Co will take over the operation of MDIS and provide related services. TCC Co will also take over facilities and accommodation at Perry Bar PCO (subject to negotiation). Access to assets and data relating to MDIS will therefore be subject to the terms and conditions of the TCC Contract.
- 3.3.15 TCC Co will be required to establish an interface to the NMCS2 instations to allow the TCC System to communicate with COBS and its subsystems. In particular, this will be required for the control of VMS provided by TCC Co. This interface, which is expected to be a computer system installed in the PCO and connected to the PCO local area network, is referred to as the Traffic Control Centre Interface ("TCCI") Subsystem. The TCCI Subsystem could be based on the existing Network Management Interface ("NMI") Subsystem or could be independently devised by TCC Co. It will be important to ensure that the interface between the TCCI Subsystem, the SDH system (which may be procured by the HA) and any system or arrangements arising from this Study are clearly defined.
- 3.3.16 With effect from the date that the SDH network becomes available, the HA will provide point to point communication links from the TCCI Subsystem located in each PCO to an interface in the Coleshill transmission station. TCC Co will design, supply, install, test, and commission the communications from the interface at Coleshill to the TCC System and will also pay for the costs of communications between the Coleshill interface and the TCC System.
- 3.3.17 TCC Co may choose to use the NMCS or it may choose to make use of radio links, leased lines, or an existing, or new, alternative network. Where the NMCS is used for communications with field equipment the HA will pay for communications and power costs. The only requirement for TCC Co to use the NMCS is for VMS infrastructure (existing VMS and VMS to be built under the TCC Contract) and existing traffic monitoring equipment which will continue to be linked to COBS via the NMCS.
- 3.3.18 The HA will maintain all equipment installed by it under the TCC Contract and VMS installed by TCC Co. The HA will also maintain the NMCS.
- 3.3.19 The TCC contract will be for a period of 10 years, including the implementation period during which the infrastructure is built, and the service period during which the TCC services are provided.

- 3.3.20 TCC Co is allowed to exploit data commercially by selling it to value added service providers through the Traffic Information Highway, which TCC is required to set up and manage. Where TCC Co obtains commercial revenue, it is required to pay the Secretary of State 25% of all revenue received after reaching a stated threshold. Although TCC Co is not given exclusive rights to exploit data collected by it, consideration should be given to the rights of TCC Co before any proposals arising from this Study for exploitation of data collected by the HA are developed.

Impact of TCC on MCS

- 3.3.21 The TCC project adds a new national layer to the motorway communications picture. It will require CCTV and data links from each of the 32 PCOs to one or more TCCs, as well as links to an expanded network of traffic detection equipment. However, the TCC project is a PPP, and the ITT states that, subject to one exception, the TCC Co is under no obligation to use the MCS provided by the HA³. Variant bids may allow TCC Co to use alternative transmission routes. It is, however, the intention that they will make use of the HA's proposed SDH network wherever practical.
- 3.3.22 The TCC bidders were required to submit base bids which assume CCTV pictures are not required at the TCC until the HA has provided the necessary circuits to the PCOs (i.e. until the interim SDH network is in place). The ITT defines the number of CCTV circuits that will be provided from each of 19 PCOs (where CCTV exists) and in total 60 circuits are required. Bidders were also invited to submit variants which offer proposals for bringing CCTV pictures in to the TCC at an earlier stage by whatever arrangements they wish to put in place. TCC bids were submitted at the end of November 1999 and, we understand, some do contain variant proposals. The possibility exists, therefore, that the outcome of TCC contract is that high bandwidth communication links from the PCOs to the TCC are supplied under separate arrangements with a telecommunications company, independent of the HA's plans for an interim SDH network and the MCS contract itself.
- 3.3.23 This outcome must be avoided. The 'national layer' of a high bandwidth transmission network which interconnects the PCOs and the new TCC is a key part of the future MCS and much of the demand for bandwidth will be generated by the TCC. The central consideration for the HA is pursuing the best value-for-money solution across the business, not solely in terms of the short-term costs of links to PCOs should this appear to be on offer from one of the TCC bidders.

³ The exception is that the national transmission network is to provide the communications links to the new VMS to be installed by the TCC Co. These signs are to be commissioned for the start of operations and must be connected through the existing PCO sub-systems (this requirement can be met by the existing HA network).

- 3.3.24 While the TCC project is the biggest single factor determining the short to medium term HA requirements for MCS, there is the broader question about the strategic requirement for MCS. KHHS have studied this broader requirement in sections 4 and 5 on the communications network vision and the commercial opportunities for MCS. We believe there is such a strategic requirement independent of TCC. Nevertheless, any uncertainty about the TCC's use of MCS in the short-term could impact on the MCS requirements.

3.4 Coleshill

- 3.4.1 Report 3A provides details of the HA's computer centre site at the M6/M42 intersection at Coleshill in the West Midlands. The computer centre building itself was designed to operate as a secure, un-staffed facility. The site was established at the geographic centre of the NMCS1 network for sound engineering reasons, many of which would be applicable to the target network proposed in the following section. Following decommissioning of the NMCS1 central computers at Coleshill, it is used for transmission network management and CENLOG systems for NMCS2.
- 3.4.2 Coleshill has been identified as a possible location for a TCC control centre. Its use as a TCC control centre makes sense as it is at a geographically central location of the motorway network. The easy and secure connection to the on-motorway telecommunications network available from the site would also be attractive as it would reduce the need for leasing high capacity links that would be required if the TCC were remote from the motorway. However, the building itself would most likely require significant modifications (e.g. a further storey), or even demolition and re-building, before it could be used as a TCC.
- 3.4.3 Attributes of the facility and its location also make it appear attractive as a network management centre for any transmission network that is established following this Study. However, its key strategic function as part of a future on-motorway network is not obvious because of the following:
- a) network operators who are public telecommunications operators ("PTO"s) will have already heavily invested in their own facilities and are likely to use these for managing the HA's network;
 - b) modern communications network management systems do not need to be geographically centralised within the network; and
 - c) communications network management facilities may be operated remotely from the physical network.
- 3.4.4 Against this, network management facilities do not take up a lot of space. Thus, if the existing computer and transmission equipment rooms at Coleshill are retained as a facility for the HA or its private sector partner to use, then this would meet the HA's needs for its own network.

- 3.4.5 The computer centre at Coleshill could be useful to an organisation as a site for a network management centre if the network operator were to be an organisation who were establishing a new, national, fibre based network along trunk roads. Research for Report 3B revealed no such potential opportunity, although one may arise as the project develops and potential bidders for any contract resulting from this Study give more consideration to their plans.

3.5 NMCS telephone system

- 3.5.1 KHHS were appointed to undertake a study into the future of the NMCS telephone system (“Telephone Study”) as an additional task to this Study. The Telephone Study was commissioned to inform the HA on technical options in anticipation of a variant bid from TCC tenderers offering the facility for answering calls from ERTs, a service currently performed by the police. Early indications are that TCC tenderers have made no such proposals. However, the majority of police forces responsible for PCOs where ERT calls are currently answered, have indicated to the HA that they do not wish to retain this responsibility. (Information provided by the HA for the Telephone Study indicates that the vast majority (at least 85%) of calls from ERTs are non-emergency, the most common being requests for vehicle breakdown assistance.)
- 3.5.2 A draft report on the findings of the Telephone Study was submitted to the HA in December 1999. Finalisation of the report is proceeding in parallel with preparation of this Final Report. The Telephone Study has concluded that the HA’s current bespoke NMCS system (excluding the roadside devices) could be replaced using modern, “off the shelf” PABX and other SDH-compatible equipment. Such equipment, referred to hereafter as “ERT transmission equipment” could be configured so as to be capable of allowing calls to be answered either at PCOs or at one, or a number of, call centres. Although a future telephone system could operate with a copper cabling infrastructure, replacement of the ERT transmission equipment is best implemented to take advantage of a fibre based network. This would allow benefits to be obtained from synergy between the equipment used for telephones and transmission network, inherent network integrity and redundancy, comprehensive network management systems, and reduced reliance on high cost leased lines.
- 3.5.3 Available technology for the proposed ERT transmission equipment is compatible with the SDH network described in section 3.2.8 *et seq.* The Telephone Study has also identified benefits of including replacement of the ERT transmission equipment in a contract that results from this Study. The contractor could be encouraged to replace the existing NMCS telephone system, excluding the roadside devices, in as short a timescale as is practical through the contract payment mechanism. For example, the contractor could be made responsible for maintenance of the existing telephone system. In practical terms, this might result in sub-contracting the service back to the RMC contractors for maintenance of the existing ERT system until such time as new ERT transmission equipment is commissioned.

- 3.5.4 The absence of any TCC variant tender to provide call answering service for ERTs suggests that the HA could adopt one of the following approaches:
- a) reach agreement with the police for them to continue to provide an ERT call answering service at PCOs;
 - b) request TCC tenderers to propose a call answering service as part of the negotiation process;
 - c) contract out call answering to a commercial organisation;
 - d) set up an HA owned and operated call centre; or
 - e) include the provision of replacement of ERT transmission equipment and an ERT call answering service in any contract arising from this Study that includes upgrade of the national transmission network.
- 3.5.5 The last mentioned approach would appear to be particularly attractive as one organisation could then have responsibility for design, supply, commissioning, operation and maintenance of all aspects of the ERT system; apart from the actual roadside devices themselves, and the transmission network over which it operates. However, the simultaneous progress of this Study and the Telephone Study make it impractical for further consideration to be given in this Final Report. Development of the last mentioned approach could be addressed in Part B of the Study, after the HA has evaluated recommendations made by the Telephone Study and decided how it intends to proceed.
- 3.6 Longer term MCS requirements**
- 3.6.1 From year 3 onwards to year 10, the factors driving the requirements for MCS are speculative but substantial.
- 3.6.2 To the extent that the TCC Co uses the HA's MCS, future requirements will be driven by the rate of operational and commercial development of TCC-supplied traffic data and CCTV images.
- 3.6.3 In addition, KHHS expect that entirely new services and ways of operating the motorway network (and APTR network) could develop within this timeframe: notably, a beacon-based communications service to moving vehicles for traffic data collection and information provision to the vehicle's computer and to the driver, and/or the implementation of road user charging (tolling) on the motorways. These are developed in sections 4 and 5.
- 3.6.4 Again these services will drive future MCS requirements only to the extent that the operation of these new services will make use of MCS (as opposed to a third party communications supplier). A key priority for the HA, therefore, is to understand these opportunities so that it can actively decide the extent to which it wishes to drive the opportunities and maintain a controlling interest by making MCS the obvious, or perhaps required, platform for their development.

THIS PAGE INTENTIONALLY LEFT BLANK

4.0 THE COMMUNICATIONS NETWORK VISION

4.1 Introduction

- 4.1.1 This network vision is a review of the extent to which communications services will feature in the HA's future. It asks, in essence, does the HA need a communications network in the longer term, say, twenty years from now?

4.2 The HA as network operator

- 4.2.1 Government will continue to shape transport provision through policy and regulation, even if the provision and operation of roads increasingly becomes a private sector responsibility.
- 4.2.2 Currently, *The Framework Document* published by the DETR in July 1999, defines the various areas in which the HA discharges the Secretary of State's responsibilities. These areas include:
- a) operation of the network including management of traffic;
 - b) maintenance of the network;
 - c) development and implementation of a programme of improvement to make better use of the existing network without major additions to the infrastructure; and
 - d) development and implementation of major schemes approved by the Secretary of State.
- 4.2.3 The Secretary of State retains responsibility for, among other things, overall Government policy on trunk roads in England; the addition of roads to, or removal of roads from, the trunk road network; and decisions on what major schemes should be taken forward to improve the network.
- 4.2.4 The new Government formally spelt out its general policy for transport on 20 July 1998 through the publication of the Integrated Transport White Paper *A New Deal for Transport*. This marked the recognition of the need to take a new approach to meeting the demand for mobility. In particular, the White Paper highlights the constraints on those choosing to travel by road, including ever higher levels of congestion, the associated unpredictability this brings to journeys, and the poor level and quality of many of the public transport alternatives. Since the White Paper, the Government has published a series of more detailed policy statements on specific issues. These are included in the Roads Review.

- 4.2.5 The White Paper underlined the shift in the HA's business from that of road builder to network operator as described at the beginning of section 2. The Government sees network operation taking place within the framework of Route Management Strategies. In this approach, individual trunk roads within defined areas are managed as part of wider transport networks. The trend is towards the (predictable, safe) journey as a service. This underlines the increasing importance, and complementarity, of traffic and network management to the traditional business of providing roads.

4.3 Potential changes to the HA's business

- 4.3.1 The HA's business will be shaped by external political, economic, social and technical factors as well as by its internal strategy and goals. We consider each of these in turn.

Political factors

- 4.3.2 The HA's new role as network operator is partly a reflection of the growing public awareness that continuing to build roads to meet projected increases in traffic levels is simply not sustainable.
- 4.3.3 The White Paper, which sets out overall policy for trunk roads, reflects the prevailing industry and public view that the UK's inter-urban road infrastructure is essentially built-out (notwithstanding various planned link improvements and a few new strategic links, now increasingly financed privately). But the Roads Review particularly changed the emphasis with regard to investment in the trunk road network. Maintenance is now the top priority. Making more efficient use of existing road space comes second and only third is tackling some of the most serious and pressing problems through the targeted programme of improvements.
- 4.3.4 In terms of classification of trunk roads, the Roads Review identified which strategically important roads will remain under the direct responsibility of the HA. About 70% of the existing motorways and trunk roads have been classified as part of this core network. The remaining 30% of the network is to be 'de-trunked' with responsibility being transferred to local authorities following consultation. Separately, the Greater London Authority ("GLA"), to be created as part of the move to an elected Mayor and Assembly for London, will take over responsibility for all motorways and trunk roads within Greater London, except for the M1, M4, M11 and M25 which will remain under the HA.
- 4.3.5 The emerging outcomes for roads proposed in the draft 10 Year Transport Plan dictate that effective communications between police control offices, TCCs and the road user are key to supporting the HA's network operator role. The roll out of Intelligent Transport systems in support of the "Active Traffic Management" concept will be dependant on the availability of an effective high integrity, high bandwidth roadside communications network.

NATA

- 4.3.6 The decisions on major schemes presented in the Roads Review were made using NATA. The Roads Review includes Appraisal Summary Tables for the 67 road schemes which were sufficiently far advanced to be candidates for the targeted programme of improvements. The outcome of this review was that only 37 schemes should be taken forward.
- 4.3.7 NATA is another important signal of current political and policy trends. Particularly relevant here is the point that NATA takes account of a much wider range of criteria than the former Cost Benefit Analysis (“COBA”) approach which focused on benefits including journey time savings, vehicle operating cost savings and reductions in accidents.
- 4.3.8 NATA is now the DETR’s standard approach to scheme appraisal. This builds on COBA giving equal prominence to the five criteria of:
- a) environmental impact;
 - b) safety;
 - c) economy;
 - d) accessibility; and
 - e) integration.
- 4.3.9 With environmental impact, accessibility (which includes access to public transport, community severance, pedestrians and others) and integration featuring so significantly in the appraisal, plans for new schemes have ever greater hurdles to overcome if they are to be approved. The move away from COBA may be expected, however, to enhance the business case for works on the network which enhance efficiency, or which contribute directly to the last four criteria.

Traffic growth

- 4.3.10 The continued growth in road traffic cannot be ignored. According to the 1997 National Road Traffic Forecasts, if present trends continue and with no change in policies, the proportion of the trunk road and motorway network with serious congestion would rise from 14 percent in 1996 to 26 per cent by 2016. This conflict between the supply and demand for road space underlines again the central importance of making better use of existing infrastructure and the role that information and communications will play in providing better information to drivers and more sophisticated control and allocation of road space to users.

- 4.3.11 How might policies change? Over the next 20 years and beyond, policies will evolve as a result of changes in social attitudes or changes of Government. But it is hard to see any dramatic policy shift which would substantially negate the need to strive continually to make better, safer use of existing capacity helped by the use of information and communications technology, even if there was to be a programme of significant new road building. Indeed, technical trends very much suggest the opposite.
- 4.3.12 Policy affects not only what HA's role should be but also how it undertakes that role. In particular, the Government has undertaken a number of initiatives in recent years aimed at modernising the delivery of public sector services.
- a) HM Treasury has set out the Government's policy of encouraging Departments and Agencies to make better use of their assets by engaging in commercial services based upon them. This has become known as the Wider Markets policy⁴. It suggests that larger, more complex projects (of which the MCS project is a good example) are to be taken forward with the private sector.
 - b) across Government, the Cabinet Office leads the Better Quality Services initiative, which is part of the Modernising Government policy⁵. This policy requires Departments and Agencies to review how services are procured periodically, including using the market testing mechanism and contracting out services as the basis of public/private partnerships.
- 4.3.13 Both these policies were instrumental to the HA's decision to proceed with the MCS study. They have encouraged wider thinking about what services the public sector should deliver in-house, what should be out-sourced and what provides opportunities for public/private partnerships that bring wider benefits. All the signs are that these policies will continue to be followed by Government, certainly over the timescales by which any MCS deal would be put in place.

Economic factors

- 4.3.14 Transport demand has always risen with, and been driven by, economic growth. This trend is expected to continue, though transport growth will increasingly be moderated by taxation and charging policies and the growth in virtual mobility (i.e. telecommunications substituting for travel). This notwithstanding, however, wealth creation and quality of life are expected to remain the key drivers for transport over the longer term.

⁴ HM Treasury (1998) *Selling Government Services into Wider Markets Policy and Guidance Note*, July.

⁵ Cabinet Office (1999) *Better Quality Services: a handbook on creating public/private partnerships through market testing and contracting out*.

- 4.3.15 At the same time there will be a continued reluctance to build more roads to match this demand. Rather, capacity will be increased by upgrades to the existing network and the use of HA Toolkit technologies to manage available road space more efficiently and effectively. Maintenance, now the top infrastructure priority, also has a role to play in maximising the availability of the road network and minimising disruptions and capacity restrictions caused by road works, for example.
- 4.3.16 Though existing infrastructure will be better used, the extent of the trunk road network which suffers from serious congestion is expected to increase, as noted above. Road users will experience increasing journey times and journey time unreliability, at the same time that their expectations for higher quality services will be increasing (see below) and transport efficiency will continue to be a key factor in economic competitiveness.
- 4.3.17 Within the medium term (10 years), future investment in roads is expected increasingly to come from various revenue streams. This will include, predominantly, road user charging, but also revenue from the sale of traffic information and possibly CCTV pictures through the Traffic Information Highway⁶.
- 4.3.18 It is likely that, against continuing pressure on public finances, DBFO-type procurement will continue and that the private sector will become increasingly involved in the building, operation and even ownership of roads.
- 4.3.19 The trunk road network is valued at £55 billion⁷. This is a tempting target for privatisation in the longer term and can be seen as the logical endpoint of current trends both in the HA's procurement strategy for new roads and in the growth of PPP and PFI more generally across government. Road user charging will in due course provide the natural mechanism for the private sector to secure a revenue stream against the capital it invests in roads.
- 4.3.20 The current precedents are for private sector investment in individual links (DBFO schemes, the Birmingham North Relief Road ("BNRR") etc.). It is much too early to say with any certainty what structure a privatised trunk network might take (one national operator? Regional operators? Route operators?) but the issue of fragmentation of responsibilities for the trunk road network is one that needs to be taken into account in thinking about the long term vision for motorway communications.

⁶ Based on *HA Vision – Years 5 and 10* a strategy paper prepared by Mel Quinn dated June 1999.

⁷ Figure quoted by the HA's then Chief Executive at KHHS meeting with HA Board on 7 September, St Christopher House, London

- 4.3.21 The type of problems that can arise when responsibilities are split are exemplified by the Yorkshire Link DBFO experience. Some of the outstation communications equipment is maintained by the DBFO contractor. The rest, and that in the PCO, is maintained by the HA's RMC contractor. This additional maintenance interface introduces delays, and makes monitoring the contractor's service levels more complicated⁸.
- 4.3.22 This fragmentation issue points to the benefits of having, as far as possible, a single national motorway communications network operator, with clearly defined standard technical and operational interfaces.
- 4.3.23 In the longer term, with road user charging on the trunk road and urban networks well established, a future Government could choose to revise the whole taxation and public funding structure for roads, conceivably creating an 'open market' for roads provision. Businesses could take the risk on building new roads (subject to the Secretary of State's approval) against their projections of demand and the revenues from charging, outside of the HA's responsibilities yet interfacing with the HA's trunk road network. A national MCS operator would be well placed to compete for the opportunity of managing that road operator's communications. This further illustrates the challenges that could lie ahead.

Social factors

- 4.3.24 In recent months, transport has risen to the top of the political agenda. There is a growing dissatisfaction with what is generally perceived as the UK's often decrepit and under funded transport infrastructure. Though this dissatisfaction is particularly targeted at underground and rail transport, the public's demand for higher quality transport services in terms of availability, reliability and safety has its echoes in the debates about road transport also.
- 4.3.25 The public has growing expectations about travel and transport service quality. In road transport, this is fuelled by the motor manufacturers who are offering ever more sophisticated passenger comfort and safety features in their vehicles. People will increasingly come to expect that the infrastructure is of similar quality and sophistication – particularly in respect of driver information, driver assistance and active safety measures. Demographic trends point to an ageing population, but older drivers will be increasingly affluent and with higher expectations of safe, comfortable and convenient travel.

⁸ The loss of end to end control lengthens response times to faults. The HA's RMC has the responsibility for identifying faults in the first instance, but must hand over to the DBFO maintenance team if the fault is in DBFO equipment. Monitoring the service level performance of the RMC contractor is made more complicated by this additional interface. Also, it happened that the equipment installed by the Yorkshire Link DBFO was not standard HA bulk purchase equipment. Despite compatibility testing, there were some initial problems during the commissioning and early operation of this equipment which were made worse by this fact.

- 4.3.26 The concept of an integrated transport system has long been held as an ideal in public transport debates and current Government policies have heightened expectations in this area. The HA will need to develop closer integration with other forms of transport in future. Better travel information, journey planning information and services (the ‘informed traveller’/seamless journey concept) has an important contribution to make to this goal.
- 4.3.27 We are only at the start of the Internet revolution and associated developments in information and communications technology. Home shopping is projected to grow exponentially and this could have a significant effect on the patterns of freight distribution. Smart cards and electronic cash payments will be in widespread use within five years and will ultimately become the dominant way people do business. They will expect the same to be true of road travel as with the other goods and services they buy.
- 4.3.28 Finally, virtual mobility could improve to the point where it is a significant alternative to travel for some purposes. Accurate information about current conditions and journey times on the road network will be an increasingly important input into the travel choices people make.

Technical factors

- 4.3.29 The major technical influence is the seemingly inexorable increase in computing power and communications bandwidth available ever more cheaply. More specifically the spectacular growth of the Internet has rapidly re-written the rules of the IT and telecommunications industries.
- 4.3.30 In 1998, data traffic exceeded voice communications traffic worldwide for the first time. The telecommunications industry faces a world in which a single high-bandwidth global network can support comprehensive, integrated service offerings. The new paradigm is that telecommunications networks should be designed for data, carrying voice as merely one application – a complete reversal of the old analogue PSTN view of the world.
- 4.3.31 At the same time, mobile telephony has taken off with subscriber numbers in the UK almost doubling over 1999 to stand at 24 million by the year end. This resulted from severe price competition amongst the operators and new services, such as pay-as-you-go, attracting new customers. For mobile operators too, voice traffic has become a commodity business and they are searching for value added services based on data (especially on wireless Internet). The launch in 2000 of General Packet Radio Service (“GPRS”) based services by the Global System for Mobile communications (“GSM”) network operators will offer packet-switched data services at up to 107 kbps compared with the circuit-switched 9.6 kbps service which is currently available over GSM.

- 4.3.32 GPRS is the forerunner of third generation mobile services based on the Universal Mobile Telecommunications System (“UMTS”) which promises wireless data rates of 2 Mbps stationary and 384 kbps moving with seamless integration between voice, data and video. UMTS spectrum is to be auctioned in early 2000 with the first services expected to be operational in the UK by 2002. The market for wireless data is expected to be huge. The wave of demand for bandwidth this will create in the network backbone, as well as the wireless service possibilities it opens up, represent another source of potential partnership/PFI opportunities for the HA. These trends are examined in detail in Report 3B.
- 4.3.33 The proportion of a vehicle’s value made up of electronic systems will continue to rise. With mobile multi-media services expected to be commonplace in our lives, people will expect and demand that these same services are available in the car (currently over 50% of mobile phone calls are said to originate from vehicles). Good quality traffic data, travel information, driver alerts and active controls will all have an important role to play in meeting the HA’s network operation and safety objectives as well as providing the basis for the value added services drivers will be looking for.
- 4.3.34 Indeed, the road safety issue continues to rise up the transport agenda. It is unlikely that society will continue to tolerate the current level of deaths and injuries on our roads. Technologies and systems which actively limit an individual’s freedom to endanger others by irresponsible driving are likely to become increasingly acceptable (the widespread introduction of speed cameras over the last few years has hardly raised a murmur of public protest).
- 4.3.35 The introduction of road user charging in the medium term will also contribute to people’s changing perceptions of travel by road. As the road environment becomes increasingly controlled (with CCTV enforcement cameras, active speed controls etc) the notion of paying for road space, even booking road space in advance or travelling in road space controlled by the infrastructure (the concept of automated vehicle platoons) will become much more socially acceptable.

Internal factors

- 4.3.36 Of all the current internal initiatives, the TCC project has perhaps the greatest potential to change the HA’s business. It will provide a step-change in the quality of traffic information delivered to the driver and, with the Traffic Information Highway, has an unlimited upside potential for the development of commercial travel and traffic information services. It is also a new departure in terms of the way the HA carries out its role. It will be the first PPP project for services and it could be income generating for the HA. Other similar projects (not least this MCS project) are likely to follow.

- 4.3.37 There is an on-going programme to rationalise and improve the framework of contracts that the HA has in place for the maintenance of the roads and the communications facilities. In general the number of contracts is being reduced (the recent reduction from 79 to 24 Maintaining Agents is one example) while the scope of those that remain is being expanded to allow greater freedom for contractors to exploit scope and scale efficiencies.
- 4.3.38 Finally, the implementation of the Triple Package and other upgrades to the motorway communications network through the CSR programmes (and later, perhaps, through the MCS contract) is key to completing a core figure-of-eight fibre cable installation. This will link the major urban centres (Manchester, Leeds, Birmingham, Bristol and London). It is the minimum target network needed to support future HA communications requirements and realise the full commercial potential of the motorway communications network.
- 4.4 The role of communications in delivering the HA's business**
- 4.4.1 All these trends point to the same conclusion: that communications are essential to network operation. In essence, we believe, the primary product of the HA is safe, efficient, dynamic road space. At present, the driver exercises full control over the vehicle in occupying that road space. In future, more control will pass from the driver to the vehicle, in terms of autonomous driver assistance systems (for headway and lane keeping, for example) and ultimately to the infrastructure, in terms of fully automated highways. Road space will be paid for, through charging, and eventually perhaps even pre-booked.
- 4.4.2 Thus, over the long term, the output of the HA as network operator is becoming analogous to the train paths produced by the rail network operator, Railtrack.
- 4.4.3 In this, the evolutionary path from roadside controls (informatory and mandatory signs and signals) to in-vehicle controls (driver information, road user charging, direct vehicle control, etc) is clear.
- 4.4.4 Communications will also underpin the delivery of increasingly integrated, inter-modal services, particularly with rail and bus operators and urban transport networks.
- 4.4.5 In summary, the Study has reviewed the external political, economic, social and technical factors shaping the HA's business. It has concluded that communications are essential to the HA's network operator role and to the provision of safe, efficient, dynamic road space. This communications requirement will evolve from the present roadside controls to in-vehicle information and controls. That is, *the HA has an on-going strategic requirement for communications services at the roadside and into vehicles on its road network.*

4.5 What role should the HA take in telecommunications?

- 4.5.1 Given the HA's on-going and growing requirement for communications services, what does this imply about the nature of the business that the HA should pursue in telecommunications services? Within the bounds of what is commercially and legally possible, the answer to this question is largely a matter of strategic choice.
- 4.5.2 Report 3B confirms how opportunities in the telecommunications industry go in waves. The general finding was that the peak opportunity to enter the market for dark fibre and new network wayleaves in the UK had passed while the demand for mobile network upgrades, particularly with third generation UMTS services expected to start in 2002, is still growing. Put another way, the market for fixed broadband data transmission capacity is becoming highly competitive and price driven, while the next revolution is all about mobile multi-media, particularly Internet access from mobile devices.
- 4.5.3 The opportunity is for the HA to become a player in the telecommunications market through partnership with a private sector MCS contractor ("MCS Co"). The clear evidence from the market assessment is that the right option for the HA if it wishes to pursue this route is to position itself for a slice of the mobile telecommunications market.
- 4.5.4 In practice, we expect companies with a stake in the mobile communications market will, in any event, show the greatest interest in the opportunities presented by partnership with the HA.
- 4.5.5 So, if this is the space in the telecommunications market to be occupied by the HA/MCS Co partnership, what form should that partnership take? The range of possibilities includes:
- a) **full outsourcing.** The HA would divest itself of the ownership and control of the motorway communications network, handing it over to MCS Co which would be entirely responsible for the delivery of the MCS to the HA and for business development and commercial exploitation of the assets and opportunities within the telecommunications market. The HA would pay MCS Co for the services it receives and could share in the profits (usually above a certain minimum level) generated by MCS Co.
 - b) **full outsourcing but with joint development interests** in in-car telematics and information services. This is the same as for a) but the HA/MCS Co. partnership would also operate and market a branded 'highways' roadside to vehicles information service offering, for example:
 - 6. tactical traffic control data such as mid-range warnings of incidents or hazards (such as bad weather) ahead;
 - 6. real-time estimates of journey times;
 - 6. strategic traffic advice provided by the TCC; and

6. transmission of value added services provided by vehicle manufacturers, haulage firms, electronic yellow pages etc.

- c) **full joint venture.** The HA would be an equity partner in a new joint venture MCS Co with a suitable telecoms partner. If the partner did not already hold a PTO licence, then MCS Co would seek one⁹. The HA would assign its communications network and operations to the MCS Co joint venture. MCS Co would also be responsible for the development of commercial business in the managed data services and mobile services markets.
- d) **wholly-owned subsidiary.** The HA would establish a wholly-owned subsidiary to take over the operation and development of the communications network and the commercial exploitation of opportunities in the telecommunications market. This subsidiary would hold a PTO licence¹⁰.

4.5.6 These options illustrate the full range from complete transfer of risk (a) to no transfer of risk (d). Partly, the choice is linked to expected rewards. The upside potential for option (d) is unlimited. Energis plc, for example, which was spun out of National Grid is now the third largest telecommunications operator in the UK market serving 38,000 business sites nationwide. After 6 years in business turnover is up 70% to £285m and losses before tax were halved to £31m. Energis' current market capitalisation is around £5 billion. Equally, however, the downside exposure is unlimited in option (d).

⁹ Organisations which offer telecommunications services on a commercial basis to third parties must hold a PTO licence. The sale of communications equipment, including physical fibre optic cables ('dark fibre' which the customer then uses for data transmission) does not require a licence.

¹⁰ As the HA forms part of the Crown, it is unclear whether it would require a licence under the Telecommunications Act 1984 to run a telecommunications system. If it did not hold such a licence, the DTI and OFTEL would not be able to enforce the requirements of the Telecommunications Act and applicable secondary legislation against it. If the HA then offered services to third parties without a licence this could give rise to arguments of a lack of transparency and discriminatory treatment, both of which are prohibited by EC law. In addition, the HA would face difficulties in attempting to interconnect its network with those of other licensed operators. It is therefore unlikely that the HA would be permitted by the Government to run a telecommunications system in order to provide services to third parties. A subsidiary could, however, apply for a PTO licence.

4.5.7 Since Energis was established, the UK telecommunications market has become very much more crowded (with nearly 300 PTO licence holders) and very much more open to global competition. Moreover, the wave of opportunity in the fixed telecommunications market has, we believe, passed for the HA. For the HA to attempt to go it alone on the basis of mobile communications opportunities, in competition with the four established operators (soon to be five with the advent of UMTS) is highly inadvisable. The market potential for in-car telematics is still very speculative and, against that context, to attempt to attract the funding and experienced staff for a start-up business under the aegis of the HA does not look feasible. There may also be legal or policy constraints against equity participation which could rule out options (c) and (d).

4.5.8 Options (a) and (b) provide mechanisms which allow the HA to benefit financially, from the growth of the mobile communications market, and operationally, from the experience and expertise of the partner, but without exposing the HA to unjustifiable risk. We return to these issues in developing the MCS procurement Strategies in section 7.5.

4.6 The requirement for a highways communications network

4.6.1 The HA's need for a communications service is not the same thing as saying the there is a need for a highways communications network. This issue therefore does need to be addressed separately.

4.6.2 There are a number of particular characteristics of the HA's communications requirements to be considered:

- a) high bandwidth is needed on the motorway network (because of current CCTV requirements and future services into vehicles (such as real-time control) and data capture from vehicles);
- b) high capacity will be needed (because of the number of vehicles passing particular points on congested sections of the motorway);
- c) high reliability is needed (because of the safety-related aspects of current systems, let alone those of active control systems or automated highways systems);
- d) communications services are required along linear 'corridors' (not wide areas) often passing through areas of the country remote from urban centres; and
- e) communications services are required along all sections of the network, including those such as cuttings and tunnels where radio coverage is difficult.

- 4.6.3 The remoteness of parts of the network and its geographic extent suggest that a wireless communications solution might be suitable. But this would not meet the requirements for high bandwidth and capacity at low cost. Fundamentally, radio spectrum is scarce and this will always impose a limit on wireless communications capacity. In contrast, the transmission capacity of fibre optic cables is effectively unlimited. Assuming a connection, wireline transmission will always be cheaper per unit volume than wireless.
- 4.6.4 The catch is, “assuming a connection”. Moving vehicles have to be connected by wireless. Thus the question becomes, where should the back-haul wireline transmission be? Within the telecommunications industry competing to deliver broadband services into the home, the key issue is local access. While there are many telecommunications companies competing in the long distance transmission business, BT has retained its dominance of the residential and business market in the UK because of its ownership and control of the local network. The same basic economics holds true for the highways. Happily, the HA has an existing fibre optic network running alongside much of the motorway which is precisely where the transmission network needs to be to provide cost effective local connections to the roadside and into the vehicle (through short-range wireless).
- 4.6.5 In short, we believe that the HA’s current and strategic communications requirements are likely to require a core dedicated fibre optic cable infrastructure which runs alongside motorway. The main reasons for this are:
- a) fibre cable is the standard infrastructure for the delivery of long distance and high bit rate communications services world-wide;
 - b) fibre cable provides a future proof solution (fibre has almost unlimited potential bandwidth (100 Tbits/s is the theoretical limit);
 - c) the large number of HA roadside devices (approximately 18,000) are simply not accessible to PTO networks on a cost-effective basis;
 - d) such an infrastructure will provide a spring board for more innovative (say wireless) solutions on the local network during the later part of any MCS contract; and
 - e) fibre cable is one investment that, if commercially exploited under the MCS contract, can pay for itself in a few years.
- 4.6.6 For these reasons, it is our firm expectation that MCS Co will employ the existing longitudinal fibre motorway communications network to meet the MCS service requirements. The expectation will, however, be tested in the market: MCS bidders will be free to propose solutions to meet the specified service requirements by whatever means they believe will offer best value for money.

- 4.6.7 The more difficult issue relates to parts of the network where there is no existing, or planned, fibre installation. There is little of the motorways where it is not existing or planned, though it could include, for example, the M6 north of Preston up to Carlisle, or the A1(M) north of Leeds up to Newcastle. It should also be noted that the great majority of the APTR network has no longitudinal cabling. Although the installation of fibre cable would be congruent with the strategic needs of the HA and the basic economic arguments presented above, it may not be cost-justifiable on a case by case basis against a wireless solution or a service procurement. Further investigation would be required to reach a definitive conclusion on this. However, our firm expectation is that it would not be justifiable to make installation of fibre along such links a requirement of MCS Co.

4.7 The target network

- 4.7.1 Any contract to be agreed with an MCS provider needs to be clear and precise about the scope of the HA's communications requirement. This is called the 'target network' and represents the physical extent of the communications network that is strategically core to the HA as trunk road network operator. In the context of a PFI, where the HA will specify services rather than assets, it illustrates the HA's requirements as to the type of coverage and performance characteristics that it will require of a PFI service.
- 4.7.2 As already discussed, the target network should represent the optimal balance between a very comprehensive network which would be 'nice to have' and best value which can only be achieved by not over constraining the MCS provider as to how particular communications requirements are met. But how should this be defined?
- 4.7.3 The current layout of installed fibre cable and short term plans for its extension as part of the Triple Package roll-out, represents the minimum target network, since it is the result of numerous separate decisions about which roads are most heavily trafficked. It is these roads which are most core to the overall trunk road network and for which the investment in CCTV, MIDAS etc and the fibre cables necessary to support these devices is justified. Drawing number KHHS/001 on the following page shows the extent of current fibre optic cable installation and the additions planned as part of the current and subsequent CSRs (i.e. up to 2004).

[Replace page with Drawing number KHHS/001]

- 4.7.4 However, much of the additional fibre must be considered speculative. Resource constraints have meant that Triple Package budgets have consistently been under-spent and there is a risk this situation may continue. As a result, planned additions may not actually be delivered within the envisaged timescales. Also, a decision to proceed with the MCS contract as a PFI/PPP would factor very heavily in the reviews of the HA's spending plans and we believe that some Triple Package schemes would be held back in the interim.
- 4.7.5 The existing copper-based national network, provides a second guide to what the target network should look like. It is more extensive than the existing fibre cable installation, making a figure-of-eight which links Leeds and Bristol as well as Manchester, Birmingham and London. It has evolved to meet current national data transmission requirements, including the central logging of signal event data at Coleshill. The carrier-based transmission equipment used in this network is life expired and expensive to maintain because it requires quarterly testing and re-setting by specialist staff. So, it needs replacing in the short-term by the new fibre-based network.
- 4.7.6 The target network also needs to be highly resilient/fully dual-routed (to meet operational/safety requirements) and one which directly interconnects the majority of PCOs and HA offices (for business communications) to reduce leased line local connection costs.
- 4.7.7 Drawing number KHHS/002 which follows shows this proposed target network. It comprises a figure of eight (matching the existing national carrier network) which links Manchester, Leeds, Birmingham, Bristol and London. It includes sub-loops around the Northwest, Manchester, Northeast, Birmingham and London upgrading the existing regional networks. It also includes spurs to Exeter, Southampton and Dover. Other points to note are:
- a) the target network passes 26 of the 32 PCOs and all eleven of the HA's offices (though these are located in city centres some distance from the motorway fibre);
 - b) not all sections of motorway are included in the target network. Our current thinking is that it would be poor value for money to require the MCS Co to install fibre along the M23, M11, M6 north of Junction 30 and A1(M). There is little traffic management requirement for coverage of these links and they do not pass through major urban or business corridors which might allow good third party revenues to MCS Co to offset the costs of installation. More controversially, Liverpool and Merseyside are not included in this initial target network – such decisions will need further consideration in Part B; and

THIS PAGE INTENTIONALLY LEFT BLANK

[Replace page with Drawing number KHHS/002]

- c) the target network also includes none of the APTR network. There is hardly any longitudinal cabling on these roads at present, though they do provide links which interconnect strategic parts of the motorway network (the A34, for example, connects the M3, M4 and M40 via Winchester, Newbury and Oxford). Such links could become important in future to add capacity and extra dual-routes to the MCS network as well as in enabling the MCS Co to reach new third party customers (if it did not already have such a network link in place). But KHHS have not identified a future requirement for communications capacity on APTRs (other than at or near motorway junctions) and, we currently believe, there is no justification for requiring that the MCS Co install such links.

4.7.8 Based on information included in NCP data provided by the HA, it is apparent that not all fibre optic cables required for the target network would be installed under planned NCP schemes before any contract arising from this Study is put in place. KHHS considers that an MCS provider might be incentivised to install cables to allow the target network to be achieved more quickly. The extent of cable installation that might be undertaken by an MCS provider is shown in drawing number KHHS/003 on the following page. Further review and discussion on NCP data will be required to ascertain whether any schemes are unlikely to proceed in accordance with the current NCP. This may result in it being practical for some additional cable works to be transferred to an MCS provider.

4.7.9 Clearly, it is possible that the HA's requirements will change and/or that the MCS Co will have commercial strategic reasons for wanting to consider fibre installation or other forms of network roll-out along other parts of the motorway or APTR network. There will, therefore, need to be mechanisms within the MCS contract which would allow such installations to take place.

THIS PAGE INTENTIONALLY LEFT BLANK

[Replace page with Drawing number KHHS/002]

4.8 Delivering the target network

- 4.8.1 As already noted, the target network represents the physical extent of the communications network that is strategically core to the HA as trunk road network operator, or, in the context of a PFI, it illustrates the HA's requirements as to the type of core coverage and performance characteristics that it will require of any PFI service.
- 4.8.2 As already noted, the partnership created by the MCS contract must allow expansion of the network beyond this extent. It is entirely possible that the commercial market for high-bandwidth managed data services will expand rapidly in the UK. Consumer demand for mobile Internet access could be extraordinary, requiring mobile network operators to increase rapidly their coverage of the APTR and motorways, creating in turn, high demand for back-haul data transmission services. The MCS Co would be well placed to compete for these opportunities and could justify investment in cabling up new parts of the trunk road network for commercial reasons which would also deliver benefits to the HA.
- 4.8.3 Clearly, the MCS contract should not require MCS Co to install anything other than links required to complete the target network but not achieved under the NCP by the time the contract is signed. Anything else would add risk (and cost) to MCS Co because it goes beyond the HA's defined requirements and into the realms of speculation about commercial market developments. Equally, because of the large potential for commercial expansion of the fibre network along HA land, the contract should provide for the sharing of any commercial upside with the HA.
- 4.8.4 This type of arrangement is made easier if there is only one MCS Co to deal with, since there are no boundary disputes. But this does raise the more general question about the structure of the MCS contract; why not split the contract between regions or even road maintenance areas and perhaps use existing HA maintenance sub-contractors? In fact, there is no reason why MCS Co should not choose to employ the existing sub-contractors to undertake maintenance work in the different regions. But there are good reasons to treat the MCS network as a single national entity:
- a) the HA's requirements for communications services are not constrained by HA regional or area boundaries;
 - b) likewise the cable routes of interest to a commercial telecoms partner will span HA regions;
 - c) the TCC project adds a new national dimension to the MCS requirements and its development, as noted in section 3.3, will be the biggest single factor in determining the short to medium term requirements of the MCS;

- d) the HA's fibre optic network assumes its greatest commercial value when considered as a whole. The complete network as identified in drawing number KHHS/002 provides diverse routing between most points in the country;
- e) mast provision services discussed in section 5 will be more easily managed and assume greatest value if provided as part of a single national agreement; and
- f) there are likely to be significant benefits of scale by specifying a single national contract, both in terms of filling in any gaps required to complete the target network and in extending the network to exploit commercial opportunities, compared to this being carried out piecemeal under a number of HA contracts.

5.0 COMMERCIAL OPPORTUNITIES

5.1 Introduction

5.1.1 As part of their brief under the Specification, KHHS have undertaken a study of the commercial telecommunications market to provide a view on potential new developments, how these might impact on the delivery of the HA's future communications requirements, the market appetite for delivering those requirements and the commercial opportunities for exploiting the HA's telecommunications assets. Details of the study and its findings are included in Report 3B and a summary is given in the following paragraphs.

5.1.2 The study covered the following areas:

- a) third generation mobile telecoms technology;
- b) requirements of cable operators to interconnect local networks;
- c) requirements for linking to international cable and satellite networks;
- d) the ambitions of foreign operators to expand their interests in the UK;
- e) changes in the regulation of the UK market; and
- f) imminent technical or market developments.

5.1.3 Over the course of the study, a clear picture emerged of the MCS opportunities which are attractive to the market, the concerns companies would have in exploiting the opportunities and how the market in general is moving. The key areas of opportunity are discussed below.

5.2 Spare network capacity

5.2.1 As noted in the previous section, the HA already has a communications network along the motorways of England with extensive geographical coverage, much of which is fibred. The first opportunity considered, therefore, was that of exploiting surplus capacity in the network.

5.2.2 The market for leasing network capacity in the UK is very active and competitive, both for dark fibre and lit capacity. Prices are amongst the lowest in the world, and certainly in Europe. However, it is apparent that there is still substantial demand for dark fibre and managed data links on certain routes depending on:

- a) the infrastructure that potential customers already have in place nationally;
- b) international back haul requirements;
- c) the ease with which alternative capacity could be installed; and

d) the demand for capacity locally.

- 5.2.3 We understand that there are many instances where local capacity is required to fill in the gaps in operators' existing networks, or provide local distribution.
- 5.2.4 It appears that there is little appetite in the market, however, for a national deal to use the fibre infrastructure of the HA, either for lit or dark capacity, unless it was bundled with a deal to maintain the whole of the HA's assets. This is because the HA's fibre network is viewed as having only marginal value. We understand that with so few spare fibres available in the network (typically 2 fibres where 12 fibre cable is installed, and 14 fibres where 24 fibre cables are installed) the operation could only be made commercially viable by an existing carrier or carriers' carrier offering the fibre or capacity as part of its existing business.
- 5.2.5 Selling lit capacity would, in particular, necessitate far greater overhead costs than dark fibre because such capacity is generally sold in smaller quantities and for shorter leasing periods, and would require a dedicated sales and support team. Such facilities could only realistically be provided by an organisation that already has such facilities in place, and one which holds a PTO licence.
- 5.2.6 The HA would, therefore, have to form a partnership with an existing licensed operator, or carriers' carrier. The value the HA would bring to such a partner would be the additional rights of access (wayleaves) to potential customers adjacent to HA infrastructure.
- 5.2.7 One of the only foreign operators during the Study to show an interest in partnership with the HA was Viatel UK Ltd who are building a European data transmission network using national highways wayleaves. They have laid cable on highways verges in Germany and France and are interested in expansion in the UK of their Northern ring which currently links London, Normandy and the Netherlands. In Italy, the motorway operator Autostrade created a telecommunications subsidiary Autostrade Telecomunicazioni Spa in the mid-1980's which now owns over 66,000 Km of fibre on 3,400 Km of highways. It supplies the national highways communications needs as well as serving third party customers. These examples are the exceptions, however, to the general picture that there is little interest from the market in a deal with the HA solely to use the fibre infrastructure and/or wayleaves (to build more).
- 5.2.8 An issue that has been raised by potential partners is that some of the HA's fibre, having been installed for longer than 5 years, may not be of sufficient quality to be able to convey higher data rates such as STM-4 (622Mbit/s). We understand that the HA has recently commissioned work specifically to test the data rates which can be achieved over some of its older fibre, but the results of this work are not currently known. The fibre would also be more attractive if it was ducted, rather than direct buried as is the case with the majority of the HA's fibre.

5.2.9 There is an opportunity, therefore, for the HA, or latterly MCS Co, to exploit some limited niches in the market for selling network capacity. This should be borne in mind when planning the build out of its network capacity, and may include routes where demand is likely to be particularly intense, such as the M4 silicon corridor.

5.2.10 A crude indication of the margin that may be made on selling network capacity can be gained by comparing the retail rates charged by BT for digital capacity with some typical wholesale tariffs. The table in Figure 5.1 shows wholesale and retail tariffs for a link from London to Manchester. The mark-ups are 120% and 180% for 155 and 45Mbit/s lines respectively.

Capacity London- Manchester (assumed 320 km)	Wholesale tariff			Retail tariff		
	Installation	Annual rental	Total (one year)	Installation	Annual rental	Total (one year)
45Mbit/s	21	115	136	15	368	383
155Mbit/s	63	330	393	32	844	876

Figure 5.1: Comparison of wholesale and retail rates (£k)

5.2.11 A key finding from the study is the need to exploit the opportunities for selling network capacity as soon as possible (within 12 months). Fierce competition means that the requirements that operators foresee now will no longer exist over longer timescales, and the tariffs that may be achieved are reducing rapidly.

5.3 Facilities management

5.3.1 KHHS understand that there is interest among telecommunications operators in managing the communications facilities of the HA. We set out below some of the suggestions which have been made to KHHS in the course of the Study.

5.3.2 Several operators can demonstrate a track record of managing networks of this magnitude for other customers, both in the public and private sectors. They include:

- Racal Telecom;
- BT;
- NTL; and
- Marconi Communications.

5.3.3 There are a number of other organisations, such as K-Net, which do not have the same experience as the established operators, but who would, we understand, be interested in exploring these opportunities with the HA. Others, for example Kingston Telecommunications, would be interested in maintaining the HA's network, but would also wish to inter-connect the telecommunications franchises that it controls in the North East and South West of England, as well as possible future acquisitions. The spare capacity on the HA's network could potentially fit this ambition. NTL also expressed interest in exploring a variety of options including full management of the HA's network, maintenance contracts or provision of fibre for communications.

5.3.4 A general view expressed to KHHS is that HA is unlikely to have the necessary skills and experience to set up as an operator by itself, offering services across its network (for which in any case it would need a PTO licence¹¹) or bandwidth. It should, therefore, seek a strategic alliance with an industrial partner.

5.4 Use of land and structures for telecommunications masts

Background

5.4.1 KHHS are aware that a key issue facing the HA is that of the siting of commercial telecommunications masts on its land. Developments in the mobile communications market and particularly the planned auction of UMTS licences have given rise to increasing pressures on the HA to permit access to telecommunication companies, prior to the conclusion of this Study, to erect and maintain mobile phone base stations on its land.

5.4.2 The HA has historically denied access to commercial operators for the siting of telecommunications masts essentially on safety grounds which are discussed in more detail in section 6. However, this policy is increasingly being challenged by telecommunications operators, who have also been petitioning Ministers for access to HA property. This in turn has led to pressure from Ministers on the HA to provide a solution to the current impasse. The HA is also aware of DETR's policy that mast site sharing should be encouraged where ever possible.

Siting of telecommunication masts on HA land and structures

5.4.3 Currently there are around 14,000 GSM cell sites in place in the UK, though a further 15,000 – 20,000 are likely to be required nationally in the near future (by 2003). There is a particular requirement to improve coverage and capacity in highly trafficked areas such as the M25.

¹¹ As noted before, the HA could hold a PTO licence but only through an incorporated HA subsidiary.

- 5.4.4 KHHS understand that all GSM network operators are keen to gain access to HA infrastructure for the siting of GSM and future UMTS cells. For example, we understand that One2One is currently expanding from 3,000 to 7,000 sites over the next 2-3 years, and considering plans to expand to 14,000 in the longer term. It has indicated that around 100 sites would be required on motorways and 400-500 on trunk roads.
- 5.4.5 Trials of UMTS have recently begun. Vodafone currently has 5,000 base stations, but requires 11,000 nationally by 2003, again with particularly dense coverage requirements around motorways.
- 5.4.6 In summary, the main interests of mobile network operators would be to:
- a) fill in gaps in their coverage of motorways;
 - b) fill in gaps in their coverage of other roads;
 - c) uplift residential areas; and
 - d) enhance capacity on certain motorways where coverage is already available.
- 5.4.7 Some operators have expressed an interest in the development of a separate 'motorway network cell layer' which would ideally be situated on HA land. The operators would, therefore, be interested in sites where large macrocells could be installed to complete coverage, and in sites for microcells to boost the capacity of their networks. Microcells along motorways can offer coverage that existing cell sites cannot achieve, especially in areas such as cuttings. Low-level sites are also becoming more attractive as the number of cell sites increases and the emphasis shifts towards capacity away from coverage enhancement.
- 5.4.8 We understand that the operators would be interested in placing sites on or near bridges or other access points, if they could be sure of long-term access to such sites. Cells would be spaced every 3 km on motorways, and some sites would be installed specifically with the intention of providing coverage on motorways, where coverage is difficult to provide at the moment. A variety of antenna mount designs could be used to maximise the possible sites and number of solutions including CCTV masts, overhead gantries and VMS cantilevers. Most of the sites could probably have Base Transceiver Station ("BTS") computers accessible without having to access the carriageway (e.g. from roads across bridges etc).

- 5.4.9 As concerns the APTR network, telecommunications operators have granted consent to exercise rights of access to trunk roads by virtue of their Code powers where these roads are not “protected streets”. Typically, these roads cut through areas where there are many other suitable land owners, buildings and other structures for cell sites. So the problem of achieving the required coverage and capacity across the trunk road network is less acute than on the motorway network, except in specific places such as the Blackwall Tunnel. Nevertheless, the HA does have structures which may be of interest to operators even if they could not prevent access by other operators to the same sites. For example, at least one operator, One-2-One, has expressed a particular interest in using the lighting columns on APTRs.
- 5.4.10 Increasingly, antenna sites are being planned with proximity to fibre as a priority because the cost of fibre back-haul compares very favourably with installation of leased lines or microwave links. Indeed, we understand that some of the operators prefer fibre because antennas for microwave are becoming more difficult to install, and there is a need to make room for UMTS antennas. Both Cellular Design Services (“CDS”) a cell site design company who work on behalf of all the operators and Vodafone confirmed in interview their interest in fibre connections for back-haul. The high capacity data throughput requirements that the UMTS service will impose means that base stations are likely to need a link into the higher capacity offered by fibre sooner than the equivalent GSM base stations.
- 5.4.11 The operators are aware of the DETR’s policy that site sharing should be pursued where possible, with the need for common antennas, possibly fitted and managed by a third party. Links from the antennas would need to be routed to the operators’ own BTSs which would need to be physically close to prevent significant engineering difficulties which may reduce the attractiveness of the sites. There is, therefore, a need to find sites that can be used by all four operators, or all five with UMTS. Currently, many sites have only 1 or 2 operators and restrictions are in place on these sites preventing other operators from co-locating.
- 5.4.12 Again, KHHS were made keenly aware of the need to exploit the opportunity to make HA land and structures available for telecommunications masts as soon as possible (i.e. within 12 months) to avoid driving the operators away to alternative sites. This theme is developed in the Strategy sections 7 to 12 of this Final Report.

Managed mast services

- 5.4.13 KHHS have also been approached by two organisations that offer managed portfolio services to organisations with large amounts of land, thus providing the buffer between the landlord and the network operators. Such organisations are aware of, and have capabilities in managing, the technical, legal, operational and commercial issues. We understand that one such organisation, CDS, has offered to set up the necessary infrastructure, negotiate with operators and provide the HA with the associated revenue stream. This is indicated to be worth in the order of £10 million/year. This again was predicated on a rapid implementation (within the next 6 months).
- 5.4.14 KHHS consider that such an approach might prove suitable for the HA, either in a PSC scenario or as a short term arrangement prior to the implementation of any PFI services. This concept is therefore developed in more detail in the Strategy sections which follow.

Management of consent

- 5.4.15 Finally, we understand that One2One would be prepared to offer the HA a substantial fee for 'management of consent', and also for access to information held by the HA on possible sites, and for assistance with facilitating the process of negotiating access rights etc. A typical fee might be a one-off payment of £2,000 per site, plus an ongoing element for management of consent. We understand that this may equate to a one-off sum to the HA of approximately £5 million, with an additional approximate £1 million per annum thereafter. However, the likely constraints on charging described in section 6 should be considered.

5.5 Roadside to vehicle communications

Introduction

- 5.5.1 As was suggested in section 4, KHHS believe that roadside to vehicle communications will be a key communications path in support of the HA's operations in the future. The questions remain therefore, what is the market's appetite for this opportunity and how might such a service be procured?

HA data requirements

- 5.5.2 The basis of the roadside to vehicle communications opportunity is an HA defined requirement for the capture of certain classes of locationally-referenced data from vehicles, and the transmission into vehicles of certain classes of locationally-relevant information, such as alert and control messages. The data requirements would need to meet the HA's operational and safety needs. The quality and type of data currently captured by the MIDAS system provide an initial indication of the type of data the HA is likely to require, though we envisage this developing into far more sophisticated data communications. Roadside to vehicle communications would be computer-to-computer communications (i.e. telemetry, thus, countering any fears that the HA would be encouraging drivers to use mobile communications on the road in breach of safe driving practice).
- 5.5.3 Vehicles are increasingly being fitted with standard data buses which connect together all electro-mechanical systems. The motivation for this trend is that digital data buses are more reliable and much lighter than the wiring harnesses they replace. The significance is that by providing a communications interface with this data bus, all data captured by sensors on the vehicle and generated by computers could, in principle, be transmitted from the vehicle. Top-of-the-range cars are bristling with such electro-mechanical systems (a Volvo S80 car, for example, has 24 computers) and they will increasingly be found on mid-range and even entry priced models. There is a wealth of data available ranging from vehicle speed, switchgear settings and outside temperature to the driver's seat position, the radio station being listened to and the air conditioning setting (assuming these systems are electronically controlled). Much of this is of no conceivable interest off-vehicle. But manufacturers are developing ideas for customer care concepts such as remote diagnostics, sending warning messages to drivers about incipient failure in a sub-system and remote de-activation of car alarm and central locking when the driver calls to say he has lost his radio fob.
- 5.5.4 Taking MIDAS data as the current baseline, the HA's requirements for off-vehicle data would be to calculate lane specific vehicle numbers, speed, headway and occupancy by time period. Taking VMS as the baseline for output, messages transmitted into vehicle could be limited to general safety and traffic information which is location and direction specific. But clearly, much more is possible. There is wide scope for the development of value added information services which could include dynamic journey time estimation, mid-range alerts of the type being investigated in the Road Traffic Adviser trial project on the M4 (e.g. warnings about stationary traffic, fog banks or rain storms a few miles ahead), or location-specific point of interest information.

Similar initiatives in the market

- 5.5.5 Similar opportunities for roadside to vehicle communications are already being explored by the mobile network operators, other information providers (such as Trafficmaster) and the motor manufacturers. Location-dependent information services are currently a topic of much interest among the mobile network operators, for example, as they are keen to expand out of the increasingly low margin business of 'bit transport' into value-added services. Both hand-held and in-vehicle device manufacturers are looking to combine Global Positioning System ("GPS") units with GSM to provide a platform for, among other things, locationally-relevant travel and traffic information services. As mentioned above, the HA is involved in the Road Traffic Adviser trial project on the M4 which is investigating over 50 potential applications of roadside to vehicle communications. Thus, in short, there are a number of initiatives currently being explored.
- 5.5.6 Nevertheless, we believe that an early announcement (i.e. at the end of this Study) that the HA has a defined future requirement for roadside to vehicle telemetry may have a significantly galvanising effect on the market. Whilst there is significant commitment among the key players (mobile phone companies, information service providers, motor manufacturers and potential new entrants) for roadside to vehicle communications, this is still an emerging market, and the likely successful services and amount of potential revenues are still uncertain.

The advantage in being the first mover

- 5.5.7 In defining its service requirements, the HA would be specifying a requirement for a certain minimum quality and quantity of data communications by a certain date. This would provide the basis for the development of high quality real-time traffic information services. We believe it is essential that the HA establishes this requirement. The precise specification of off-vehicle data for the HA's traffic monitoring, incident detection, driver alert, safety and driver information functions may be materially different from those of a general purpose commercial information service based on probe vehicle data. It may, for example, be that the HA will require greater locational accuracy and lane specificity in its vehicle speed data. However, these operational data requirements should provide the natural base data layer on which high quality commercial value-added services can be developed.
- 5.5.8 As section 5.4 shows, there is a strong and immediate demand for mast sites along the motorways on HA land. Operators are likely to build out these networks with commercial location-dependent services (among other services) in mind. The MCS project, provides the HA with the opportunity to influence the roll-out plans of operators to meet its particular requirements for roadside to vehicle communications. There is a risk to the HA that if it does not define its requirements at this stage, then the operational roadside to vehicle communications 'layer' may become an add-on to what will by then be an extensive network of cell sites, TCC beacons, Trafficmaster beacons and the like. This could potentially involve an imperfect solution, a high additional cost and a further cluttering of the environment with communications infrastructure.

- 5.5.9 The counter argument is that in acting now, the HA faces market risks due to the current immaturity of the market. However, commercial in-vehicle location-dependent services are expected to be rolled-out within the next 12 to 18 months, i.e. well within the timeframe for establishing the MCS contract. Moreover, in practice, the risks to the HA can be substantially mitigated through a PPP or PFI procurement route.
- 5.5.10 The key to mitigating this risk is to invite MCS bidders to offer proposals for the roadside to vehicle operational communications layer as a variant bid, in addition to a fixed network management service. This approach is developed further in the Strategy sections which follow. The scope and prices of the variant bids offered would reflect the market's view of the commercial, technical and other risks. The HA would also undertake its own further research during Part B of the project into the feasibility and viability of the bidders' proposals, and would only sign an MCS contract including roadside to vehicle communications if it was fully satisfied that the service was deliverable.

Technical solutions

- 5.5.11 There are two main technical solutions that may emerge to meet the roadside to vehicle requirement. These can be categorised as licensed radio solutions, i.e. requiring a PTO licence and a radio communications licence, characterised in our models as UMTS (but Terrestrial Enhanced Trunk Radio ("TETRA") and possibly other radio technologies might be suitable), and unlicensed radio solutions such as Dedicated Short Range Communications ("DSRC").
- 5.5.12 No DSRC network currently exists. Therefore, the DSRC roadside to vehicle solution would result in the creation of a new national communications network in competition with (or in addition to) the existing cellular and TETRA-based national networks.
- 5.5.13 Under the UMTS model, the HA would contract with one of the five UMTS licence holders to roll out a 'motorway cell layer' over its motorway network to capture and transmit its defined data requirements. It is possible that the fifth licensee, which will be required to roll out an entire new network regardless of the HA opportunity, will attach greater value to this opportunity than the existing four mobile operators. In any case, the HA will only have access through this arrangement to its UMTS contractor's data communications with vehicles, i.e. it is theoretically only able to communicate with a fifth of motorway vehicle traffic under this arrangement. It would have to make separate data communications arrangements with the remaining four UMTS licence holders, possibly as part of mast sharing arrangements on HA land.
- 5.5.14 In fact, there are two main ways MCS Co could interface with the five operators for the transmission of HA traffic data over their networks:
- a) in-car telematics units could be programmed to call a special MCS Co national number and traffic data would simply be routed as a normal cellular data call through whichever network the motorist happened to subscribe to; and

- b) MCS Co could offer its own-brand mobile subscriptions and call services direct to motorists (in technical terms there would be an MCS Co Subscriber Identification Module (“SIM”) card in the in-car telematics unit). MCS Co would be competing with the other operators for motorists’ in-car unit subscriptions and would be a re-seller of air-time from whichever mobile network operators it managed to negotiate deals with.

5.5.15 Organisations which take the second role above are known as Mobile Virtual Network Operators (“MVNO”s). MVNOs have been the subject of a recent Office of Telecommunications (“OFTEL”) consultation as to whether regulatory intervention to force mobile network operators to offer wholesale services to MVNOs is justified. OFTEL has concluded for the moment that it is not¹². So an MCS Co which took this option would be relying on its commercial proposition alone.

5.5.16 An obvious, but essential, requirement of whatever technical solution is proposed by MCS Co is that it must provide a seamless switchover from areas of no traffic data service to areas where the service is provided. Superficially, the latter means areas within range of UMTS or DSRC sites on HA land. Motorists will expect service coverage to include major APTRs which integrate seamlessly with the motorway network and appear to all intents and purposes to be motorway grade roads (such as the A42 which connects into the M42).

5.5.17 In detail, the problem is not so much technical as one of identifying which roads should be covered by the service, and by when. Mobile network operators are likely to be as keen to cover these important APTRs as the motorways themselves. If beacons are to be used to provide the communications link, then the DSRC network must be extended on to the relevant APTRs if the service is to be provided there. But, in any event, the MCS contract should be structured in such a way that these considerations, and the commercial risk of providing services based on roadside to vehicle communications, falls to MCS Co not the HA.

Conclusion

5.5.18 The roadside to vehicle communications opportunity is seen as a significant opportunity both for the HA and the commercial telecommunications operators. The mechanisms by which the HA could exploit this opportunity at minimum risk to itself whilst maximising its operational and financial benefits are reviewed further in the Strategy sections which follow.

¹² This decision was published by OFTEL in the *Statement on Mobile Virtual Network Operators (October 1999)*, following an earlier enquiry document published in June 1999.

THIS PAGE INTENTIONALLY LEFT BLANK

6.0 CONSTRAINTS

6.1 Introduction

- 6.1.1 This section looks at various factors that might constrain the HA in taking advantage of the opportunities available for exploitation of assets and more general implementation of the strategies identified above.
- 6.1.2 Report 3A identified a number of legal constraints within which any arrangements for the MCS would need to act. Although these might all to a greater or lesser extent affect the timetable or value which a potential private sector partner, or MCS Co, might put on its involvement, they are not all repeated here. It is however appropriate to focus on the key legal constraints which have been identified, since these may impact not only on value but also on the manner in which or even whether the strategies can be pursued.
- 6.1.3 In the case of each of the legal constraints discussed below, it has not been possible to reach a definitive view on the legal position. The MCS project is simply not contemplated by the highways legislation. Although it has been possible for KHHS and the HA's internal lawyers to reach a broad measure of agreement on the effect which the legal constraints may have, KHHS's views are in some cases more cautious than those of HA's lawyers. This reflects the different perspectives from which KHHS and the HA approach the issues, and KHHS's anticipation of the views on legal risks likely to be held by prospective private sector partners and (in particular) their funders.

6.2 The contracting party's powers

Background

- 6.2.1 KHHS have been influenced by the fact that there have been a number of problems in the past bringing projects to a conclusion where there have been doubts as to the power of the relevant public body to enter into the relevant contractual arrangements. In each case, the answer was to pass new primary legislation to provide the necessary reassurance to the private sector parties that the contracts would be enforceable against the public body.
- 6.2.2 The contracting party for the HA is the Secretary of State. The Secretary of State derives wide powers to contract from the royal prerogative. However, the royal prerogative gives way where constrained by legislation. It is not entirely clear the extent to which the legislative framework of the highways or telecommunications legislation would act to constrain the Secretary of State's prerogative powers in the context of the MCS. However, in KHHS's view there is a material risk that the royal prerogative could be displaced in these circumstances and that the relevant legislation is not sufficient for the purposes of the MCS project. The HA's lawyers acknowledge that this risk will be one which is considered carefully by potential partners and their funders, but are not convinced that the Secretary of State's prerogative powers are so constrained.

Interim arrangements for the provision of telecommunications masts

- 6.2.3 This debate is extremely pertinent, as one of the possibilities raised in this report is that the HA could let a contract for the installation of telecommunications masts to a managing agent, who would then let space on the masts to operators and pay HA a proportion of the revenue earned. This might be a transitional arrangement to capture the urgent market demand for mast coverage, prior to eventual handover to MCS Co. It is not obvious that such an arrangement is within the powers of the Secretary of State. This should not be a risk issue for MCS Co, but will require the HA to reach the conclusion that the Secretary of State has the power to enter into the interim arrangements.
- 6.2.4 Given the importance of interim arrangements for mast provision to capture urgent market requirements, this report assumes that the HA will be able to reach such a conclusion, but clearly further detailed legal analysis needs to be done by HA, and perhaps also Treasury, lawyers as a matter of priority. It might be possible to avoid this by clarifying the position in new legislation. Such legislation would need to set out that the Secretary of State had the necessary powers to implement these arrangements, including the power to enter into a contract with a third party to enable third party access to its land to carry out the relevant work, plus also the right for the Secretary of State to levy a charge pursuant to such a contract together with all other necessary ancillary powers. We understand however that DETR have confirmed to HA that they see little prospect of this being accommodated in the forthcoming Transport Bill.
- 6.2.5 The installation of telecommunications masts is also envisaged as part of the PFI strategies in the following sections, being a way in which a private sector partner could generate third party revenue. We consider that, where this takes place in the context of an HA requirement to provide MCS services, with the third party revenue being used to defray the fee that would otherwise be payable by the HA, it may be easier to come to the conclusion that the Secretary of State has the necessary powers. It would clearly be necessary to persuade the potential private sector partner and its funders that this was the case. Clearly, if the telecommunications masts were also utilised in the delivery of services to the HA (e.g. roadside to vehicle communication) this would strengthen the argument.

Protected street and the granting of licences or consent

- 6.2.6 It is also likely that the Secretary of State will be constrained from charging (other than administrative costs) for the grant of licences or for giving consent to a PTO to carry out installation on a "protected street" (as a result of highways legislation and telecommunications legislation taken together). This should not however be a significant problem provided that such an arrangement is constructed in such a way that the Secretary of State benefits indirectly from third party revenue via a reduction in the fee which would otherwise be payable to the private sector partner. We think there are strong arguments that such an arrangement would not amount to charging.

6.3 Exercise of Code powers

- 6.3.1 In addition to the constraints set out in section 6.2, the way in which the HA could make its land available for exploitation (e.g. for mast installation) to MCS Co needs to be considered. The two practical alternatives are to grant a licence or to permit MCS Co to exercise its “Code powers” as a PTO. Whichever mechanism is used, the question arises as to whether MCS Co could be given exclusive rights. All PTOs with Code powers have the right to install apparatus alongside highways. In the case of “protected streets”, however, which includes all motorways, the highways authority’s consent is required. The HA has to date withheld its consent, essentially on safety grounds. However, the granting of rights to one PTO would undermine the HA’s reasons for refusing access to PTOs generally.
- 6.3.2 If the Secretary of State entered into a contract with a private sector partner in relation to the MCS which purported to restrict him from giving consent to other PTOs to install apparatus, there is a risk that this would be considered by the courts to be an unlawful fetter on his discretion. In this way, therefore, a grant of exclusivity might be challenged by a competing PTO. In the absence of new legislation, this is a risk which potential MCS Co partners and their funders will need to be persuaded to live with. The risk of challenge may be mitigated in practice by ensuring that MCS Co offers any spare capacity to the other PTOs on a non-discriminatory basis. This should limit the necessity for these PTOs to seek access themselves to install their own equipment.
- 6.3.3 It should be noted that KHHS have been informed by the HA that APTRs are not generally “protected streets”. Although this would not prevent MSC Co extending its coverage to APTRs it would be harder for the HA to maintain any element of exclusivity as PTOs would have access to install apparatus on those APTRs that were not “protected streets” under Code Powers without requiring the HA’s consent. In these circumstances, MCS Co would need to rely on the commercial terms that it offers to PTOs for access to its network or use of its apparatus on the APTRs to incentivise those PTOs to use MCS Co’s network or apparatus rather than install their own.
- 6.3.4 To assess the extent of any such risk it may be useful to establish a register of protected streets. To limit this risk further, the HA may wish to consider the classification of certain high standard APTRs¹³ and decide as a matter of policy whether these should be reclassified as protected streets¹⁴ given their critical role in the HA’s core network.

¹³ For example roads with a minimum of dual, two lane carriageways with grade separated junctions.

¹⁴ A street may only be designated as protected if it fulfils a specific strategic traffic need, is subject to high and constant traffic flows so that designation of the street as a traffic-sensitive street would not be sufficient to avoid serious disruption from street works and there exist alternatives for the placing of the relevant statutory undertaker’s apparatus.

6.4 Delegation of statutory highways functions

- 6.4.1 Another legal constraint results from the possibility that the arrangements with a private sector partner in relation to the MCS will involve an express or implied delegation of certain of the statutory highways functions of the Secretary of State. This is legally permissible but any such delegation is limited to a period of ten years by virtue of Section 69(5)(4) of the Deregulation and Contracting Out Act 1994. It may well therefore be impractical to let a project for a longer period than ten years.

6.5 Data protection and confidentiality issues

- 6.5.1 Since submitting Report 3A (Assets Available for Exploitation) KHHS have been considering the option of installing a beacon system which will enable the transmission of data direct to road users. Such a system could be used for the following activities:
- a) collection of raw traffic data;
 - b) creation of traffic statistics from raw data;
 - c) the sale of processed traffic data; and
 - d) the transmission of data to and from vehicles to support value added services, for example providing traffic or weather reports to vehicles and the collection of data from vehicles for onward transmission to service providers (for example dynamic engine monitoring and advance fault warning).
- 6.5.2 Depending on the use of the system by MCS Co, data protection and confidentiality issues may be important. Data protection legislation relates to “personal data” and this is defined as data relating to a ***living individual who can be identified*** from that data or from that data and other information in the possession of the relevant data processor.
- 6.5.3 If MCS Co simply collects raw traffic data and then processes this for use or sale this is unlikely to give rise to data protection issues. Raw traffic data and statistics created from it, are unlikely to be personal data. However, if occupants of vehicles may be reliably identified (perhaps using DVLA registration data, mobile telephone number data or data from smartcards in the case of road user charging schemes) then it may be possible that personal data is collected.

- 6.5.4 If MCS Co is able to collect data identifying individuals and then process and sell it or market goods and services to individuals then MCS Co would need to register and comply with data protection rules. Issues such as the giving of consents to the use of personal data would become important. However, it may be that such data would relate to a vehicle, not to a living individual; if MCS Co were to consider providing advertising (perhaps the details of hotels and restaurants near the location of a vehicle) then consideration of the regulation of direct marketing will become important as this may be done without knowledge of who the vehicle user is.
- 6.5.5 Where data is transmitted to or from the occupier of a vehicle then it will be important to understand whether MCS Co has access to, and processes, personal data or whether it simply provides the transmission means. If there is access to the data of the vehicle user or the service provider then appropriate consents and data protection compliance will need to be considered by MCS Co. The main arrangements regulating such value added data services will be between the vehicle user and the service provider and such contracts would need to address data protection issues.
- 6.5.6 The crucial questions are set out below:
- a) is MCS Co using the beacon system solely for the transmission of data?
 - b) if not, to what use is MCS Co putting the beacon system?
 - c) is the data personal data?
 - d) is data collected or transmitted in such a way that MCS Co has access to it?
- 6.5.7 Data protection, confidentiality and marketing issues will need to be considered by both the HA and MCS Co as the commercial proposals for use of any system are developed and these issues should, if relevant to the chosen option, be explored further in Part B of the Project.
- 6.6 Resolving the legal issues**
- 6.6.1 This section has highlighted that there is a reasonable uncertainty as to the HA's legal powers to undertake the commercial opportunities outlined in section 5 and the Strategies which follow. Figure 6.1 below provides a summary of the legal issues, possible means of mitigation and the proposed actions to resolve them. Section 17, Next steps, records those actions to be taken in Part B.

Issue	Relevant Legislation / Point of Law	Mitigation	Action
1. DOES THE SECRETARY OF STATE HAVE SUFFICIENT POWERS TO CARRY OUT THE PROJECT?	Secretary of State derives wide powers from Royal Prerogative. However, these powers may be displaced where there are overlapping statutory provisions.	This issue would be eliminated if primary legislation were enacted to clarify the Secretary of State's powers in respect of the project.	1. Investigate further nature of statutory provisions: <ul style="list-style-type: none"> (i) the extent to which they cover the project; and (ii) the extent to which they displace the Royal Prerogative powers. 2. Investigate further whether primary legislation is a possibility.
2. WILL THE SECRETARY OF STATE BE CONSTRAINED FROM CHARGING FOR ACCESS?	If statutory basis for gaining access is found to be by virtue of PTO Code Powers, then the Secretary of State would need to give its consent to such access where the relevant road is a "protected street". It may be constrained from charging a commercial rate for granting such consent.	As above, primary legislation would clarify this. Also if the amounts that the Secretary of State wishes to charge are set off its fee for the provision of services then there are strong arguments to say that this would not amount to charging.	Clarification on statutory basis for gaining access (as above).
3. CAN MCS CO BE GIVEN EXCLUSIVE RIGHTS?	Any promise by the Secretary of State to MCS Co to not grant consent to other PTOs or any subsequent refusal to other PTOs for access could be challenged by such PTOs on the basis that such agreement with MCS Co was an unlawful fetter on the Secretary of State's discretion.	Again, primary legislation could clarify this. In reality any risks here could be mitigated by ensuring that such other PTOs are given access to any spare capacity by MCS Co – this should limit the necessity for these PTOs to seek access themselves to install their own equipment.	Clarification on statutory basis for gaining access (as above).
4. ARE THERE ANY TIME LIMITS ON THESE ARRANGEMENTS?	If contract with MCS Co is interpreted to be a delegation of the Secretary of States powers to MCS Co then delegation is limited to 10 years (Section 69(5)(4) of the Deregulation and Contracting Out Act 1994).	Limit contract term to ten years.	N/A

Figure 6.1: Legal issues summary

6.7 Policy constraints

6.7.1 In addition to the legal constraints, Report 3A identified various policy and operational constraints that might impact on the ability of a third party to exploit the HA's assets. The more important matters are listed in the following two tables, together with implications and possible mitigating circumstances.

Policy Constraints

6.7.2 Figure 6.2 below summaries the policy constraints.

Constraint	Implications/mitigation
The objective of keeping the number of people who carry out work on the motorway to a minimum.	Proposal for MCS Co to take over functions of NTMC and NTWC contractors, coupled with inherent reliability of newer generation equipment should avoid significant increase in number of people, except during initial installation works.
Police concerns over the number of people allowed access to gantries where enforcement equipment installed.	Might make it impractical for gantries on controlled motorways to be used for mounting of aerials or beacons. Scenario where gantry is used by MCS Co and then becomes part of a controlled motorway scheme needs to be considered.
Traffic management measures required to protect the safety of motorists and safe working conditions.	Comprehensive measures already defined for various situations but in some cases, local arrangements agreed by police prevail. Some measures may be more onerous than those currently adopted by telecommunications operators.
Approval required from the HA for mounting equipment on structures.	The HA already has procedures in place for approval of mounting equipment on structures, e.g. Trafficmaster equipment on bridges. Some revisions/refinements may be needed in respect of MCS Co apparatus.
Installation of mobile telephone apparatus adjacent to roads in England has not been permitted to date.	This policy will be reviewed when the findings of this Study are considered. It is envisaged that the HA will allow the installation of such equipment adjacent to roads under a contract arising from this Study. It should also be recognised that if the HA does not allow masts on its land, then operators will make arrangements with owners of adjacent land.
Bespoke design of much of the HA's equipment.	Main thrust of Strategies 3 and 4 in the Strategies sections concerns the transmission network. Use of recognised standards is not seen as being a constraint in this area. Development of Strategy 5 could address some issues in respect of bespoke design of devices.
Health and Safety issues	Main issues relate to safety of workers in the vicinity of aerials, ensuring there is no electromagnetic interference with the HA's other equipment and implications of CDM regulations with respect to RMC, TMC and MA.
Existing agreements may inhibit use of some assets in particular areas.	There are thought to be a number of local level agreements that have allowed third parties to use the HA's assets. The number and extent of these agreements has not yet been determined. They may set a precedent or inhibit the scope of future arrangements for use of the HA's assets by MCS Co.
Impact of GLA becoming responsible for trunk	Some opportunities for provision of fibre optic links

Constraint	Implications/mitigation
roads in London.	across London or into central London may be lost unless special arrangements are negotiated with GLA.
Strict interpretation of European Directives may imply extensive environmental assessments are required for works carried out under any contract arising from this Study.	Requirement for environmental assessments on mast sites is likely to result in operators seeking alternative sites on adjacent land.

Figure 6.2: Policy constraints

Operational Constraints

6.7.3 Figure 6.3 below summarises the operational constraints.

Constraint	Implications/mitigation
Power supplies may not be available at all locations where required by MCS Co.	Cost of provision of supplies to remote locations can be very high (tens of thousands of pounds per site). Use of local generators is only possible for short periods / emergencies as these require regular access for refuelling. HA may, however, already have supplies in areas where MCS Co wants to install aerials and where it would be expensive for them to arrange for independent supplies.
Access to some of the assets for purposes of installing and maintaining equipment may be difficult.	Agreements with third party land owners may be required for MCS Co to access overbridges. Alternatively, special access paths/steps could be provided from carriageways.
Interfaces with Maintaining Agent and Term Maintenance Contractor.	Refer to section 13.7 for details of issues arising from the interface between managing agents/term maintenance contractors and MCS Co.
Cable routes not owned by the HA, including those on certain DBFO roads.	Commercial exploitation, or even use, by a private sector partner may not be permitted under existing agreements. On certain DBFO roads, the HA is only given use of two fibres in a multi-fibre longitudinal cable.
There may be only a short window of opportunity for some assets to be made available to a private sector partner, i.e. before MCS Co could be appointed.	Mobile operators have advised that if they cannot install aerials on the HA's land by mid-2000, they will have to make alternative arrangements. The HA are considering whether interim measures could be put in place in advance of MCS Co being appointed.
PS and their designers may be constrained in respect of their design freedom when considering major maintenance / reconstruction / widening works. As with diversion / relocation of existing utility assets, there will be a cost implication to the HA.	MCS Co arrangements must provide for the situations whereby the HA require MCS Co operated cable / infrastructure is required to be 'by-passed' relocated or removed / re-configured in some other way. Extent of costs to the HA may be mitigated to some extent through appropriate contractual arrangements.
Possible disruption to traffic during the MCS build phase	Core requirement no more onerous than existing HA plans for triple package roll out. Additional fibre installation for commercial use would require hard shoulder closure only, with minimal disruption. Mast erection would be done at night to reduce disruption to traffic.

Figure 6.3: Operational constraints

- 6.7.4 None of the constraints classified under policy or operational are considered to be of such a nature as to prevent implementation of any of the Strategies identified. They would, however, have to be borne in mind and appropriate measures put in place when documentation is finalised under Part B of the project.

THIS PAGE INTENTIONALLY LEFT BLANK

7.0 APPROACH TO FORMULATING STRATEGIES

7.1 Introduction

7.1.1 The main objective of the Study is to identify and assess new ways of procuring the HA's communications services that harness the commercial opportunities in the services and provide better value for money, enable expansion of the HA's network and shares the cost of the development with private partners. In this report we have identified these new ways as Strategies and have identified 5 core Strategies.

7.1.2 This section sets out the approach to formulating the Strategies. It discusses how these Strategies map on to the procurement options (the "HA Options") identified in the Specification, and it also provides at the end of the section, some commentary on matters relevant to all the PFI Strategies on third party revenues and charging principles.

7.2 Approach

7.2.1 Figure 7.1 provides a route map for the Study and the Strategy forming process.

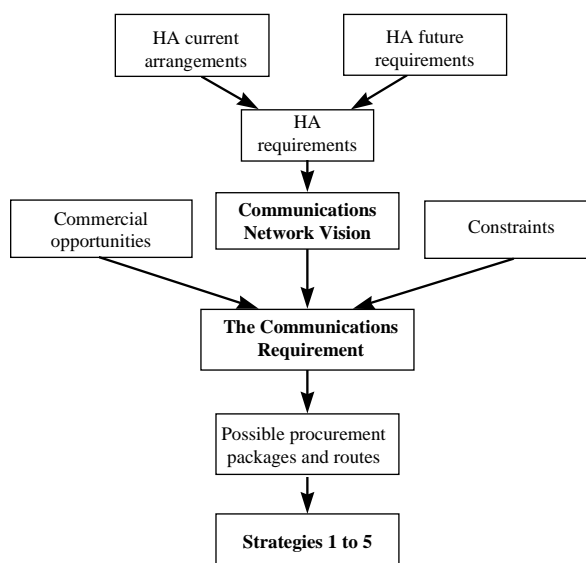


Figure 7.1: Approach to formulating the Strategies

7.2.2 The HA's current arrangements and future requirements in sections 2 and 3 provide the HA's baseline requirement. In section 4, the communications network vision develops this requirement by providing a broader view of how communications are evolving and how their role is likely to expand within the HA. In sections 5 and 6, we consider the external influences on this requirement, the commercial opportunities in developing the HA's communications network and the constraints on its commercial development. From this, we can deduce the HA's communications requirement.

7.2.3 In this section, we summarise the HA's communications requirement and examine whether and how it should be divided up for the purposes of procurement. We also look at the appropriate procurement methods for its purchase.

7.3 The HA's communications requirements

7.3.1 The core aspects of the HA's communications requirements, as discussed in the previous sections, are as follows:

- a) the HA requires a communications service which supports the HA's existing and immediate communications requirements for communications links between roadside devices and PCOs (and potentially TCC), and is positioned for the additional communications link from the roadside into vehicles. The backbone of this communications service is considered to be the target network described in section 4.7;
- b) there is an opportunity to enhance communications by contracting for a roadside to vehicles link now as part of the requirement of this project. This new link would enable more sophisticated traffic information and traffic management services to support the HA's roads network operator role, and position the HA for potential new applications such as road user charging;
- c) the HA wishes to take advantage of the perceived revenue generating opportunities in exploiting its existing fibre network, potential roadside to vehicle links, and the opportunities for the positioning of telecommunication masts on its land;
- d) the HA wishes to provide and maintain its existing roadside communications devices in the most cost effective manner; and
- e) the HA needs to maintain and upgrade its business communications requirements with the introduction of an ATM based office WAN.

7.4 Procurement packages

7.4.1 In examining the potential procurement strategies for the HA, we have divided its communications requirement into three distinct parts:

- a) the motorway communications network;
- b) roadside equipment such as emergency telephones, VMS, CCTV and MIDAS equipment; and
- c) the business communications network, which includes both voice and data connections between the HA's offices and its maintaining agents.

- 7.4.2 The nature of the requirements for each of these elements and the market for their provision are very different, quite possibly requiring different solutions if optimum value for money is to be realised. The key differences are highlighted below.

Motorway communications network

- 7.4.3 The motorway communications network is a reasonably constant and steady requirement operating within known and fixed parameters, except for the possible extension of the link from the roadside into vehicles.
- 7.4.4 These requirements are unlikely to change dramatically over the timeframe of the this Study provided appropriate capacity is specified upfront. Also, it should be possible to absorb any unforeseen changes in capacity relatively easily through upgrades in transmission technology, as long as these are adequately provided for in any long term contract.
- 7.4.5 The existing communications network is in parts quite bespoke, but with the roll-out of fibre and the introduction of transmission technologies such as SDH, it should increasingly be viewed as a commodity service. This should also enable standard interfaces with commercial telecommunications operators.
- 7.4.6 There is an existing competitive supplier base for the provision of communications services similar to those required for the motorway communications network which is independent and non-reliant on HA communications business.

Roadside equipment

- 7.4.7 The roadside equipment is entirely bespoke and, unlike the motorway communications network, within the timeframe of any contract arising from this Study is likely to evolve considerably such that it is not possible to specify upfront what the requirements are likely to be over that timeframe.
- 7.4.8 Due to the bespoke and varied nature of the equipment, a single contract for the provision and maintenance of all of the equipment is unlikely to be cost effective.
- 7.4.9 Due also to the bespoke nature of the HA's requirements, the equipment is provided by specialist suppliers who may be commercially reliant on continuing to receive a portion of the HA's equipment supply business.

Business communications

- 7.4.10 The HA's business communications are entirely a commodity service with no special HA requirements and a well developed, open market for their provision.

- 7.4.11 This study has concentrated primarily on the provision of the motorway communications network and the roadside equipment to the extent that it drives the requirements for that network. The reasons for this are twofold: first, the motorway communications network is necessarily at the centre of any motorway communications PFI study; and, second, it is apparent that this is where the best opportunities for realising significant value for the HA lie¹⁵. Nevertheless, KHHS have also looked at ways to improve the procurement of the roadside equipment and the business communications services and this is covered in this Final Report.

7.5 Procurement methods

- 7.5.1 Having established that a communications link into vehicles is ultimately where the HA's communication needs are heading, KHHS then considered the options for its provision. We introduced some of the options in section 4.5 when looking at what role the HA should take in relation to telecommunications services provision. Here we expand particularly the partnering options (outsource, joint venture, PFI, PPP etc.) in looking at procurement methods.
- 7.5.2 At one end of the spectrum the HA could outsource the entire provision of the service simply by specifying a requirement for telecommunications links between existing and new equipment, vehicles and control centres. At the other end of the spectrum, the HA could develop the network entirely under its own management and control, in effect a PSC approach. In between these two, there are possibilities for passing the network to a separate HA telecommunications company co-owned with a strategic partner, a PFI approach, a public-private partnering approach or a facilities management approach. We look at each of these options below.

Network outsource

- 7.5.3 At one extreme it is possible to imagine a roadside communications network where every piece of end user equipment is linked directly by satellite, microwave or other wireless technology to a commercial network. The requirement for a highways specific network infrastructure would disappear and the HA's existing network and transmission technology would no longer be required. Alternatively, each piece of end user equipment would be linked by a variety of fixed and wireless links to the nearest node of a commercial operator's fixed network such as BT or Energis. In both cases the commercial operator would be responsible for providing the end to end communications network in its entirety.
- 7.5.4 KHHS do not believe that this is a viable option for the HA for a number of reasons:

¹⁵ It is worth noting that a similar project, London Underground's CONNECT project, also split out the provision of the telecommunications network from the provision of the end user equipment, and focused on a PFI procurement of the former.

- a) the large number of HA roadside devices¹⁶ requiring communications links and their geographical spread is likely to render such an approach involving linking every piece of equipment to a new network unviable;
- b) fibre optic cable is the current industry standard method of providing the type of high capacity links that is required, at least, to the level of the TSs. A roadside fibre network is the obvious means of linking the TSs given their roadside profile; and
- c) the bespoke nature of much of the HA's existing devices, means that transition to a fully outsourced public network would require a substantial amount of redesign and reconfiguration of the existing equipment which is likely to render such an approach unviable in the short to medium term.

Joint ventures

- 7.5.5 KHHS have considered whether the HA could assign its telecommunications operations to a joint venture organisation with a commercial operator. The aim would be to develop its network into one offering commercial services to the private sector with the aim of being self-financing and, possibly, income generating for the HA. It is assumed that such an arrangement would involve some sort of equity participation, probably through the contribution of its existing network and rights to develop additional network capacity across its land. The HA could either be an active partner or a passive partner in such a venture and the amount of risk to which it would be exposed could be controlled to an extent through the contractual arrangements with its partner.
- 7.5.6 This solution and the next three mentioned, a PFI, a PPP and a facilities management solution, all involve the use and development of the HA's existing motorway communications network. The key difference between them is the extent of the HA's involvement and hence, its retained risk in each of the solutions.
- 7.5.7 A joint venture generally involves a substantial amount of risk remaining with the public sector by virtue of its equity partnership in the arrangement. Such ventures are suitable therefore only where the downside risk is considered to be small and manageable and the public sector wishes to benefit directly from any realised upside.

¹⁶ The number of roadside devices is estimated to be in the region of 18,000 devices.

RSI

- 7.5.8 An example of a joint venture between the private sector and government is Radio Spectrum International (“RSI”). This is a joint venture set up in June 1998 between the Radiocommunications Agency (“RA”) and Computer Management Group (“CMG”), with The Smith Group and National Economic Research Associates (“NERA”) as preferred partners. RSI provides information technology (“IT”) services to the RA and consultancy advice for spectrum management to other telecommunications organisations. The joint venture, which will run for a minimum of seven years, is managed by CMG which owns 70% of the company. The remaining 30% is owned by the Secretary of State for Trade and Industry. The company is staffed by CMG consultants with additional staff on secondment from the RA.
- 7.5.9 The purpose of the joint venture is to exploit software developed for the RA by CMG and to utilise the knowledge gained by the RA and its advisers through the UK spectrum management experience. The upside for the RA is a share in the potential third party sales of the software and know-how already developed and paid for by the RA. The RA is therefore taking little risk in RSI, save for its administration costs in the joint venture, but may gain from a potentially significant upside.

Royal Parks Enterprises

- 7.5.10 A similar example is Royal Parks Enterprises a joint venture between the Royal Parks Agency (“RPA”) and a marketing company set up in 1998 to develop events and merchandise in the Royal Parks and to return some of any profit to the RPA. Again, there is very little if any downside risk for the public sector, but it is set to benefit if the operations are profitable.

2020Speech

- 7.5.11 The public sector has a more active involvement in the Government’s Defence Evaluation and Research Agency’s (“DERA”) joint venture called 2020Speech. This is a joint venture with a UK audio technology company NXT to develop speech applications for functions such as voice-activated web browsing and network security. The joint venture is part of an initiative to turn DERA into a more commercially focused business and is aimed at combining NXT’s skills in intellectual property, technology licencing and marketing with the expertise of DERA’s Speech Research Unit. DERA holds a stake of about 40% in 2020Speech, and the intention is to realise the investment within five years by means of an Initial Public Offering (“IPO”).

- 7.5.12 Unlike the previous two joint ventures considered above, the public sector is taking a genuine risk in 2020Speech through the further development of its speech technology. Nevertheless, it is arguable that it would incur the development risk as part of its research operations in any case, and the joint venture simply gives it the opportunity to benefit from any upside. In this case, the public sector has a unique set of skills and intellectual property which it wishes to benefit from, and is best placed to develop as part of a commercial enterprise.

HA joint venture company

- 7.5.13 In considering whether joint venture arrangements may be suitable for the development of the HA's telecommunications services, KHHS have considered two models. The first is the passive model, similar to Royal Parks Enterprises, where the HA would make its existing network available to a joint venture partner who would develop the system at its own risk for commercial use while at the same time meeting the HA's communications requirements. The HA would benefit from a share of any potential profits. The second is an active model, similar to 2020Speech, where the HA would play an active role in the development of the network in return for a direct share in the profits or losses of the venture.
- 7.5.14 The active model can be discounted on the grounds that the HA does not have a unique asset – there are already several substantially more developed networks providing national coverage – and it does not possess unique specialist skills which would be suitable for commercial exploitation. Indeed, the HA has already contracted out substantial parts of its network design and maintenance functions as these are not seen as core to its activities. In the absence of a competitive advantage or a unique opportunity that would necessitate the active involvement of the HA for its exploitation, the additional risks of such a role could not be justified.
- 7.5.15 Under a passive model on the other hand, the arrangements should provide few additional risks to the HA. It would, in effect, be simply handing over control of its network to a private sector partner, but it would be able to share, through some form of profit sharing mechanism, in the potential upside benefits. Whilst its entitlement to a share of the profits is likely to be more circumscribed than in the active model to reflect its lower risk participation, some form of sharing in the upside with little downside risk is obviously attractive to the HA and in line with the Government's Wider Markets objectives. The question in this case is, therefore, whether a joint venture is the best means to achieve this objective.
- 7.5.16 As well as joint venture arrangements, PFIs and PPPs also seek to achieve broadly similar objectives. The question of which structure is suitable for the HA's telecommunications operations depends in part on policy considerations, but also on the best fit with the HA's requirements, and best value for money in terms of risk transfer.

- 7.5.17 KHHS have established in interviews with senior management that whilst communications are seen as key to the development of the HA's role as trunk road network operator, the business of providing telecommunications services is not. In the same way, most modern businesses depend fundamentally on telecommunications for the operation of their businesses, but very few actually own and operate their own telecommunications networks and fewer still make them available for the commercial use of others.
- 7.5.18 For the HA, telecommunications network provision, offering commercial services to the private sector, would not be a core activity and could distract it from its main purpose of managing the highways network. The HA does not possess the skills and management expertise to manage the risks of operating such services. Even though a substantial portion of these risks could be passed to a private sector partner, the HA would still retain some exposure through its participation in such an arrangement.
- 7.5.19 However, perhaps more significantly, joint ventures generally involve the pooling of assets and expertise in order to exploit a third party opportunity. The exploitation of the third party opportunity is the primary purpose. For example, RSI aims to sell software and consultancy advice developed for the RA to other telecommunications organisations; Royal Parks Enterprises markets events and merchandise in the Royal Parks to the public; and 2020Speech pools DERA research and NXT's marketing skills. Joint Ventures are not an obvious vehicle, however, where the primary purpose is the development of services for the provision by one party to the other.
- 7.5.20 The core requirement identified by the Study is the development and provision of a communications network to the HA which has the potential of providing roadside to vehicle links. The natural ambitions of a joint venture to exploit the third party revenue opportunities provided by such a network are important but ultimately secondary considerations. The system first needs developing, and the key risks facing the HA relate to the design, development, implementation and operation of the system. This requirement lends itself more obviously to a PFI which is described below.

PFI

- 7.5.21 The HA requires a structure which minimises the design, development, implementation and operational risks to it, fulfils its policy objectives and delivers a portion of the benefits which commercial exploitation should deliver, and, above all, a structure which delivers best value for money.
- 7.5.22 PFI was developed to meet these objectives and provide a framework for private sector participation in the provision of public services of the sort which have traditionally been supplied by central or local governments. The essential features of a PFI are:
- a) the allocation of risk to the party best able to manage and control it; and
 - b) the purchase of services rather than assets.

- 7.5.23 A PFI for the motorway communications services is likely to involve the transfer of much of the ownership risks and operating risks of the HA's communications requirement to the private sector. Ownership risks include design, development and implementation risks. In practical terms, this is likely to involve the transfer of the existing motorway communications network to the private sector in return for the development of the network and the provision of communications services, specified in a concession agreement, over a fixed term, subject to charges based on usage and availability.
- 7.5.24 One of the key mechanisms by which the risk transfer is achieved is the use of output based specifications to describe the PFI services which the public sector is purchasing. In essence, an output based specification for the HA's communication services would describes the "what", i.e. the communications operations the HA will require the PFI services to support, leaving the "how", i.e. the private sectors' technical solution for meeting those requirements, as the responsibility of the private sector. In this way, the design, development, roll-out, implementation, operation and fitness for purpose risks would remain with the private sector.
- 7.5.25 This is not to say that the HA would have no control over the technical solution. In specifying its requirement, the HA will provide in considerable detail the geographical coverage, capacity, reliability, data speeds, maintenance, residual life, upgrade and other performance characteristics of the services it requires. The target network described in section 4.7 provides a starting point for the type of coverage and performance characteristics the HA will require. Specified in this way, the requirement will limit the range of potential solutions offered by bidders to the HA. In addition, the HA will evaluate each technical solution proposed by bidders for its ability to meet the HA's requirements and will favour those which best match its requirements.
- 7.5.26 Under a PFI arrangement the HA would also benefit from the realisation of the commercial opportunities inherent in its existing network and the upgraded network provided by the private sector supplier. This could be by way of a reduction in the charges it pays for its service, a direct share in revenues over a certain level, or a combination of both. This is explored in more detail in section 8.2.
- 7.5.27 The motorway communications network has a number of attributes that lend it to a PFI arrangement:
- a) The HA's communications requirements are likely to remain fairly predictable both in terms of capacity and coverage over the foreseeable future and are therefore capable of being specified in a concession agreement. Capacity upgrades that may be required over the term of a concession are capable of being delivered primarily through transmission equipment upgrades such as SDH, the costs of which can be catered for in the concession agreement either by being specified in the agreed requirement, or, where they are unforeseen, by being subject to pre-agreed upgrade prices or calculated by reference to an agreed formula;

- b) there is an opportunity in the operation and development of the network for commercial revenues with which to offset the cost of the network to the HA and these can best be realised through the participation of the private sector; and
- c) there is an opportunity to increase the efficiency and effectiveness of the network through the introduction of modern technologies thereby increasing the range and quality of services which can be offered to the HA and increasing the opportunity for commercial revenues.

7.5.28 There are strong arguments, therefore, for exploring the PFI option in more detail and this option is analysed in two of the Strategies developed by the Study as explained in section 7.6.

PPP and facilities management

7.5.29 PPP is a wider term than PFI and can describe any situation in which the private sector is involved in the provision of public services which have traditionally been supplied by local or central governments. This includes anything from PFI asset based services to facilities management arrangements to arrangements to develop areas of government operations or to introduce commercial exploitation of government assets. The Wider Markets policy is aimed at creating more PPP arrangements with the private sector to introduce more private sector skills and commercial enterprise into the HA.

7.5.30 Relating PPP to the motorway communication services, we use it to describe a looser arrangement than a PFI where the degree of upfront development of the requirement specification in the concession agreement and the corresponding risk transfer is less rigorous than a PFI. This would include maintain, finance and operate (“MFO”) arrangements and maintain and operate (“MO”) arrangements. Many of the risks which would be transferred to the private sector under a PFI such as demand risk, fitness for purpose and certain other ownership risks are not transferred, or not transferred in their entirety, to the private sector under a PPP arrangement.

7.5.31 The choice between a PFI and PPP will depend on which delivers the best value for money for a given requirement. A PFI will generally deliver better value for money where the requirement is clear and certain over the term of the concession. This can include circumstances where the requirement is likely to change as long as the change can be forecast with a sufficient degree of certainty to make assumption of the risk of that change by the private sector cost effective. If the requirement is too uncertain, the private sector will price the risk accordingly and this will not provide good value for money to the public sector. In such circumstances, a PPP arrangement where the contract provides mechanisms for developing the requirement and its pricing over the term of the contract is more suitable.

- 7.5.32 As mentioned above, the requirement for the motorway communications network has a number of attributes which, in our judgement, lead us to consider that a PFI for the services would provide the optimum risk transfer and, hence, best value for money for the HA. For the purposes of this Study, therefore, we have assessed Strategies involving private sector participation on the basis of PFI arrangements. During the course of Part B of the project, the requirement and the risks associated with it will be subject to detailed development and a detailed reappraisal of the value for money arguments behind each risk transfer will be carried out in negotiation with bidders.

PSC

- 7.5.33 A conventional procurement approach which a PSC would assume, has the HA and the private sector in their traditional roles. The HA would design, specify, purchase and roll out the motorway communications network it requires. It would let a separate contract for the maintenance of the network. All of the ownership risks and the substantial majority of the operating risks would remain with the HA. We assume that there would be no commercial exploitation of the system other than via mobile telephone mast related activities.
- 7.5.34 The only exception to this is that KHHS considers that the HA must develop a policy for making mast sites available to mobile network operators, as a matter of urgency, under all procurement scenarios. Such a policy will have to address the legal constraints identified in section 6, which indicate that there is reasonable uncertainty as to the legality of these arrangements. In addition, the telecommunications market survey has identified that there is a short term window of opportunity for making sites available to mobile network operators. If the HA is not able to do so within, say, six months, the mobile network operators will be forced to look elsewhere and make alternative arrangements. Any arrangements that are made in the short term would then be included in the PFI parts of relevant strategies.
- 7.5.35 A PSC has been developed as a comparison against each of the PFI Strategies in order to demonstrate value for money. In each case the PSC delivers the same functionality as the PFI Strategy but assumes a conventional procurement.

7.6 Introduction to the Strategies

- 7.6.1 KHHS have examined Strategies for each of the procurement packages identified in section 7.4 above. These are:
- a) the motorway communications network;
 - b) roadside equipment; and
 - c) the business communications network.

Motorway communications network

- 7.6.2 KHHS have developed five Strategies. Of these, Strategies 3 and 4 are for the motorway communications network (Strategies 1, 2 and 5 are described later in the following sections). Both these are PFI Strategies on the basis of the strong correlation between the HA's aspirations for its motorway network in terms of private sector involvement, development and funding and the requirements for a successful PFI discussed above.
- 7.6.3 Strategy 3 is a PFI for a national motorway communications network up to the roadside verge, with the right to exploit surplus fibre capacity for commercial services and the requirement to develop a managed telecommunications mast sharing service. This Strategy is developed in detail in section 10.
- 7.6.4 Strategy 4 is the same as Strategy 3, but with the additional obligation to provide a roadside to vehicle link, and the right to exploit surplus capacity on this link for commercial services. This Strategy is developed in detail in section 11.
- 7.6.5 There are broadly two competing classes of technology that could potentially provide the roadside to vehicle links in Strategy 4. These are referred to as UMTS and DSRC. Commercially, the key distinction is that the former would require MCS Co to be a radio licence holder (for UMTS, GSM or even TETRA spectrum) and implies that the partner would be an existing mobile network operator, other than for any fifth UMTS licence holder that might emerge. For DSRC operation, no radio licence is required as it operates in an unlicensed frequency band and no such network currently exists. Thus, MCS Co could become a new national network operator in the UK telecommunications market. These two technologies are substantially different in their infrastructure requirements, the method of communication and the types of information they can carry. KHHS have, therefore, prepared two iterations of Strategy 4 in the financial analysis, based on the two different technologies.
- 7.6.6 The Specification requires that KHHS prepare suitable PSCs by which to assess the potential value for money of any PFI procurement strategies, in this case Strategies 3 and 4. Since the functionality proposed in Strategies 3 and 4 differ between the strategies and both differ to the functionality proposed in the 'Do Minimum' strategy described below, separate PSCs have been prepared for Strategies 3 and 4.

Roadside equipment

- 7.6.7 The HA currently procures most of its roadside equipment through bulk purchase contracts and stores the equipment centrally before it is called off for installation. Installation of the equipment and associated infrastructure proceeds under defined schemes for a Triple Package of measures comprising NMCS infrastructure, cantilever MS2 and MS3 signs and MIDAS. On completion of the installation, extensive commissioning tests are carried out and the equipment is handed over to the HA. Maintenance is then carried out under one of seven geographically based RMC contracts. Responsibilities for the design, provision, installation, testing and maintenance of the equipment are, thus, divided. KHHS have considered the options for involving suppliers in the whole life cost of roadside equipment and the setting up of framework agreements for the delivery of triple package schemes and RMC functions. This is developed in Strategy 5 and is discussed in section 12.

Business communications network

- 7.6.8 The business communications network operates in an open and competitive market, and the requirements on it are unlikely to change significantly in the foreseeable future. The HA is, therefore, only likely to realise material benefits through a service provider offering to discount provision of the HA's business communications as part of an overall network management package (i.e. one including the motorway communications network). Thus, inclusion of the business communications network is considered as an option in Strategies 3 and 4 above. Preliminary enquiries, documented in Report 2, indicated a possible saving of up to £400,000 per annum may result if such an option was pursued.

Do Nothing and Do Minimum

- 7.6.9 In addition to the three strategies outlined above, KHHS have considered a 'Do Nothing' strategy, Strategy 1, and a 'Do Minimum' strategy, Strategy 2.
- 7.6.10 The Do Nothing strategy, which is described in more detail below, has not been developed on the grounds that it fails to meet the HA's essential requirements.
- 7.6.11 The Do Minimum strategy represents the minimum network maintenance and upgrade that the HA is likely to carry out and is based on the HA's current plans for its network. These envisage an affordable conventional procurement and as such represent the HA's public sector alternative to a PFI procurement. This Strategy is developed in section 9.

Summary

7.6.12 Figure 7.2 below summarises the Strategies against the three procurement packages.

Procurement strategies		
HA's communications network		
<i>Motorway communications network</i>	<i>Roadside equipment</i>	<i>Business communications network</i>
← Strategy 1: Do nothing →		
← Strategy 2: Do minimum →		
Strategy 3: A PFI for a national motorway communications network up to the roadside verge, with the right to exploit surplus fibre capacity for commercial services and the requirement to develop a managed telecommunications mast sharing service (PFI and PSC iterations) Strategy 4: As for Strategy 3, but with the additional obligation to provide a roadside to vehicle link, and the right to exploit surplus capacity on this link for commercial services (PFI iterations for UMTS and DSRC, and a PSC iteration)	Strategy 5: Whole life cost approach for the design, build, finance and maintenance of roadside equipment Setting up of framework agreements for delivery of triple package schemes and RMC functions	Option as part of an overall network management package on the motorway communications strategies (Strategies 3 and 4)

Figure 7.2: Strategies summary

7.6.13 The selection of one of the above strategies does not preclude proceeding with others in parallel. For example, Strategy 4 builds additional features onto the framework of Strategy 3 and the HA could therefore proceed with both.

Strategy 1 - Do nothing

7.6.14 A 'Do Nothing' Strategy is a strategy where the HA undertakes no work to upgrade or enhance its existing communications network other than essential repair and maintenance. It is in effect a stand-still strategy and assumes that the current annual maintenance costs would be carried forward each year with an ever higher risk of additional exceptional costs. The system is already obsolete and will in due course become inoperable.

- 7.6.15 Strategy 1 is regarded as non-viable, even in the short term, as it would fail to meet the HA essential minimum requirements which are:
- a) support 105 new VMS signs;
 - b) MIDAS expansion;
 - c) replace ageing carrier networks which have reached the end of their useful life;
 - d) improvement in response times of traffic logging systems; and
 - e) upgrade HA's office WAN.
- 7.6.16 Consequently, Strategy 1 is noted here as a strategy which was considered by KHHS but has been discounted as unviable and, therefore, has not been developed further.

7.7 Project timeline

- 7.7.1 The timeline diagram at Figure 7.3 shows the relationships between the MCS project, the HA's existing Triple Package Programme and the TCC project. It also highlights the impact of the UMTS programme on the MCS project and the need for interim arrangements if the opportunity for providing mast sites on HA land for UMTS telecommunications is to be realised. This is due to the long lead time to award and commencement of the MCS PFI. Interim arrangements are discussed later for Strategies 3 and 4 in sections 10 and 11 respectively.

MCS Time line

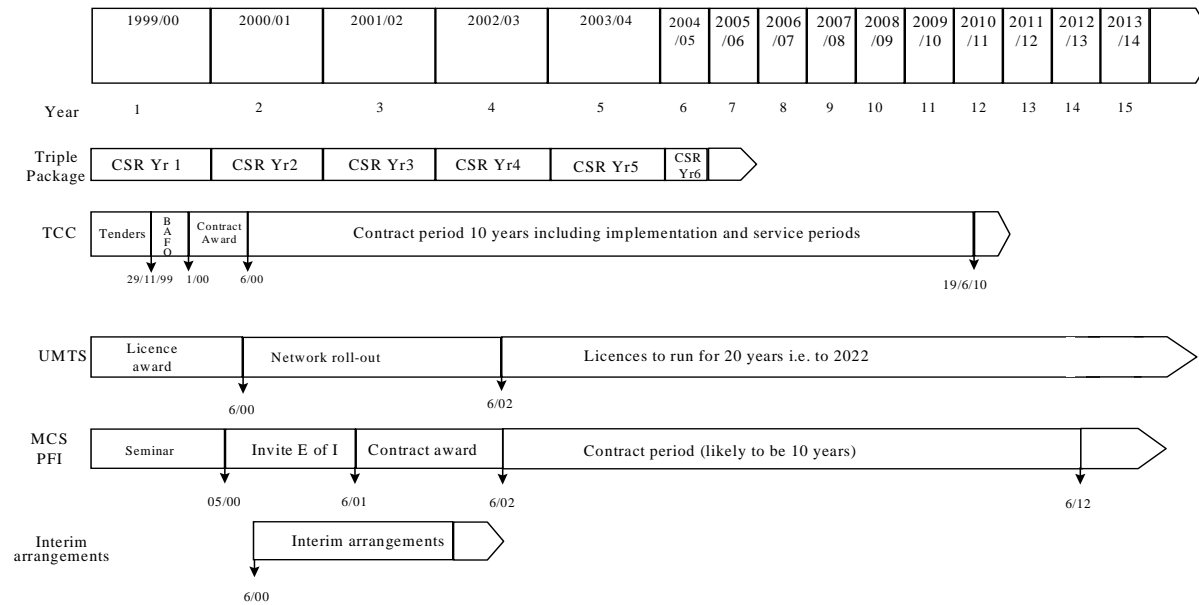


Figure 7.3: MCS Co Project timeline

7.7.2 The significant points arising from the above are:

- a) The TCC deal will be completed prior to the receipt of expressions of interest in MCS Co. The interfaces between MCS Co and TCC Co will need to be carefully considered and addressed in the TCC Co negotiations; and
- b) The HA's Triple Package programme will continue in parallel with the MCS Co PFI procurement up to MCS Co contract commencement and a review of the planned schemes will need to consider their value to any MCS contract.

7.7.3 These matters are developed in the "recommendations" in section 16 and "next steps" in section 17.

7.8 Matching the Strategies to the HA Options

7.8.1 The Specification requires KHHS to examine the HA Options which involve the grouping together of services currently provided under separate contracts. The intention is to examine whether the services included in each option can be procured more effectively as a single service than under the existing arrangements and to propose the type of procurement, i.e. PFI, PPP, MO or MFO, which would best suit the merged services.

7.8.2 The approach taken by KHHS in formulating the Strategies is based on identifying the requirements of the HA's communications networks, the opportunities for both the HA and the private sector in delivering those requirements, and the potential constraints. We have then proposed procurement options to meet these criteria.

7.8.3 The HA Options approach starts from the position of the existing contractual arrangements rather than the future communications requirements and develops options based on the existing service delivery.

7.8.4 Both approaches are relevant. Any Strategy that is to be adopted must be capable of meeting the HA's requirements and exploiting the opportunities whilst recognising the existing arrangements and transition that adoption of the Strategy would entail.

7.8.5 Figure 7.4 below summarises the HA Options contained in Annex 8 of the Specification.

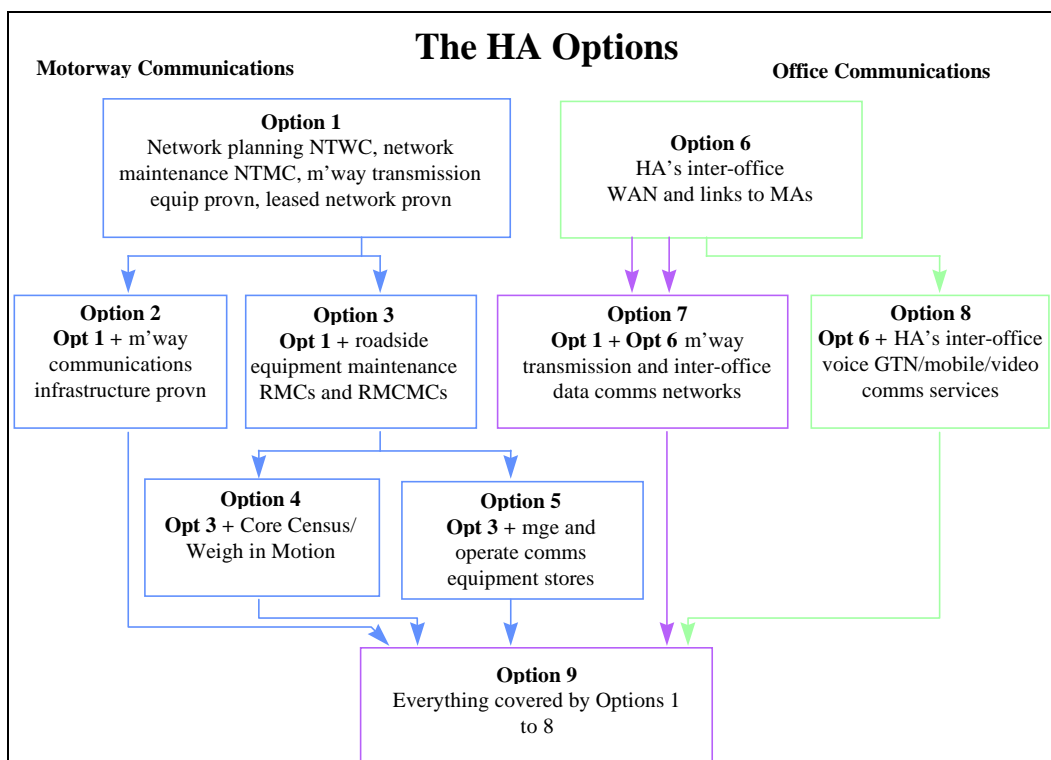


Figure 7.4: The HA Options

- 7.8.6 The two core Strategies identified by KHHS, Strategies 3 and 4, focus principally on HA Option 2 (which includes HA Option 1). As mentioned above, KHHS consider that it is in the motorway communications network that the most value for the HA can be realised. Within both of those strategies, they have taken forward an option to include HA Options 7 and 8 (which include HA Option 6), the business communications, if it is demonstrated (by making this an option in the PFI bids) that it would provide better value for money than the existing arrangements.
- 7.8.7 KHHS have also developed Strategy 5 for the roadside devices. This covers HA Option 5 (including HA Option 3, but excluding HA Option 1). KHHS have not specifically developed a Strategy for the Core Census and Weigh in Motion elements of HA Option 4 as it was agreed with the HA that these services, which are procured by DETR as opposed to the HA, were not considered material to the overall scope of the project. Likewise, apart from Strategy 2, the Do Minimum Strategy which assumes broadly the continuation of the existing arrangements, KHHS have not developed an all encompassing Strategy envisaged by HA Option 9, since, as explained above, the requirements of the motorway communications network, the roadside equipment and the business communications are considered to be too diverse to be combined cost effectively into a single procurement.

7.8.8 Paragraphs 7.8.6 and 7.8.7 are summarised in Figure 7.5 below.

Strategy	HA Options	Existing services covered
Strategy 2	Option 9	All services covered by Options 1 to 8
Strategy 3	Option 1 Option 2 Bids to include options on Option 6, Option 7, and Option 8	Network planning NTWC, network maintenance NTMC, motorway transmission equipment provision, leased network provision Motorway communications infrastructure provision (longitudinal cable infrastructure only) HA's inter-office WAN and links to MAs Motorway transmission and inter-office data communications network HA's inter-office voice GTN/mobile/video communications services
Strategy 4	As for Strategy 3	
Strategy 5	Option 3 (excluding Option 1)	Triple package schemes (excluding longitudinal cable infrastructure). Design, build and maintenance of roadside equipment RMCs and RMCMCs

Figure 7.5: Mapping the Strategies to the HA Options

THIS PAGE INTENTIONALLY LEFT BLANK

8.0 PFI ISSUES

8.1 Introduction

8.1.1 This section examines three key issues to be addressed in any PFI for the HA's communications network. They are:

- a) charging principles
- b) realising the benefit of third party revenues; and
- c) ownership of assets at the end of a PFI contract.

8.1.2 These are considered in turn below.

8.2 Charging principles

8.2.1 The payment mechanism is one of the primary mechanisms in a PFI contract regulating the allocation of risks between the public sector customer and private sector supplier. In this section we set out some the principles which would determine the type of payment mechanism we would propose for the PFI Strategies. The details of the payment mechanism will be developed once the nature of the PFI deal is more clearly defined in terms of the precise nature of the services to be provided and the risks to be transferred.

8.2.2 The actual payments in any accounting period would depend on a number of factors:

- a) the terms of the payment mechanism, which defines what is paid for what specified level and quantity of services;
- b) the risks associated with service delivery and usage;
- c) actual performance against the specified level and quantity of services;
- d) the periodicity of the payments;
- e) any changes to the service agreed under the variation provisions of the contract.

8.2.3 Most PFI contracts provide for payment to start when the specified service first starts to be delivered (which transfers the financial risks of late completion to the private sector). Payments are then made in respect of either:

- a) the service provider making the serviced asset available to the customer (the "availability basis"); or
- b) the service provider carrying quantities of service, for example, the amount of bits transmitted (the "usage basis").

- 8.2.4 In practice there is crossover between the two, because they generally both provide for deductions to be made in respect of poor service quality (e.g., unavailability of service, unreliability, poor technical quality), and may both include a measure of variation in payment with levels of usage.
- 8.2.5 One of the main factors affecting the choice is certainty about levels of usage. If the public sector's strategic interest is to have access to a system regardless of how much it is likely to be used, availability and confidence of access can be said to be more important. Similarly, where it is uncertain how much an asset or service is likely to be used it may be impossible to determine a throughput basis which offers value for money across the range of likely usage levels. Conversely, if the level of predicted usage can be established with confidence, it may prove better value for money to pay on the basis of throughput, though there is still the question of the rates to be applied, especially outside a central band of predicted need.
- 8.2.6 Many PFI contracts address this by specifying a minimum payment level set as the "take or pay" level of usage: the service is paid for at given rates per quantity of service, subject to a minimum level of usage. In most cases the take or pay level is set at a value which ensures the servicing of senior debt, which often works out at approximately 70% of the maximum potential income. Such contractual arrangements also used to appeal to those who saw the possibility of project commitments being tested under the UK's Statement of Standard Accounting Practice ("SSAP") 21 (accounting for leases), and who would therefore keep the payment of the committed amount less than 90% of the intended total.
- 8.2.7 A key question in many PFI project agreements is that of the extent to which payments vary with changing legal requirements or operational needs. PFI projects, in providing a strongly contractualised solution, can be inflexible in dealing with emerging or changing requirements: providing for a lot of routine but unplan-able changes in the base service may provoke a higher price than the prospect of no significant change. The potential effect of big, one-off changes may also be considerable, so where a high degree of uncertainty attaches to a significant cost item, this can have significant consequences for reserving, cover ratios and other financing covenants, which will tend to become harsher with increased risk. This will lead to a consequent increase in funding costs which would inevitably be passed on to the HA.
- 8.2.8 In the case of the HA communications network, there would appear to be a relatively stable requirement for the transmission of data, such that a usage basis (payment per BIT transferred) may offer better value than an availability-driven (payment for capacity) regime. This would need to be subject to deductions for poor service (interruption of transmission, weak or unusable strength of signal, unreliability of messages) as provided for in a service level specification within the contract. Possibly, payment could be based upon the availability of the target network to give the contractor incentive to complete this as soon as possible and to de-commission the ageing carrier network.

- 8.2.9 A common issue for IT or telecommunications related PFI agreements is what happens when something is changed. Reconfiguration has been a recurring theme in the present study, and it certainly appears to be a major issue in the system as currently designed and operated. The HA has highlighted the frequent need for reconfiguration at short notice and its management of this demand by the use of a full time team of engineers. Typical examples of reconfiguration are:
- a) minor configuration changes, for example, adding a single device such as a message sign to an existing circuit;
 - b) more complex configuration changes, for example adding a number of devices in an area where no circuit for those devices currently exists;
 - c) major configuration changes, for example, seamlessly redirecting all services currently connected to five M25 PCOs to two new PCOs (currently under consideration). Such a task takes months of planning and implementation; and
 - d) the requirement for circuits to locations off the HA network, such as those currently leased from BT. Any contract with a third party operator would need to reflect the downward trend in telecoms prices.
- 8.2.10 If the reconfiguration service were to be continued as at present for the duration of a PFI agreement, there would probably need to be either:
- a) a mechanism for calling down reconfiguration tasks, perhaps according to pre-agreed price lists for the type of reconfiguration and banded according to the period of notice provided to the contractor by the HA; or
 - b) hourly rates applied to agreed time estimates; or
 - c) an agreed provisional allowance within the annual charge, set aside for reconfigurations.
- 8.2.11 The former would ensure that only requested changes were paid for and would avoid the risk that an overestimate would lead to overpayment by the HA. The latter might take two forms - one in which the service provider undertakes to supply reconfigurations on a lump sum cost (keeping the benefits of any underspend and absorbing the cost of any overspend); the other in which the contractor and the customer share the upside and downside risks according to agreed proportions either side of the provisional allowance. Given the apparently constant flow and diversity of reconfiguration tasks, it is unlikely that the private sector would offer value by taking the risk on a fixed charge basis. A provisional sum may offer a keener price, but will leave much of the risk with the HA.

- 8.2.12 Newer technologies likely to be introduced for the motorway communications network would reduce or eliminate the reconfiguration process, replacing it with much simpler re-programming tasks, readily absorbed in normal running costs. If this approach were adopted, then the private sector could be incentivised to invest in system upgrades which would obviate the need for reconfiguration as a long term activity. This incentive could take the form of a progressive phasing out of special reconfiguration payments, or payment of increased service charges only once the new, programmable system is installed.

8.3 Realising the benefit of third party revenues

Introduction

- 8.3.1 One of the HA's key aims in the PFI Strategies is to exploit the commercial opportunities inherent in communications services, utilising the skills and capabilities of the private sector, and to receive a share of the benefit from that exploitation. In this section, we discuss the mechanisms by which that share of the benefits may be realised by the HA.
- 8.3.2 The main third party revenue streams are assumed to accrue to MCS Co in the PFI Strategies 3 and 4. Whilst, we have assumed in the PSC Strategies that the HA will offer a mast sharing service, in the PFI Strategies, MCS Co will be expected to develop extensive commercial services providing both mast sites and managed data services. The benefits of the revenues thus generated will flow through to the HA by one or both of two methods.

Reduction in charges

- 8.3.3 One of the core concepts in PFI is that the private sector, i.e. MCS Co, will be expected to subsidise its charges to the public sector, the HA, from the revenues of its commercial operations. In return the HA will provide MCS Co with a substantial part of its initial infrastructure and a guaranteed source of business.
- 8.3.4 This subsidy to charges will be fixed in the charges bid by MCS Co for the PFI contract, prior to having commenced commercial services and at a time when the amount of realisable revenues will be uncertain. MCS Co will, therefore, be taking a risk on the amount of revenues it expects to generate and hence the amount of subsidy it can guarantee to the HA. The key to ensuring that the HA is offered a reasonable level of subsidy is a strong competitive tendering process.

Share of excess of revenues

- 8.3.5 As part of the partnership principles of PFI, the HA also want to ensure that it is able to claw back a share of any 'super profits' that MCS Co may generate. It can do this by specifying that it is entitled to a share of MCS Co's revenues above a certain annual level. Such formulas are common in PFI contracts and will take account of any additional investment made by MCS Co in order to generate the additional revenues.

- 8.3.6 It should be noted that section 6 on legal constraints states that the Secretary of State (as the contracting party for the HA) may be limited as to how he may charge MCS Co for the granting of licences or consent to carry out installation on a “protected street”. However, the section notes that this should not be a significant problem provided that such an arrangement is constructed in such a way that the Secretary of State benefits indirectly from third party revenue via a reduction in the fee which would otherwise be payable to the private sector partner. There is little doubt that the reduction in charges method achieves this purpose, though we may have to investigate further whether this can also be achieved for the share of excess revenues method.

8.4 Ownership of assets at the end of a PFI contract

Introduction

- 8.4.1 In section 4.7 we have described a target network which is a fully fibred national network covering specific motorways and APTRs shown in drawing number KHHS/002. The purpose of the target network is to illustrate for the purposes of this Study the HA’s requirements as to the type of core coverage and performance characteristics that it will require of any PFI service. It also provides the basis for the financial analysis of the proposed Strategies in Volume 3 of this Final Report.
- 8.4.2 As with London Underground’s CONNECT project, the actual PFI requirement which the HA contracts for under a PFI Strategy 3 or 4 will not be expressed in terms of assets, i.e. fibre network and SDH transmission technologies. Instead, like CONNECT, it will be expressed in terms of services, i.e. data transfer requirements from point A to point B, with very high services levels in terms of availability and performance.
- 8.4.3 It will be for the private sector to determine the assets over which the services are provided. However, again like CONNECT, we have concluded in section 4.6 that it is expected at this stage and based on today’s technologies, that only a fibre optic cable based service as outlined in the target network would be capable of meeting the HA’s service requirements. Nevertheless, the door will be open for private sector innovation, and bidders will be encouraged to consider alternative solutions which meet all of the HA’s service requirements but at a lower cost.
- 8.4.4 Part of the private sector innovation and cost savings may come from providing certain of the services over their own commercial networks, and by passing commercial traffic over the HA’s network. The implications are twofold:
- a) does the HA require an exclusive communications network rather than one where it shares links with other users?; and
 - b) since the PFI contract for the services will be for a finite term (thought to be 10 years¹⁷), how will the HA be assured of the continuation of the services at the end of the contract term?

¹⁷ See section 6.4.

Exclusive communications network

- 8.4.5 The first question is whether the HA has reasons for retaining an exclusive telecommunications network.
- 8.4.6 If there was such a requirement then it is likely that the HA would require MCS Co to maintain an exclusive network for the HA over the life of a contract and to deliver it back to the HA at its expiry, perhaps significantly reducing the value to the HA of any PPP or PFI arrangement.
- 8.4.7 KHHS have not identified any external legal, policy or operational constraints which require the HA to have a network which is *exclusive* to its own use. We have therefore assumed that the HA should have no objection, in principle, to having at least some of its telecommunications traffic passed over a commercial network.

Continuation of the services at the end of the PFI contract

- 8.4.8 Accepting that some of the HA's communications traffic may be routed over non-HA exclusive communications infrastructure, i.e. public telephone networks, the second question is what safeguards should the HA include in a PFI contract to ensure the cost effective continuation of its services at the end of the contract term? In this regard, the question most frequently asked by the HA is ***"does the HA require the transfer to it of the target network or its equivalent at the end of the contract term?"***

Monopoly provision

- 8.4.9 A key factor in considering the above question is whether, at the end of the contract term, there will be parts of the HA's communications network provided by the MCS Co for which there is no viable, alternative means of provision, i.e. is the nature of the infrastructure over which the services are provided such that MCS Co is in effect a monopoly provider? Looking at the same question slightly differently, will there be parts of the services provided by MCS Co for which there will be no commercially available alternative?
- 8.4.10 If MCS Co is not a monopoly provider, if all of the HA's communications links were likely to be available at the end of the contract term from other commercial network operators at equivalent market rates, then the HA need have no interest at the end of the contract term in the communications infrastructure used by MCS Co to provide the services to it. No transfer of the target network to it would be required as it could simply contract for the same services from an alternative network operator.

- 8.4.11 However, given the unique nature of the HA's communications requirements, the requirement for longitudinal, high bandwidth, highly reliable communications to a large number of essentially isolated points along the sides of motorways, KHHS believe that it is possible that significant elements of the infrastructure used in the provision of the PFI services will have no readily available commercial alternative at the end of the contract term¹⁸. In these circumstances, the HA needs to consider the options open to it to ensure the continuation of its services after this period.

Option 1: Transfer of the entire network to the HA

- 8.4.12 The HA could require that the entire network over which the MCS services are provided will be transferred to the HA or its nominee at the end of the contract term. This could be at no cost, or for a predetermined cost or at market value¹⁹.
- 8.4.13 The problem with this option is that it may impact severely on the value for money which the HA is able to realise through a PFI contract. This is because, if MCS Co knows that it will have to hand over a complete network at the end of the contract term, it will not be incentivised to route HA communications traffic where possible over its own network, thus losing potential synergies. Also, any contracts for third party usage of the HA network are likely to be limited to the term of the PFI contract due to the uncertainties of continued provision after this period. This in turn will reduce MCS Co's ability to attract third party revenues.
- 8.4.14 Another consideration is that it is far from certain that the HA would wish to take over the infrastructure at the end of the contract term. It may be that alternative, more suitable technologies have been developed which do not require the existing infrastructure. In such circumstances, the HA should be free to embrace the new technologies. Alternatively, a rival network operator may be prepared to build out a competing network at its own expense in pursuit of its broader strategic objectives. Again, the HA should be free to seize these opportunities.

Option 2: Option for the transfer of parts of the communications network to the HA

- 8.4.15 Rather than require an automatic transfer of the entire network to it at the end of the contract term, the HA could instead retain an *option* to purchase certain parts of the network at their market value. Within this option it could specify whether the parts are to be transferred to it or to a newly appointed alternative service provider.

¹⁸ This is likely to include much, if not all, of the target network.

¹⁹ The last option, market value, is favoured by Treasury Taskforce guidance, and may be the only option which could achieve off-balance sheet treatment of the communications network during the course of the contract.

- 8.4.16 The parts over which the option would be retained are likely to relate to those parts for which MCS Co is a monopoly provider and will depend on the desirability and feasibility of transferring ownership at the end of the contract and the effect on value for money. This in turn will depend on bidders' proposed solutions and it will not be possible to make firm recommendations until the nature of the proposed solutions is known.

Option 3: Option for a further contract term

- 8.4.17 A third option is that the HA would retain an *option* to require MCS Co to provide the services for which MCS Co is a monopoly provider for a further term to the HA directly or to a newly appointed alternative service provider. MCS Co would keep the assets and would be prevented from exploiting its monopoly through the use of specified index formulas and other regulatory constraints.
- 8.4.18 This final option is similar to the interconnect regulations in the telecommunications industry whereby incumbent telecommunications operators, such as BT, are required to provide access to other operators across their infrastructure.
- 8.4.19 Under this arrangement, MCS Co would be able to provide greater certainty in respect of continuity of service to third parties perhaps improving the overall value for money of the service to the HA.

Condition of assets transferred to the HA

- 8.4.20 One final consideration in respect of assets which may be transferred to the HA at the end of the contract term under options 1 and 2 above relates to securing their continued fitness for purpose after the contract end.
- 8.4.21 During the course of a PFI contract, all ownership risks in existing HA assets are transferred to MCS Co and any new assets used by MCS Co for the delivery of the services rest entirely with MCS Co. Any attempt by the HA to retain an interest in these assets or a say over their condition would transfer some of this risk back to the HA, and may affect their off-balance sheet status.
- 8.4.22 Their fitness for purpose at the end of the contract term can be addressed in other ways though, and this is usually achieved by specifying performance or remaining useful life criteria by reference to industry standards which the assets must satisfy at the contract end.

Conclusion

- 8.4.23 As noted previously the choice as to the approach taken in respect to the ownership of the assets at the end of a PFI contract and the decision on whether to adopt options 1, 2 or 3 above will be influenced heavily by the bidder's proposed solutions. It is unlikely for the reasons given that option 1 above will be adopted, but all of the options can be developed further with potential bidders in Part B, and a decision taken then on the HA's preferred approach, having regard to the impact on value for money in each case.

9.0 STRATEGY 2 - DO MINIMUM

9.1 Introduction

9.1.1 This section sets out the key assumptions in respect of the Do Minimum Strategy, Strategy 2. This Strategy represents the minimum network maintenance and upgrade that the HA is likely to carry out over the 15 year period of assessment based on the HA's current plans for its network²⁰. The objective in providing the Strategy is to provide a benchmark against which to evaluate the alternative Strategies which follow.

9.1.2 The Strategy has been assessed over a 15 year period in order to provide comparison with Strategies 3 and 4.

9.2 Specification

9.2.1 The Strategy envisages Triple Package roll-out as per the Northern Region, Midlands Region and Southern Region business plans. The simplest SDH network would be installed (described as Option 1 in the HA's SDH National Network Business Case). This provides a national SDH network based on the M25, Midlands and Manchester fibre cable rings, connected by single links along the M40 and M6.

9.2.2 The SDH network would support and upgrade some of the existing national RCC and SCADA networks which are based on carrier circuits provided on a national figure-of-eight copper network. It would also replace the regional PCM networks around Manchester, the Midlands and the M25. The following factors are also relevant:

- a) it assumes an incomplete fibre network (a leased link is required for the Midlands to Manchester inter-connect);
- b) it does not offer full diversity;
- c) not all transmission stations along the inter-connecting links (i.e. between the three rings) are themselves connected;
- d) only half of the 32 PCOs are connected;
- e) local video connections (from each TS to its associated PCO) are not included;
- f) a maximum of 6 full-motion video channels per PCO is provided. This may not prove sufficient to meet TCC needs or commercial demand for CCTV picture access in future; and

²⁰ A 15 year period of assessment was chosen to cover the Study and procurement period of approximately three to four years, commencing April 1999, and an initial contract period of approximately ten years.

g) no revenue earning opportunities such as roadside masts are exploited.

9.2.3 Cost savings would result mainly from the reductions in NTMC costs as ageing carrier equipment is removed from the network.

9.2.4 The network is designed solely to meet the basic requirements of the TCC for high bandwidth links to the PCOs.

9.2.5 For the roadside equipment, no change is assumed to the existing RMC and RMCMC arrangements in respect to the maintenance of the roadside equipment, or in respect to its provision and disposal.

9.2.6 For the business communications, the WAN would be upgraded (by way of separate arrangements to ATM to increase bandwidth and provide links to 24 Maintaining Agents and improve inter-office communications).

9.3 Delivery

9.3.1 Delivery is assumed to be by way of a public sector conventional procurement of each of the three elements listed above.

9.3.2 Maintenance is assumed to be provided through existing arrangements, i.e. the NTMC.

9.4 Ownership

9.4.1 HA will own all assets and bear all ownership risks in respect to fitness for purpose, usage, maintenance, residual value, etc.

9.5 Third party income possibilities

9.5.1 It is assumed that there will be no third party incomes, on the basis that the HA does not currently have the resources or the know-how to exploit third party revenue opportunities.

9.6 Timetable and term

9.6.1 The timetable for delivery of the Triple Package will be in accordance with that proposed in the Northern, Midland and Southern Area Business Plans for the Comprehensive Spending Review. This follows a six year plan commencing in the financial year, 1999/00.

9.6.2 The communications assets will be purchased and owned by the HA. Maintenance contracts will follow current practice of a fixed term (typically four or five years for the current contracts).

9.7 Payment

9.7.1 Payment will be based on existing contract provisions, on acceptance for assets, and on a fixed price for maintenance.

9.8 Performance

- 9.8.1 Maintenance performance regimes will be based as they are currently on system down time referenced to “accountable service hours lost”.

9.9 PSC assumptions

- 9.9.1 A PSC is not relevant as this is a public sector procurement.

9.10 Fit with government policy

- 9.10.1 The Strategy maintains the current arrangement for internal management and development of the MCS. Generally, this fails to meet Government policy which is to encourage public/private partnerships, particularly in respect of the Wider Markets and Better Quality Services initiatives (see section 4.3). By failing to exploit third party income possibilities, Strategy 2 can be seen as a wasted opportunity and one which fails to deliver best value for the HA and the taxpayer.

9.11 Benefits

- 9.11.1 The benefits of the do minimum strategy are as follows:

- a) Replacement of part of the ageing carrier network;

9.12 Disadvantages

- 9.12.1 The disadvantages are:

- a) poor network capability in comparison with other strategies, to the detriment of the HA’s role as network operator; and
- b) loss of opportunities to offset the HA’s costs through the exploitation of private sector revenue earning opportunities.

THIS PAGE INTENTIONALLY LEFT BLANK

10.0 STRATEGY 3 - PFI FOR A NATIONAL NETWORK

10.1 Introduction

10.1.1 This section sets out the key assumptions in respect of Strategy 3, the PFI for a national motorway communications network, the target network, up to the roadside verge, with the right to exploit surplus fibre capacity for commercial services and the requirement to develop a managed telecommunications mast sharing service.

10.2 Specification

10.2.1 The basis for the communications network would be the target network set out in section 4.7.

10.2.2 As already mentioned in section 6, although MCS Co will be the only party granted access to HA land to carry out the MCS project, such access will only be exclusive to the extent that the HA refuses consent to requests by other operators to exercise their Code powers. Such refusals of consent may be subject to challenge. Any promise to MCS Co to refuse consents to other operators may also be subject to challenge. This risk of challenge may be mitigated in practice by ensuring that such other PTOs are given access to any spare capacity by MCS Co. This should limit the necessity for these PTOs to seek access themselves to install their own equipment.

10.2.3 The SDH network would be expanded, as and when fibre cable has been installed, to include connections to Leeds and Bristol with full diverse routing (essentially using a figure-of-eight between Manchester, Leeds, Birmingham, Bristol and London).

10.2.4 The main differences between this Strategy and Strategy 2 are thus as follows:

- a) Strategy 3 assumes the development of a managed telecommunications mast service whereas Strategy 2 has no plans in respect of allowing mobile operators on to its land;
- b) Strategy 3 assumes also the development of third party income through exploitation of spare capacity within the fibre network;
- c) Strategy 3 assumes a national approach to network planning based on the target national network, whereas Strategy 2 assumes a largely locally driven planning approach; and
- d) Strategy 3 assumes the roll-out of the SDH network across the entire fibre network whereas in Strategy 2 SDH is limited to the M25, Midlands and Manchester fibre cable rings, linked by single links along the M40 and M6.

- 10.2.5 Using the current CSR as a basis, the Strategy assumes that fibre will be installed along the M6 up to Manchester and along the M1 (and completed by 2003). In the Southern Region, feasibility studies have been carried out and there are plans to implement the Triple Package, installing fibre optic cable, along the key missing links along the M4 from Tormarton to the M25 (120km) and along the M5 from Michaelwood to Strensham (50km). There are also plans to install fibre cable along the M3 (south of the M25) and the M27 and M271. Design work has yet to start on any of these links and we have assumed that none would be installed via the CSR before 2005. Planned links in CSR2 are likely to be implemented by MCS Co under any Strategy 3 PFI contract.
- 10.2.6 The provision of the HA's business communications, including an upgrade of the WAN to ATM to increase bandwidth and provide links to 24 Maintaining Agents and improve inter-office communications, would be included as a variant bid option in this Strategy.
- 10.2.7 The technologies and standards for reliable high quality voice telephony over ATM networks are becoming more mature and the provision of the HA's business telephony needs would be included as a separate variant bid option in this strategy.
- 10.2.8 A major feature of this strategy is the consolidation into a single contract of the provision of services currently provided under a large number of contracts. The benefits to the HA are:
- a) reduction of the number of the HA's interfaces and therefore reduction of its retained risk;
 - b) the reduction in the number of contracts will provide economies of scale, reduced overall staff numbers and better-trained staff;
 - c) inclusion of cable installation from a number of schemes into the PFI would enable programmes to be focussed on strategic needs rather than managed in a fragmented manner;
 - d) the introduction of private finance will accelerate the HA's cable installation programme, bringing it early benefits;
 - e) stability across the network, providing a consistent level of provision across the country, will deliver shorter and more predictable lead times for operational activities such as reconfiguration. In time this will provide a cheaper and more responsive service to customers (HA project managers);
 - f) decommissioning of the ageing analogue carrier network enabling savings of some £0.5 million p.a. in maintenance costs;
 - g) the provision of maintenance free equipment of the same type used by many other network operators, thus removing the need for a dedicated maintenance team for out of hours maintenance;

- h) greater price certainty leading to easier planning of expenditure; and
- i) a network which will support all existing and emerging telecoms protocols and standards, enabling the HA to respond easily and quickly to new initiatives.

10.3 Delivery

10.3.1 As discussed in section 7.5, KHHS believe that the motorway communications network has a number of attributes that lend it to a PFI concession agreement. These are:

- a) the reasonably predictable nature of the communications requirement in terms of capacity and coverage over the foreseeable future;
- b) the opportunity to upgrade the network and in doing so to broaden the services offered to the HA over the network; and
- c) the opportunity to exploit third party revenue opportunities with which to offset the cost of the network to the HA.

10.3.2 Under a PFI concession agreement for the provision of the motorway communications network, a PFI contractor, MCS Co, will deliver communications services up to the HA's transmission stations in accordance with an agreed network solution. Payment will be made for the delivery of the services to agreed service levels over the term of the concession.

10.3.3 Delivery of the business communications may also be included within the PFI concession if it is demonstrated (by making this an option in the PFI bids) that it would provide better value for money than the existing arrangements.

10.3.4 The PFI contract would be delivered by a Special Purpose Vehicle ("SPV"). This is a specially formed company, owned by the members of the PFI consortium. It would have contractual relationships with its owners, financiers and service providers, as well as the HA.

10.4 Ownership

10.4.1 Subject to any restrictions on transfer, for accounting and commercial purposes ownership of the HA's existing communications will be transferred into the MCS Co which will be responsible for the operation and maintenance of the existing infrastructure, and the design, implementation, finance and operation of the upgraded system thus assuming the risks and rewards of ownership. Legally, ownership may be retained by the Secretary of State, as in the case of the DBFOs, but accounting for the project could reflect the commercial substance rather than the legal form of the transaction.

10.4.2 MCS Co will bear all ownership risks in respect to fitness for purpose, usage, maintenance, residual value, etc.

- 10.4.3 As explained in section 8.4, the HA may retain an option on termination of the concession that certain of the assets which are core to the operation of its services and unique to those services are returned to it or transferred to an alternative supplier. Alternatively, it may require that it, or an alternative supplier, is permitted to interconnect over those assets.

10.5 Third party income possibilities

- 10.5.1 There are two main opportunities:

- a) the use of HA land and structures for mobile telecommunication base stations; and
- b) the use of spare bandwidth on the national network as a managed data service. This service would require a PTO licence and will be developed by MCS Co following award of its PFI contract.

10.6 Staffing

- 10.6.1 Staff requirements are analysed in Volume 3, section 6.

10.7 Timetable and interim arrangements

- 10.7.1 The timetable for a PFI contract assumes that it would take approximately two and a half years from the date of this Final Report to sign the contract and commence operations, i.e. during the third quarter of 2002.
- 10.7.2 A term of ten years is considered reasonable and is the maximum period for which the Secretary of State is allowed by law to delegate his highways powers.
- 10.7.3 This Study has identified that the window of opportunity in respect of the telecommunications masts opportunity described in section 5.4 is unlikely to extend as far as the commencement of a PFI contract in the third quarter of 2002. We have therefore recommended in section 16.11 that interim arrangements are put in place for exploiting this opportunity on the proviso that the arrangements are capable of being transferred into the PFI in due course. The interim arrangements are to be developed in Part B of the Study.

10.8 Payment

- 10.8.1 Charges would only become payable upon acceptance by the HA of a fully operational service. Assuming MCS Co took over the operation and maintenance of the existing network, then payment would commence shortly after award of the contract with steps up in charges on implementation of new or additional functionality through upgrades and enhancements to the network.
- 10.8.2 Charges are likely to be based on usage (either time or bits), although there may need to be a guaranteed level of usage, i.e. a take or pay level, in order to optimise the value for money to the public sector. See section 8.2 on charging principles for more detail.

10.8.3 The contract and payment mechanism should be structured to encourage the PFI contractor to:

- a) replace existing analogue CCTV transmission equipment to free spare fibres for exploitation;
- b) replace ageing analogue carrier equipment; and
- c) use innovative cable installation techniques whilst delivering HA requirements.

10.9 Performance

10.9.1 The performance regime for the services will be driven by the HA's requirements for safety, security, reliability and quality of signal. The regime is likely to define key performance indicators including: service levels, specifying high levels of availability (which will dictate the need for redundancy and alternative routing in the network); performance, based on network latency (the time it takes a message to transit the network), quality, reliability, etc; and the time to fix faults. Escalation procedures will need to be defined for extended periods of down time or repetitive faults.

10.9.2 Such performance indicators are readily monitored in modern networks based on digital transmission standards such as SDH and ATM. They will offer a step change not only in the quality of service but also in the quality of evidence of the service and the tools available for auditing MCS Co's performance. SDH and ATM network management systems provide statistics on the availability of all services, event and fault logs. These can be archived and automatically analysed by MCS Co in its management reports to the HA.

10.9.3 The supplier will be required to provide a 24 hour helpdesk to the HA. Breaches in service levels resulting in service credits to be applied against charges will be recorded by the helpdesk and automatically, where appropriate, through the switching equipment.

10.9.4 Breaches in service levels will result in service credits to be applied against the charges for the corresponding period.

10.10 PSC assumptions

10.10.1 The PSC developed for this option assumes delivery of the same functionality to the HA and hence is based on the same cost structure as that outlined above. However, rather than assume a special purpose vehicle ("SPV") structure and an associated cost of finance and tax, it is assumed that the HA meets all of the costs of the option directly in the period in which they are incurred.

10.10.2 The PSC also assumes that only mast revenues (described in section 10.5.1 a)) will be developed by the HA and not those from provision of a managed data service.

10.11 Fit with government policy

- 10.11.1 This Strategy creates a PPP which would be financially incentivised to maximise the commercial exploitation of HA assets which meets well the Government's Wider Markets policy. By bringing in private sector capital and service innovation, this will support the HA in delivering its network operator role and should result in better informed, safer and more predictable journeys for the motorist. Providing access to HA land for mobile telecommunications masts will serve the Government's aims of encouraging mast sharing and reducing the environmental impact of mobile network expansion in the UK.

10.12 Benefits

- 10.12.1 The benefits of Strategy 3 are:
- a) completion of a fully fibred network;
 - b) potentially, the improvement of HA WAN inter office communications;
 - c) exploitation of private sector revenue opportunities through mobile telephone masts and data management;
 - d) reduction in the number of contractual relationships managed by the HA; and
 - e) transfer of risk from the HA to the private sector under a PFI contact.

10.13 Disadvantages

- 10.13.1 The disadvantages of Strategy 3 are:
- a) uncertainty over the Secretary of State's powers;
 - b) the Secretary of State may be unable to guarantee exclusive access to HA property to a single operator;
 - c) Strategy 3 is considerably limited, in comparison to Strategy 4, in its contribution to the HA's objective to act as a network operator; and
 - d) the cost to the HA of Strategy 3 is dependent upon third party revenues earned by MCS Co.

11.0 STRATEGY 4 - PFI FOR AN ENHANCED NATIONAL NETWORK

11.1 Introduction

11.1.1 This section sets out the key assumptions in respect of Strategy 4, the PFI for a national motorway communications network up to the roadside verge and the requirement to develop a managed telecommunications mast sharing service, with the additional obligation to provide a roadside to vehicle link. MCS Co would be provided with the right to exploit surplus capacity on this link for commercial services, and to exploit surplus fibre capacity for commercial services.

11.1.2 It is possible that Strategy 3 and 4 could be offered together, with Strategy 3 as a baseline requirement, and Strategy 4 as a variant bid.

11.2 Specification

11.2.1 Strategy 4 is identical to Strategy 3 except that the capture of traffic data and delivery of driver information direct to and from the vehicle is a defined requirement for Year 5 onwards. Thus a computer-to-computer communications (telemetry) capability is required from the roadside to the vehicle.

11.2.2 A defined minimum level of data is required by the HA to meet network operation and safety needs. This is tentatively defined as being based as a starting point on the same categories of data as currently provided by MIDAS (namely lane specific vehicle numbers, speed, headway and occupancy by time period) and disseminated through VMS (namely general messages which are location and direction specific).

11.2.3 The types of application that roadside to vehicle communication can support are being investigated in the Road Traffic Adviser research project which is due to start live trials on the M4 in 2000 using a network of over one hundred microwave beacons and a number of specially equipped vehicles. The HA is a partner in this research. Results will emerge from the trials in parallel with the development of the MCS deal. It is important to track the research findings to inform the detailed requirements for Strategy 4.

11.2.4 Under the PFI route, it is required that the MCS Co is a PTO licence holder. The MCS Co would be encouraged to capture additional data from vehicles and provide a wide range of value-added traffic and travel information services to subscribing customers in addition to the 'public service' data (as defined above) which must be provided free.

11.2.5 Commercial vehicle telemetry services are expected to develop over the next few years anyway. The HA requirement would bring greater certainty to the market and would help drive the adoption of technical and operational standards.

- 11.2.6 It is envisaged that the HA requirement could be met either through a suitably planned network of GSM/UMTS cells or through the construction of an entirely new communications network based on DSRC beacons (the technology currently being trialled in the Road Traffic Adviser project, mentioned above). These two technologies are substantially different in their infrastructure requirements and in terms of the method of communication and the types of information they can carry. KHHS have therefore prepared two iterations of the PFI model for Strategy 4, based on the two different technologies.
- 11.2.7 If the HA maintains responsibility for the MCS, the assumption is that it cannot become a licensed PTO. Under the UMTS scenario, the communications traffic is actually transported by the mobile network operators (though over HA infrastructure) and the HA would source the traffic data off the mobile operators' networks.
- 11.2.8 For the purposes of the financial models, it has been assumed that the roadside to vehicle communications services will cover just the motorway network (since this is simply defined). The intention of the strategy, however, is not to limit the coverage of the services. There will be parts of the APTR which are also protected streets and/or which are seen by the motorist as effectively motorway standard and/or which connect seamlessly with the motorway network (such as the A42/M42). MCS Co may be required to cover such areas within a certain timescale. But, in any event, MCS Co will be financially incentivised to extend the services to, and beyond, these areas of the APTR.
- 11.2.9 The provision of the HA's business communications, including an upgrade of the WAN to ATM to increase bandwidth and provide links to 24 Maintaining Agents and improve inter-office communications, would like Strategy 3 be included as a variant bid option in this Strategy.
- 11.2.10 The technologies and standards for reliable high quality voice telephony over ATM networks are becoming more mature and the provision of the HA's business telephony needs would also be included as a separate variant bid option in this strategy.

11.3 Delivery

- 11.3.1 As with Strategy 3, KHHS believe that the Strategy 4 requirement has a number of attributes that lend it to a PFI concession agreement. These are set out in section 7.5 and summarised below:
- a) the reasonably predictable nature of the communications requirement in terms of capacity and coverage over the foreseeable future;
 - b) the opportunity to upgrade the network and in doing so to broaden the services offered to the HA over the network; and
 - c) the opportunity to exploit third party revenue opportunities with which to offset the cost of the network to the HA.

- 11.3.2 Under a PFI concession agreement for the provision of the motorway communications network and driver information service, a PFI contractor, MCS Co, will deliver communications services up to the HA's transmission stations, and latterly into vehicles in accordance with an agreed network solution. Payment will be made for the delivery of the services to agreed service levels over the term of the concession.
- 11.3.3 Delivery of the business communications may also be included within the PFI concession if it is demonstrated (by making this an option in the PFI bids) that it would provide better value for money than the existing arrangements.
- 11.3.4 There may be scope to structure any contract to encourage MCS Co to migrate to a position where it can take responsibility for the final communications path (TS to roadside device) by the adoption of wireless technologies (eg UMTS) for this connection. This would be subject to MCS Co developing the necessary UMTS motorway layer and demonstration/trial projects to show that the adopted technologies address the needs for guaranteed levels of service, security etc. (Previous trials using Packnet for this purpose concluded that current technologies are unsuitable for delivering this requirement.)
- 11.3.5 Alternatively, future developments in roadside devices might include use of standard interfaces and protocols. Should this occur, it would be practical for MCS Co to assume responsibility for the final communications path from the TS to the devices using either fibre optic cables or copper cables installed along the motorway. This approach is further explored in section 13.5.

11.4 Ownership

- 11.4.1 Whilst legal ownership may remain with the Secretary of State, as is the case of DBFOs, for commercial and accounting purposes, ownership of the HA's existing communications will be transferred into the MCS Co which will be responsible for the operation and maintenance of the existing infrastructure, and the design, implementation, finance and operation of the upgraded system and would therefore assume the risks and rewards of ownership. Accounting for the project would reflect the commercial substance rather than the legal form.
- 11.4.2 MCS Co will bear all ownership risks in respect to fitness for purpose, usage, maintenance, residual value, etc.
- 11.4.3 As explained in section 8.4, the HA may retain an option on termination of the concession that certain of the assets which are core to the operation of its services and unique to those services are returned to it or transferred to an alternative supplier. Alternatively, it may require that it or an alternative supplier is permitted to interconnect over those assets.

- 11.4.4 As already mentioned in section 6, although MCS Co will be the only party granted access to HA land to carry out the MCS project, such access will only be exclusive to the extent that the HA refuses consent to requests by other operators to exercise their Code powers. Such refusals of consent may be subject to challenge. Any promise to MCS Co to refuse consents to other operators may also be subject to challenge. This risk of challenge may be mitigated in practice by ensuring that such other PTOs are given access to any spare capacity by MCS Co. This should limit the necessity for these PTOs to seek access themselves to install their own equipment.

11.5 Third party income possibilities

- 11.5.1 As for Strategy 3, third party income possibilities are:

- a) use of HA land and structures for mobile telecommunication base stations;
- b) use of spare bandwidth on the national network as a managed data service. This service would require a PTO licence and will be developed by MCS Co following award of its PFI contract.

- 11.5.2 In addition to these revenues, MCS Co would have the right to exploit surplus capacity on roadside to vehicle links for commercial services and the information gathered from it. It is likely that under the terms of the HA agreement with TCC Co, the latter will have the sole right to traffic information, but MCS Co may be able to develop additional revenue streams with vehicle manufacturers, haulage companies and other users of vehicle information, and with hotels, service stations, and other service providers wishing to deliver information into the vehicles.

11.6 Staffing

- 11.6.1 Staff requirements are analysed in Volume 3, section 6.

11.7 Timetable and interim arrangements

- 11.7.1 The timetable for a PFI contract assumes that it would take approximately two and a half years from the date of this Final Report to sign the contract and commence operations, i.e. during the third quarter of 2002.
- 11.7.2 As noted for Strategy 3, a term of ten years is considered reasonable and is the maximum period for which the Secretary of State is allowed by law to delegate his highways powers.
- 11.7.3 Likewise, the comments in respect of the need for interim arrangements for the telecommunications masts opportunity noted for Strategy 3 also apply to Strategy 4.

11.8 Payment

- 11.8.1 Charges would only become payable upon the acceptance by the HA of a fully operational service. Assuming MCS Co took over the operation and maintenance of the existing network, then payment would commence shortly after award of the contract with steps up in charges on implementation of new or additional functionality through upgrades and enhancements to the network, including the introduction of the roadside to vehicle link.
- 11.8.2 Charges are likely to be based on usage (either time or bits), although there may need to be a guaranteed level of usage, i.e. a take or pay level, in order to optimise the value for money to the public sector. See section 8.2 on charging principles for more detail.

11.9 Performance

- 11.9.1 The performance regime for the services will be driven by the HA's requirements for safety, security, reliability and quality of signal. The regime is likely to define key performance indicators including: service levels, specifying high levels of availability (which will dictate the need for redundancy and alternative routing in the network); performance, based on network latency (the time it takes a message to transit the network), quality, reliability, etc; and the time to fix faults. Escalation procedures will need to be defined for extended periods of down time or repetitive faults.
- 11.9.2 Such performance indicators are readily monitored in modern networks based on digital transmission standards such as SDH and ATM. They will offer a step change not only in the quality of service but also in the quality of evidence of the service and the tools available for auditing MCS Co's performance. SDH and ATM network management systems provide statistics on the availability of all services, event and fault logs. These can be archived and automatically analysed by MCS Co in its management reports to the HA.
- 11.9.3 The supplier will be required to provide a 24 hour helpdesk to the HA. Breaches in service levels resulting in service credits to be applied against charges will be recorded by the helpdesk and automatically, where appropriate, through the switching equipment.

11.10 PSC assumptions

- 11.10.1 The PSC developed for this option assumes delivery of the same functionality to the HA and hence is based on the same cost structure as that outlined above. However, rather than assume an SPV structure and an associated cost of finance and tax, it is assumed that the HA meets all of the costs of the option directly in the period in which they are incurred.
- 11.10.2 The PSC also assumes that only the mast revenues (described in section 11.5.1 a)) will be developed by the HA.

11.11 Fit with government policy

- 11.11.1 In the same way as Strategy 3, this strategy meets many of the Government's key policies for selling into wider markets and encouraging PPPs. But it goes further, in encouraging the development of innovative new services which have the potential significantly to improve travel and traffic information, network operations and road safety and provide the basis for wider value added information services to the road users.

11.12 Benefits

- 11.12.1 The benefits of Strategy 4 are:
- a) development of roadside to vehicle communications enhancing the HA's capability as a network operator;
 - b) the UMTS variant of this Strategy builds on existing technology and may therefore be attractive to potential operators;
 - c) both the UMTS and DSRC variants of this option provide considerable opportunities to offset HA's costs through the generation of private sector revenues by the MCS Co;
 - d) potentially lower cost to the HA than Strategy 3; and
 - e) transfer of risk to the private sector under a PFI contract.

11.13 Disadvantages

- 11.13.1 The disadvantages of Strategy 4 are;
- a) doubts over the Secretary of State's powers;
 - b) DSRC is a new technology and the MCS Co would have to construct a new network – an operator may therefore choose the potentially less lucrative, but less risky, UMTS technology; and
 - c) the cost to the HA is heavily reliant upon the achievement of third party revenues by MCS Co.

12.0 STRATEGY 5 - DESIGN, PROVISION AND MAINTENANCE OF ROADSIDE EQUIPMENT

12.1 Introduction

12.1.1 Whereas Strategies 2, 3 and 4 are concerned with the motorway communications network, Strategy 5 looks at the roadside equipment, namely the emergency roadside telephones, VMS, CCTV cameras and MIDAS equipment, and, separately, at the delivery of triple package schemes and the RMC functions. Strategy 5 is complementary to Strategies 3 and 4 and can be implemented irrespective of any action taken on Strategies 3 and 4. (Strategy 2 is the Do minimum strategy and assumes no change in respect of the provision and maintenance of the roadside equipment.)

12.1.2 Strategy 5 does not propose a comprehensive solution for the provision, operation and maintenance of the roadside equipment in the same way that Strategies 3 and 4 do for the motorway communications network. The roadside equipment is too varied in age, type and application, and its procurement is the subject of existing projects within the HA. Rather, Strategy 5 highlights the potential benefits which may be available to the HA by making suppliers responsible for the whole life cost of the model. The Strategy is therefore one of a shift in policy in respect of the HA's on-going procurements of road equipment and delivery of triple package schemes. It recognises that steps are already being taken in this direction, particularly in one area of roadside equipment, the ERTs, through the on-going PPP procurement of these items.

12.2 Existing Arrangements

12.2.1 The HA currently retains responsibility for many aspects of the design, purchase, integration, assembly, storage, provision and maintenance of its roadside equipment as the following paragraphs demonstrate. Consultants and other external organisations are employed by the HA to assist in discharging these responsibilities. The HA have provided information on the costs incurred in employing these external parties in 1998/99. A spreadsheet providing details is included as Appendix 18 in Volume 4 of this Report. Selected figures have been extracted and included in the following clauses.

12.2.2 The motorway communication services installed on motorways and trunk roads in England have been developed by the HA to meet their operational requirements. An extensive series of specifications and drawings have been prepared to define requirements for all aspects of the systems, equipment and services. The HA currently employs consultants to keep documentation updated and ensure that any anomalies are corrected. (The cost of these consultants was £388,000 in 1998/99.)

12.2.3 Designs are based on national and international standards but these have, in some instances, been modified or supplemented to meet the particular requirements of the HA. This has resulted in proprietary designs for roadside devices, data transfer protocols and the transmission network. Many specifications have been notified to the EC in accordance with Directive 83/189/EEC.

- 12.2.4 Equipment specifications for roadside devices, together with associated test specifications, are intended to ensure full functional compatibility of equipment procured from different suppliers. In practice, this has proved to be very difficult to achieve in full and the HA has been obliged to employ specialist consultants to assist them in resolving difficulties in compatibility as they arise. (The cost of these consultants was £543,000 in 1998/99)
- 12.2.5 The HA is the main, and in many cases, only market for many of the devices or equipment required for motorway communications. This may have the effect of creating and sustaining a distinct UK roadside devices industry, but may also deprive the HA of economies of scale. Furthermore, by sustaining the domestic suppliers with these unique standards, the HA may be losing out on the benefit of more robust competition and innovation. Schemes for implementation typically cover up to 30 kms of motorway and the number of devices required for each scheme do not currently make it economically viable for devices to be purchased on a per scheme basis. In order to maintain a competitive supply base for devices and equipment, HA purchases these in bulk and has them delivered to a storage depot at Yate near Bristol. As schemes are implemented, devices and equipment are issued from Yate Stores to the individual schemes for installation. The number and size of bulk purchase orders are planned by the HA against the NCP with the aim of retaining a minimum of three suppliers of each type of device.
- 12.2.6 The HA specifies a comprehensive range of tests to be carried out at all stages of manufacture and installation on site. On completion of installation on site, comprehensive tests are carried out on all aspects of a completed scheme to verify correct operation. On completion of these tests, the scheme is handed over to the HA and passed into maintenance under existing contracts.
- 12.2.7 Maintenance of roadside equipment is carried out under the RMCs, of which there are seven. Performance of the RMC contractors is assessed on the basis of availability of equipment maintained. Availability is calculated for the following, which are defined as being Accountable Services:
- a) motorway telephones;
 - b) all purpose trunk road telephones;
 - c) motorway signals;
 - d) message signs (EMSs and VMSs);
 - e) CCTV;
 - f) MIDAS; and
 - g) ramp metering.
- 12.2.8 Availability is calculated as a percentage of the hours for which 'devices' are available out of the total potential hours in the reporting period.

- 12.2.9 HA have had a computer program developed (FLOG) that allows a large degree of automation in the calculation of availability. Use of this program by the RMCs is mandatory with output from the program being included in reports against which the contractors' performance is assessed. A consultant is appointed by the HA to carry out audit and quality control of RMC. (The cost of this consultant was £536,000 in 1998/99, although the HA have advised this may not be a typical figure as a lot of work was required to develop specifications for FLOG. Costs of RMC auditing and quality control in a typical year are thought, by the HA, to be in the region of £120,000.) Payments to RMCs including RCMCs in 1998/99 were £6,285,000, plus £39,000 for DRC RMC.)
- 12.2.10 The HA's strategy for provision of motorway communications services is based on the Triple Package as described in section 2.6 above. The Triple Package of measures are implemented under various schemes, which are now increasingly implemented under design and build type contracts. At any one time there may be a dozen or so schemes in progress, with many more being planned or at the outline design stage.
- 12.2.11 Although not directly relevant to the communications services, it is worth noting that the HA has in place twenty Term Maintenance Contracts and associated Managing Agent contracts for routine, cyclical and winter maintenance of the trunk road network, other than for communications. Separate contracts are usually put in place for major discrete maintenance schemes. The HA is in the process of reviewing these arrangements with a view to implementing a number of Managing Agent and Contractor ("MAC") contracts where the roles of the two existing contractors are combined into a single contract. This review also includes consideration of the period for which contracts are awarded and the type of contract. A variety of options including partnering and private financing are under active consideration.

12.3 The Opportunity

Approach

- 12.3.1 The thinking behind Strategy 5 is that responsibilities for the design, procurement, assembly, integration, installation and maintenance of the roadside equipment are all to a greater or lesser extent separated. Decisions taken at each step of the process do not necessarily take full account of their impact on future cost streams. The effect of this arrangement is that there is no mechanism by which the whole life cost of equipment to the HA can be assessed and minimised.
- 12.3.2 Strategy 5 proposes the application of PPP-type arrangements incentivising a whole life cost approach to the provision of roadside equipment. It does not propose a comprehensive solution for the provision of roadside equipment, but instead suggests that the arrangements for each category of roadside equipment (e.g. VMS, CCTV cameras, MIDAS equipment etc.) should be considered separately.
- 12.3.3 The following PPP-type features should be considered by the HA:

- a) setting up of partnering or framework agreements with a small pool of suitably equipped and skilled contractors, enabling the HA to foster best practice with a core group of suppliers who, in turn will be sufficiently confident of receiving enough business to justify their investment in HA-agreed quality assurance processes, protocols for ordering and commissioning etc. These could be run on a regional or national basis.
- b) introducing the concept of whole-life costing into the contracts for the provision of devices. By combining bids for the upfront supply and ongoing maintenance of equipment, we believe that the HA would be able to transfer greater whole life risk to the contractor - the more so if design and input specification were left to the contractor, with the HA taking a more remote client role.

Potential scope

- 12.3.4 To give an idea of the potential size of the opportunity, NCP data provided by the HA indicates 18 schemes in progress in 1999/2000, 25 in 2000/2001 and 23 in 2001/2002. The budgeted capital expenditure for these schemes is £38 million, £68 million and £72 million respectively. The length of longitudinal cables included in these schemes and cost breakdown data provided by the HA, indicates that approximately 75% of scheme costs are attributable to purchase, installation and testing of roadside equipment, i.e. the equipment which would be covered by Strategy 5. The remaining 25% is attributable to provision of ducted infrastructure and purchase, installation and testing of cables.
- 12.3.5 Another view of the potential cost base of and hence opportunity for Strategy 5 is provided by the financial analysis in Volume 3. Non-project infrastructure capital and operating costs²¹ which relate primarily to provision and on-going maintenance of roadside equipment for 15 year period commencing April 1999 discounted at 6% amount to £424.8 million.

Yate Stores

- 12.3.6 The majority of equipment and cable is procured under bulk purchase arrangements and held at the HA's Yate Stores until it is required for installation as part of a scheme. The HA has verbally advised that the value of stock held at Yate Stores averages around £19 million, the turnover of stock is approximately £8 million to £9 million per annum and the contract for operation of the Stores itself costs the HA approximately £500k per annum.
- 12.3.7 The successful implementation of Strategy 5 should in the long term lead to a reduction in the amount of communication stores required by the HA. This may provide opportunities for relocating the remaining stores to smaller stores at maintenance depots or to other alternatives, allowing the HA to realise value on its ownership of Yate.

²¹ See Volume 3 Figures 3.1 and 3.2

- 12.3.8 However, in the short term the HA has determined through other studies that its current practice of bulk and forward purchasing is cost effective and is necessary due to the lack of notice currently given of communications infrastructure requirements for many road schemes. For the foreseeable future, it will, therefore, be necessary to maintain the stores at Yate or a similar communications stores.

Safety implications

- 12.3.9 The Strategy envisages that for new items of equipment, such as the EMSs, the supplier will be responsible for the design, provision, finance and third line maintenance of the equipment over its expected useful life. Suppliers will be asked to bid a monthly charge, similar to a PFI charge, payable only on acceptance of the installed device and thereafter over the lifetime of the equipment, subject to a minimum period. It is likely for safety reasons, namely limiting the number of contractors with access to the highways verge, that the RMCs will maintain responsibility for first line maintenance, but the supplier will be responsible and bear the cost of all second and third line repair and servicing of the equipment.

Triple Package Schemes

- 12.3.10 Under Strategy 5, implementation of Triple Package schemes could be reviewed, particularly if alternative methods of procurement of roadside equipment are put in place. One option may be to set up framework contracts with a small pool of suitably equipped and skilled contractors based on a regional or national basis, for delivery of the triple package schemes. The scope for such framework contractors could even be included in the MAC contracts under consideration for trunk road maintenance other than communications. RMC contractors, or similar, could be engaged in a similar manner to the current arrangements to provide first line maintenance of the roadside equipment. Alternatively, the functions of the RMC could also be incorporated in the proposed MAC contracts.

12.4 Strategy 5 in the context of this Study

- 12.4.1 Strategy 5 is outlined very briefly in this report but is clearly an area of significant potential savings for the HA. It is a huge subject, and it was decided by the Project Steering Committee that to devote much time developing it as part of this Study would divert attention from the main purpose of the Study, which is to develop the opportunities in the motorway communications network. It was also noted by the Steering Committee that Strategy 5 is already, in part being explored in other guises by the HA in other projects, such as the Emergency Roadside Telephones PPP. It was therefore agreed to outline the Strategy and the opportunity in this report, and to promote its further development within the HA.
- 12.4.2 KHHS believes, however, that there is merit in developing a strategic plan for the communications services to cover the period up to, and beyond, the inception of an MCS PFI contract.
- 12.4.3 For the triple package and RMC contracts, the strategic plan would cover:

- a) the current Triple Package programme, reviewing the planned schemes in the light of, among other things, their value to any MCS contract; and
- b) the opportunities for the setting up of framework agreements with a small pool of suitably equipped and skilled contractors based on a regional or national basis for the delivery of triple package schemes and first line (repair by unit or module replacement) maintenance services for roadside devices.

12.4.4 It is noted that any action in respect of triple package delivery would require close liaison with the HA team developing the new road maintenance contracts (since they are also considering how RMC contracts could be repackaged). KHHS understands that the HA recently conducted a study to examine the pros and cons of combining the RMC function into the future road maintenance contracts (“MAC”s) (Ref. OW report number L377/070). The HA will need to establish whether best value for money can be obtained by combining it with the road maintenance function or as part of the framework agreements suggested above.

Fit with government policy

12.4.5 Strategy 5 is, in part, concerned with new procurement mechanisms for roadside devices which could substantially reduce the HA’s capital spending and encourage product and service innovations through a ‘whole life cost minimisation’ approach to equipment supply and maintenance. It is a good example of exploring the potential of PPPs under the Better Quality Services policy. However, the extent to which Strategy 5 delivers against other Government policies is limited.

12.4.6 Delivery of triple package schemes under framework agreements, as suggested under Strategy 5, could be further considered in relation to the HA’s proposals to change the way in which it procures highways maintenance contracts. Arrangements for these contracts are currently under review as part of the “Paving the Way” initiative and involve possible combination of existing term maintenance and maintaining agents contracts for super-agency areas into MACs.

THIS PAGE INTENTIONALLY LEFT BLANK

13.0 TRANSITION ISSUES

13.1 Introduction

- 13.1.1 This section of the report examines the issues associated with the transition from the current arrangements to those now proposed and documents matters that will need to be addressed. In addition, it provides an outline of the way in which transition might be arranged. Much further development will be required under Part B of the project but the aim of this section is to demonstrate that there are unlikely to be issues identified at a later stage that would present an insurmountable obstacle to implementation of the preferred procurement option.
- 13.1.2 The aim of any contract resulting from this Study will be to create a telecommunications ‘cloud’ (the MCS Cloud), where the HA specifies interfaces for entering and leaving the cloud and the performance of the service between these interfaces. This concept is shown in Figure 13.1. The numbered boxes are “sinks” that for the most part receive data from the cloud, e.g. a standard transponder controlling matrix signals. Those identified with letters are “sources” of this data, e.g. a COBS sub-system.

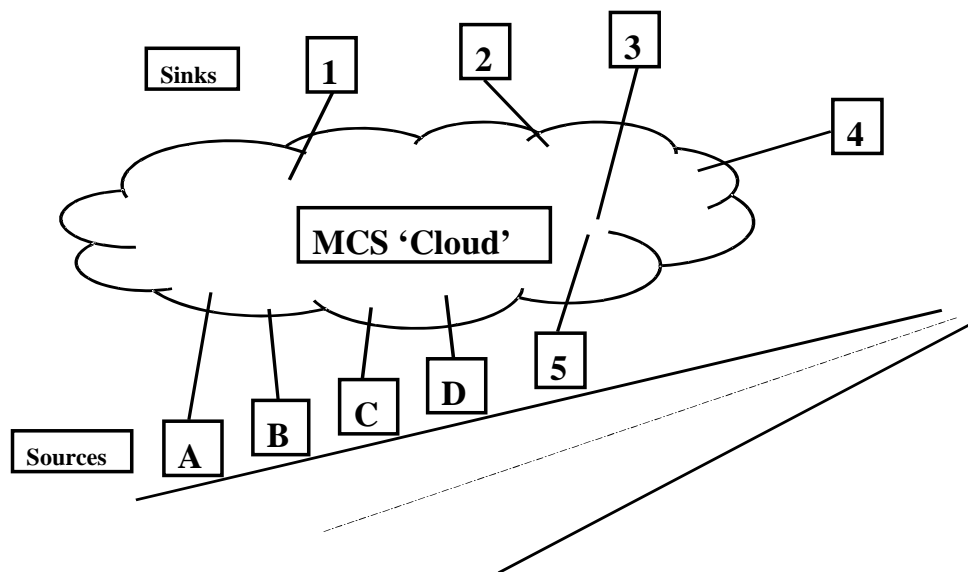


Figure 13.1 The MCS Cloud

- 13.1.3 It is proposed that at the start of any contract, the MCS Cloud would extend from the PCO or TCC to the TS nearest to the roadside device to which communication is required as explained below.

- 13.1.4 It is the long-term aim of any contract, or follow on contract, to migrate to an arrangement where the MCS Cloud is extended to provide an interface at the roadside device. For this to happen, it is necessary for the service to be provided as a transparent point to point connection (which could be either a physical or virtual connection) and for the interface at either end of the connection to be to an established international standard. The speed and extent of this migration would largely depend on the types of roadside devices for which communication services are required.
- 13.1.5 Most roadside devices currently use the HA's own bespoke interfaces. Some, notably emergency telephones and CCTV, could now be replaced by off the shelf solutions with established standard interfaces. The adoption of new communications standards (e.g. National Transportation Communications for ITS Protocol ("NTCIP")) for interfacing with traffic control devices (ref architecture study paper 298/133/REP/011 prepared by Information Processing Limited ("IPL")) could contribute to extending the MCS Cloud to roadside traffic counting and signal sites. Likewise, if MCS Co were to establish a UMTS network giving complete coverage of the motorway network, this could provide the necessary communications paths to facilitate the adoption of these standards. More detailed consideration of issues associated with extending the MCS Cloud to roadside devices is given in section 13.5 below.

13.2 Procurement of services under a PFI Scheme

- 13.2.1 The current procurement strategy adopted by HA for motorway communications services is by way of planned schemes. Such schemes typically include provision of some or all elements of the Triple Package on a section of motorway. The Triple Package includes NMCS infrastructure, installation and commissioning of MIDAS and installation and commissioning of EMS.
- 13.2.2 In parallel with construction works, the NTWC team configures circuits within the transmission network to support the devices being installed. Transmission equipment required to establish these circuits might be either obtained from surplus held by HA at Yate Stores, be purchased and installed by the NTWC or, for major upgrades, be procured under a transmission equipment contract. The NTWC team will commission the transmission circuits required so that installed equipment can be put into service as and when it is installed and tested.
- 13.2.3 Under either Strategy 3 or 4, the vision of the MCS Cloud is fibre optic cables being provided adjacent to those motorways in England that link the main centres of population and for transmission stations to be connected via an SDH network. Such a solution would give sufficient capacity to meet perceived needs of HA, not only for its current operations but also for future developments, such as TCC, which would require greater amounts of data to be transmitted over a wider area than is the case at present.

- 13.2.4 Under a PFI approach, it is proposed that responsibility for construction of the ducted network for cables, installation and testing of multi-pair copper and fibre optic longitudinal cables and provision of data transmission equipment passes to MCS Co. MCS Co would also become responsible for the end to end configuration and commissioning of circuits (from PCO to roadside device) within the transmission network. Once the circuits have been commissioned, responsibility for maintenance would remain with MCS Co where data is carried on fibre, but would pass to the RMC for the final circuit operating over copper cables. The reasons for this division of responsibilities are given in section 13.4 below.
- 13.2.5 Strategy 5 proposed in this Report introduces possible alternative ways in which procurement and maintenance of roadside devices might be effected. Development of this strategy does not form part of this Study. It is, therefore, assumed that HA would continue to procure roadside devices in a similar manner to that employed at present, i.e. through planned schemes implemented by project services staff at ROs, until such time as an alternative method has been developed and put in place. It is, however, noted that by making MCS Co responsible for installation of cables, a convenient split is created that allows for ready implementation of an alternative strategy for procurement of roadside devices. Furthermore, if the adoption of Strategy 5 were to include the adoption of new communications standards, as opposed to continuing use of bespoke interfaces and protocols, it would be practical for the MCS Cloud to be extended so that the interface would be at the roadside device.

13.3 Transition arrangements

Situation at the start of MCS Co contract

- 13.3.1 It is assumed that the HA will implement its currently planned SDH network which covers the Manchester, Birmingham and M25 fibre optic rings with links in between. Such implementation is assumed to proceed in advance of MCS Co being appointed. This SDH network is needed to meet immediate upgrade requirements in the regional networks and to meet some of the TCC requirements.
- 13.3.2 With the decommissioning of the Coleshill and Westhoughton computer centres (closing down of the last NMCS 1 installations) at the end of 1999, only three of the twenty four circuits currently supported by the copper-based national carrier network will still be required. The retained circuits will be for SCADA and the RCC network bringing log data from police control offices back to CENLOG. Much of the carrier based network will have been replaced by the SDH network to be implemented by the HA, but not all. Specifically, 16 of the current 32 PCOs would still be connected via copper circuits, since they are not in areas served by the initial SDH network configuration.

- 13.3.3 On day 1 of the MCS contract, the contractor would take over responsibility for provision and maintenance of the entire transmission network, including leased services, from PCOs to transmission stations, i.e. the MCS Cloud. MCS Co would take over the roles of the NTMC and the NTWC contractors. A suitable period for handover and costs incurred by the NTMC and NTWC contractors will have to be negotiated.
- 13.3.4 MCS Co would be given a period of, say, six months to replace the remaining copper-based national carrier network, initially through use of leased services. As fibre optic cable is commissioned (either as part of the HA's schemes or by MCS Co) to fill in gaps in the current network, additional SDH equipment would be installed by MCS Co. SCADA and RCC network services would then be moved to the SDH network, thereby reducing the need for leased services.
- 13.3.5 Early decommissioning of the copper-based national carrier network equipment would have the benefit of eliminating maintenance of this plant, an activity that attracts considerable costs as regular routine checking and adjustment is required, as well as fault repairs. In addition, removal of this equipment from transmission station buildings would free up much space for installation of SDH plant. Modern SDH equipment requires significantly less space than the carrier network equipment while allowing greater transmission of higher bandwidths.
- 13.3.6 The SDH network implemented by the HA will replace the PDH regional carrier systems around Manchester, Birmingham and the M25. Thus, it would be practical to migrate the PDH circuits to the SDH network in these areas and for maintenance responsibility for them to transfer to MCS Co at an early stage. MCS Co would be given a defined period (perhaps 18 months or two years) to implement SDH and PDH operating over fibre optic cables and transfer the remaining PDH regional carrier systems in the North East and North West to these new networks.
- 13.3.7 KHHS suggested in Report 2 that HA should conduct trials of use of asynchronous or high speed digital subscriber line ("HDSL") modems over existing copper cables. IPL carried out such trials for the HA in September 1999. The HA has provided copies of the results obtained in the form of two letters from IPL²². IPL have recommended that it would be possible to use HDSL modems operating at 2Mbits/s over distances of up to 8 kms without repeaters on existing HA cables. Longer distances should use repeaters or further modems so that each leg of the link is 8km or less.
- 13.3.8 Ideally for the purposes of motorway communications services, HDSL links would operate over at least 10 kms, thereby obviating the need for intermediate repeaters between TSs. It is noted that in some tests carried out by IPL, communication was possible over 10kms and it was concluded that the condition of the line is important in determining the absolute maximum distance. Further investigation may be considered appropriate by the HA.

²² Reference CH/8.1/298/A1739 dated 13 September 1999 and CH/298/133/A1883 dated 5 October 1999.

- 13.3.9 Assuming HDSL technology were to be adopted, MCS Co would be given a defined period to replace the local mini-carrier networks with PDH operating over existing copper cables via HDSL modems. On completion of this transfer, maintenance of the modems and the circuits operating over the copper cables would become the responsibility of the RMC. It is noted that HDSL modem links would require minimal maintenance when compared to the current mini-carrier system.
- 13.3.10 MCS Co would be responsible for the design and configuration of the transmission network (MCS Cloud), including on-going reconfiguration to meet HA's operating requirements. This responsibility would extend to the provision of final circuits from the last transmission station (edge of the MCS Cloud) to roadside devices. Where this requires use of interim PDH circuits using HDSL modems, additional works charges might be necessary.

13.4 Interfaces between MCS Co and RMC

- 13.4.1 Under Strategies 3 and 4, MCS Co would become responsible for provision, configuration and maintenance of all aspects of the MCS Cloud. Given that the Cloud is unlikely to extend beyond TSs, at least in the initial period of any contract, and would not in any case include roadside devices, there would still be a role for one or more RMC type contractors.
- 13.4.2 Definition of a clear interface between MCS Co and RMC is essential in allowing maintenance contracts to progress with the minimum of confusion as to the responsibility for resolving any faults that do occur. It is proposed that this interface be established based on whether data is carried over fibre optic or copper cables.
- 13.4.3 Responsibility for maintenance of fibre optic cable and equipment associated with transmission over the fibre network, such as SDH equipment, would rest with MCS Co. Once the circuits come off of the fibre network (or leave the MCS Cloud), typically at a TS, responsibility for maintenance of copper cables together with HDSL modems and other equipment associated with transmission over the copper cable would pass to the RMC. The RMC would remain responsible for maintenance of the roadside devices and the power supplies as under current arrangements.
- 13.4.4 The main reasons for proposing this split in responsibility between the RMC are given below:
- a) the RMC is best placed to maintain the final (copper) circuit since failure of this circuit will always affect the services (roadside devices) for which the RMC is also responsible;
 - b) copper cable has little perceived value for commercial exploitation, yet forms a crucial part of the circuit delivering the roadside service (generally fibre is diverse routed, not so the final copper connection);

- c) network management systems for modern fibre optic based transmission systems provide comprehensive fault diagnosis and reporting facilities that could result in a better targeted approach to fault call outs, reducing, if not eliminating, the need for a dedicated transmission network maintenance team while still allowing response times to call outs to be met;
- d) longitudinal copper cables are used for connection of roadside devices (matrix signals and ERT) to their associated transponders and responders as well as for transmission to and from TSs. The RMC would remain responsible for these connections under all strategies and is, thus, best placed to maintain the copper cables; and
- e) the concept is broadly similar to existing arrangements between the NTMC and RMC, although rapidly removes the current interface where much of the carrier network (maintained by the NTMC) operates over copper cables (maintained by the RMC).

13.4.5 The above arrangements would apply on roads that are under HA management. The issue of what happens in the longer term if, or when, private roads are built (such as the BNRR) or if roads are part of a privatised scheme, needs to be separately considered.

13.4.6 During the initial period of the MCS Contract, responsibility for maintenance of carrier equipment would rest with MCS Co. This would result in one contractor being responsible for maintenance of equipment that operates over cables maintained by a second contractor. This is an undesirable but, in practice, unavoidable situation. The fact that carrier equipment is all but obsolete and the limited number of companies experienced in its maintenance, coupled with its high demands for maintenance will encourage MCS Co to replace this equipment as soon as is practical. This is seen as a very real incentive to MCS Co while allowing HA to achieve its vision of the target fibre optic network with SDH transmission equipment at an early stage.

13.5 Extending the MCS Cloud to roadside devices

13.5.1 Management of the local copper cable network is an issue but not one that would last forever. It would, however, most likely exist throughout the period of the first MCS Co contract. Copper cable is essential to providing the “last mile” connection from the TS to a roadside device under current arrangements. Historically, the HA have had to pay careful attention to allocation and use of copper pairs within longitudinal cables to ensure that all communications requirements can be met.

13.5.2 Much of the effort currently put in by the NTWC team in reconfiguring the network is aimed at “plugging holes” in the network and finding ways of meeting requirements for circuits in longitudinal cables as needs change and more and different roadside devices are used. The demands imposed by changing requirements are in part reflected by the change from 20 pair cable for NMCS1 infrastructure, through 30 pair for early NMCS2 schemes to the current 40 pair cable.

- 13.5.3 The proposed target network would provide ample capacity for envisaged current and long term communications requirements between PCOs and TSs. The provision of the final circuits from the last transmission station to the end of the circuit (roadside cabinet) is the area of biggest risk. It is essential that provision is made for circuits to be configured and the need for required changes in configuration to be recognised. Ideally, each circuit should be reconfigured as a point to point link (e.g. from PCO to device) and responsibility for configuration and maintenance should rest with one party, MCS Co. This is not feasible at present for the reasons described above. The proposed approach of making MCS Co responsible for configuration of all communications requirements but splitting the responsibility for maintenance is the most practical solution.
- 13.5.4 Ultimately, the HA might adopt roadside devices that use communications interfaces compliant with international standards. At such a time, the boundary of the MCS Cloud would be pushed out to the device itself and the responsibilities of MCS Co might be changed accordingly. The following paragraphs provide more details in respect of different types of roadside devices.
- 13.5.5 For matrix signals and EMS, the signal transponder has significant intelligence and is more than just a communications router. It is not practical for point to point links from the PCO to the device to be implemented without significant changes being made to the device and/or the installation. Thus, the current multi-drop circuits from TSs will be retained for the foreseeable future.
- 13.5.6 However, giving MCS Co the responsibility for provision and maintenance of a point to point link from the PCO to telephones might be practical as the functionality of the telephone responder could be replaced by a PABX or other SDH-compatible equipment. This is one of the aspects being addressed by KHHS as part of the Telephone Study, an additional task to this Study. A summary of the Telephone Study is given in section 3.5.
- 13.5.7 MIDAS collects data from detector loops buried in each lane of the carriageway and the hardshoulder. The loops are connected to detector units and processing electronics installed in a MIDAS detector ("MD") cabinet. A number of MD cabinets are connected to a MIDAS transponder ("MT") from where data is sent to and received from the PCO. MTs function as data routers and carry out minimal processing.
- 13.5.8 It would be practical to consider passing the responsibility for provision of a complete point to point link from the PCO to a MD cabinet to MCS Co. Requirements for the frequency with which data is required to be transferred from MD sites to the PCO (and on to the TCC) and the volume of such data may well change. These requirements are likely to emerge from TCC or MIDAS 2 applications and would need the current communications arrangements for MIDAS to be re-examined.

- 13.5.9 CCTV facilities require transmission of video signals from cameras to PCO and transmission of camera control signals from the PCO to the Camera site. Current arrangements for transmission from the last TS are for video signals to be carried over optical fibre cables and control signals over copper cables. Ways in which video signals could be transferred to copper cables have been suggested in Report 2. It would be practical for MCS Co to be responsible for circuits up to the last TS and for the RMC to be responsible for the final circuits carried over copper. Alternatively, it may be practical for both video and control signals to be carried over fibre to the camera site (600 CCTV cabinet). Under such an arrangement, MCS Co would be responsible for circuits to the camera site.
- 13.5.10 While the aim of creating clean interfaces between MCS Co and the RMC would primarily be in the electrical sense, physical considerations are also relevant. Where optical fibre cables contain 12 fibres, the cable is composite and includes a number of copper pairs in the same physical cable. This would make it less practical for a division to be set where MCS Co is responsible for maintenance of the fibre optic cable and all transmission over this cable and the RMC is responsible for copper cable and all circuits carried over it. Further investigations are recommended under Part B of the Study to evaluate how copper pairs in the composite cable might be used for transmission of video signals and/or how fibres might be used for transmission of control signals from the PCO (or last transmission station) to the camera site.

13.6 Legal issues

- 13.6.1 In moving from the existing arrangements to any new arrangements which are put in place as a result of the MCS project the HA will need to review which of its existing arrangements are to continue, be transferred or be terminated. In some cases, variations may need to be negotiated to continuing contracts to clarify the interface and risk allocation between the HA and its contractors.
- 13.6.2 This process will require further due diligence together with a review of service provision. Existing contracts between the HA and existing service providers could be novated so that services are provided to MCS Co either in support of MCS Co or as part of its service delivery to the HA. However, there may be some services which will be provided by MCS Co itself or which are no longer required and the existing service arrangements will need to be terminated. Where an agreement is to be novated it will be important to ensure that change of control and other provisions designed to prevent the transfer of contracts are considered and dealt with. Where existing arrangements are to be terminated the HA should review whether it is preferable to allow contracts to expire or to terminate them early. When terminating contracts before their expiry date it is likely that the HA will be required to pay termination payments. In some cases, it may be necessary to seek an extension to existing contracts which expire before the commencement of arrangements with MCS Co.

- 13.6.3 It will also be important to consider whether any intellectual property rights or other material need to be transferred or licensed from existing service providers either direct to the HA or to MCS Co. Other practical and operational issues for the handover of service provision must be considered.
- 13.6.4 Where contracts are to be allowed to expire or to be novated they will need to be reviewed to confirm whether their existing terms need to be varied in the light of any new proposal. Variation of existing and novated contracts will normally require the consent of the existing service provider and it may be necessary for the HA to compensate service providers for such variations.
- 13.7 Interface with the Maintaining Agent and Term Maintenance Contractor**
- 13.7.1 Maintenance of the trunk road network in England, other than for the motorway communications services, is arranged on the basis of 24 geographic “super agency” areas. In each area, the HA has appointed a Term Maintenance Contractor (“TMC”) and a Managing Agent (“MA”). The TMC is responsible for routine and winter maintenance of the carriageways, verges and structures on all trunk roads within its area. The TMC also provides an emergency call out service to make roads safe after an incident, e.g. removal of debris and repair of safety fence. The MA is responsible for management, supervision and auditing of these works on behalf of the HA.
- 13.7.2 Contracts with the TMCs and MAs are not among those reviewed under this Study. It is, however, understood that contracts are awarded for a fixed duration, typically three years, but may be extended to five years. Current contracts for the various areas are reported²³ to have been awarded in April of 1997, 1998 and 1999. The approximate annual value of the TMC contracts is reported as being almost £200million and that of corresponding MA contracts, £34million.
- 13.7.3 In addition to routine and winter maintenance duties, the TMC contractor undertakes minor works contracts in its area up to a prescribed maximum value (thought to be £100K), at agreed rates, without the need for tender. Should major works (e.g. rehabilitation, resurfacing or widening of a section of road) be required above this limit, contracts are tendered and contractors compete in the normal manner. For the period of construction, responsibility for the site passes from the TMC to the appointed contractor. On completion of the works, responsibility reverts to the TMC.
- 13.7.4 London is covered by four of the geographic areas mentioned above. Responsibility for trunk roads (apart from the M1, M4, M11 and M25) in these areas will pass from the HA to the Greater London Authority, when this is established in 2000. Procedures and agreements will need to be in place in each of the 20 regions for which the HA retains responsibility to define the operational and contractual interface between MCS Co and the MA/TMC.

²³ H&T, the Journal of the Institution of Highways and Transportation, May 1999

- 13.7.5 Formulation of such agreements is likely to be one of the most difficult operational constraints and will require careful planning to ensure that relevant matters are adequately addressed. An initial list of the main items that need to be addressed, is given below. It is expected that these, and other items that become apparent, will be further developed under Part B of the Study.
- a) arrangements for MCS Co access to verges, carriageways, structures and other areas for which the MA/TMC are responsible;
 - b) planning and co-ordination of traffic management for various works;
 - c) restrictions on access arising from works being carried out by another party;
 - d) response to make safe after accidental damage or vandalism;
 - e) risk of damage by MA/TMC to MCS Co infrastructure installed in verges and other areas maintained by MA/TMC;
 - f) risk of damage to HA infrastructure for which MA/TMC is responsible by MCS Co;
 - g) sharing of power supplies used for street lighting;
 - h) impact of planned MA/TMC works on MCS Co equipment, e.g. when bridge parapets are being changed or when gantries are being painted; and
 - i) prioritising of MCS Co activities with respect to other core functions of the HA for which the MA/TMC is responsible.
- 13.7.6 Organisational changes may be required within the HA to accommodate the envisaged large scale exploitation of assets on a commercial basis. Particular consideration will have to be given at all times to ensure that the HA's priority business of operating and maintaining the trunk road network is not compromised by activities of private sector operations.
- 13.7.7 MCS Co arrangements must, as far as is practical, protect the MA/TMCs operations without impeding the MCS Co's operations. Some modifications to MA/TMC contracts would be inevitable. The interface must be robust enough to withstand the relatively high commercial pressures that would be applied by MCS Co in the event of a breakdown of the interface. Commercial pressures faced by MA/TMCs can be likened to those present within 'lane rental' type maintenance contracts.

- 13.7.8 It will also be necessary to address the situation where current proposals to combine the roles of MA and TMC into a single contract are implemented. It is possible that, with the proposed de-trunking programme included in the Roads Review, the number of combined MA/TMC contracts will be reduced and each contract will cover a wider area. Depending on the timing of de-trunking proposals being effected and MA/TMC contracts being tendered, changes to the existing contracts might be avoided. Any new contracts should, however, take account of the possible establishment of MCS Co and appropriate provision for this new interface should be made at time of drafting tender documents.

THIS PAGE INTENTIONALLY LEFT BLANK

14.0 FINANCIAL ANALYSIS AND RANKING

14.1 Introduction

14.1.1 This section summarises the results of the financial analysis of Strategies 2, 3 and 4 which is set out separately in Volume 3 of this report.

14.1.2 The financial models in Volume 3 estimate the cost to the HA of each of the Strategies so that they can be ranked where appropriate and assessed for potential value for money against their relevant PSC. The materiality and sophistication of the models, and the inputs and assumptions, reflect the feasibility status of the Study. Much of the information being modelled at this stage has been supplied without commitment on the part of interviewees and is substantially untested. Nevertheless, the financial model has been planned and developed to provide as accurately as possible at this stage in the project a high level indication of the potential benefits of one Strategy over another.

14.2 Wider socio-economic benefits

14.2.1 The financial analysis is concerned solely with the financial costs and benefits of each of the Strategies to the HA, i.e. those costs and benefits which ultimately result in cashflows to or from the HA. It does not attempt to place a value on the wider socio-economic benefits of the each of the Strategies, that is those costs and benefits to the HA's customers resulting from increased safety, journey time savings, journey time certainty, vehicle operating costs and the like.

14.2.2 Thus, in this analysis, Strategies which are more limited in scope and thereby incur less cost, may compare favourably in terms of their net NPV cost to the HA against more ambitious Strategies which on the face of it cost more, but which aim to provide a larger range of socio-economic benefits to the road user in furtherance of the HA's policy objectives.

14.2.3 An assessment of the socio-economic benefits was not required by the Specification and is inappropriate in anything but qualitative terms at this feasibility stage of the Study. An initial assessment of the impact of the derived strategies against the NATA criteria has, however, been undertaken. The more significant factors that would result from the adoption of different strategies are presented in tabular form in section 15.2.

14.3 HA risk adjusted NPV retained costs

14.3.1 The NPV cost of each Strategy to the HA and its risk adjusted cost to the HA is set out in Figure 14.1 below.

Retained HA NPV costs	Strategy 2	Strategy 3 PSC	Strategy 3 PFI	Strategy 4 PSC UMTS	Strategy 4 PFI UMTS	Strategy 4 PSC DSRC	Strategy 4 PFI DSRC
	£'m	£'m	£'m	£'m	£'m	£'m	£'m
Non project costs							
HA capital costs	(369.0)	(346.4)	(346.4)	(346.4)	(346.4)	(346.4)	(346.4)
HA operating costs	(105.5)	(100.1)	(100.1)	(100.1)	(100.1)	(100.1)	(100.1)
HA mgt and admin	(24.2)	(24.3)	(24.3)	(24.3)	(24.3)	(24.3)	(24.3)
HA revenues	-	3.3	3.3	3.3	3.3	3.3	3.3
Non project costs	(498.7)	(467.5)	(467.5)	(467.5)	(467.5)	(467.5)	(467.5)
Project costs							
HA capital costs	-	(42.8)	-	(42.8)	-	(42.8)	-
HA operating costs	-	(30.2)	-	(30.2)	-	(30.2)	-
MCS Co charges	-	-	(32.7)	-	(27.3)	-	198.4
HA mgt and admin	-	(2.1)	(3.7)	(2.1)	(3.7)	(2.1)	(3.7)
Consultants fees	-	-	(2.8)	-	(2.8)	-	(2.8)
HA revenues	-	38.4	-	38.4	-	38.4	-
Project costs	-	(36.7)	(39.2)	(36.7)	(33.8)	(36.7)	191.9
Total HA costs before risk	(498.7)	(504.2)	(506.7)	(504.2)	(501.3)	(504.2)	(275.6)
Mean non project risk adjusted costs	(520.6)	(490.9)	(490.9)	(490.9)	(490.9)	(490.9)	(490.9)
Mean project risk adjusted costs	-	(56.4)	(39.4)	(56.4)	(34.0)	(56.4)	191.8
95 th percentile	-	(40.4)	(39.0)	(40.4)	(33.6)	(39.5)	192.1
5 th percentile	-	(75.4)	(39.9)	(75.9)	(34.5)	(76.0)	191.2
Mean total HA risk adjusted costs	(520.6)	(547.3)	(530.3)	(547.3)	(524.9)	(547.3)	(299.1)
95 th percentile	(496.5)	(504.7)	(503.3)	(504.7)	(498.8)	(503.8)	(221.9)
5 th percentile	(550.1)	(591.0)	(555.5)	(591.5)	(544.2)	(591.6)	(342.3)
Nil third party revenues sensitivity							
Mean total HA risk adjusted costs		(572.8)	(584.9)	(572.8)	(609.8)	(572.8)	(628.2)

Figure 14.1: NPV of HA risk adjusted retained costs by Strategy

14.3.2 The costs are shown over the 15 year evaluation period commencing 1 April 1999 and ending 31 March 2014, discounted at the Treasury's appraisal rate of 6%.

- 14.3.3 The risk adjustments made to the risk adjusted costs have been made in accordance with the risk assessments set out in section 7 of Volume 3 using Latin hypercube sampling analysis. This provides a distribution of results for which we have provided the mean figure and the 90% confidence range bounded by the 95th and 5th percentile.

Analysis of results

- 14.3.4 Non Project costs broadly relate to all the HA's activities up to the end of year 3, which is considered to be the earliest date for the introduction of an MCS contract, and, from Year 4 onwards, to the provision and maintenance of the roadside equipment and provision of the business communications network.
- 14.3.5 Project costs and revenues relate to the activities which may be effected by a MCS contract from Year 4 onwards and, therefore, cover broadly the operation of the motorway communications network.
- 14.3.6 Strategy 2, the Do Minimum Strategy, relates to all of the activities included in the Study, and so includes both the Non project and Project costs. In comparing Strategy 2 with the other Strategies it is necessary to review the total HA risk adjusted costs, highlighted by the lower box in Figure 14.1
- 14.3.7 Strategies 3 and 4 relate solely to Project activities, i.e. the operation of the motorway communications network and associated opportunities from year 4 onwards. Therefore, when comparing Strategies 3 and 4 with each other and with their PSCs, it is necessary to review the Project risk adjusted costs to the HA, highlighted by the upper box in Figure 14.1.

14.4 Commentary on results

Project and non project costs

- 14.4.1 The striking observation for all of the strategies is that the non project costs are so much greater than the project costs. The inference is that the majority of the cost in the HA's communications network resides in the provision and maintenance of its roadside devices.
- 14.4.2 However, KHHS believe that the wider opportunities for the HA, both in financial terms and in terms of achieving its broader policy objectives, rest in the development of its motorway communications network. That is why the two Strategies developed in most detail by KHHS, Strategies 3 and 4, concern this part of the MCS and only Strategy 5 considers the procurement of the roadside equipment.

Public sector options

- 14.4.3 Strategy 2 has a lower NPV risk adjusted cost to the HA at £520.6 million than each of the PSCs for the PFI Strategies 3 and 4 which have risk adjusted NPVs of £547.3 million. This is to be expected since Strategy 2 is a smaller scope option and no account is taken in this analysis of the broader socio-economic benefits which the HA would expect to achieve through Strategies 3 and 4.

PFI options

- 14.4.4 When reviewing the PFI options in Strategies 3 and 4, it appears that Strategy 3 appears to be marginally more expensive than its PSC alternative before account is taken of risk, whilst Strategy 4 UMTS is marginally less expensive, (see Project costs line in Figure 14.1) but that each appears to demonstrate substantial value for money (i.e. is a lower cost to its PSC) when the HA's retained risk is also considered. Furthermore, these Strategies also provide better value for money than Strategy 2, the Do Minimum, even before taking account of the broader socio-economic benefits.
- 14.4.5 The figure for the DSRC option assume that MCS Co would be the sole national operator (at least until such time another operator started-up in competition) of the beacon-based roadside to in-vehicle communications services, because there is no existing DSRC network. Thus MCS Co would capture all subscription revenues from motorists using the service. With the UMTS option motorists are not assumed to subscribe to MCS Co, but to their usual mobile operator. In this scenario, MCS Co would only make a small margin on telematics communications traffic carried over the operators' networks.
- 14.4.6 It is apparent from the results that the Strategy 4 DSRC PFI appears prima facie to be the best option for the HA. Indeed, such are the assumed potential revenues under the DSRC option (even when reduced to 40% of expected total revenues for the purposes of calculating the cost to the HA), MCS Co would appear to be paying the HA to provide the services rather than vice-versa. This results in an NPV risk adjusted cost to the HA of £299.1 million against £547.3 million for the DSRC PSC, and £530.3 million and £524.9 million for each of the other PFI options.
- 14.4.7 However, it must be pointed out that the revenue numbers, particularly, are very speculative, and would need thorough testing in the market. The HA would not seek in requesting tenders for a Strategy 4 bid to specify either a UMTS or DSRC solution, and it would be for the bidders, based on their knowledge of the market conditions and the technologies at the time to decide on the solutions and to carry the risk of achieving forecast revenues. The results of the financial analysis are useful though in giving an idea of the range of potential savings the HA may seek to achieve through PFI over a conventional procurement.

15.0 NATA

15.1 Introduction

15.1.1 The application of NATA to schemes presented in the Roads Review was introduced in sections 4.3.5 to 4.3.8. This section provides more detail on the application of the NATA and provides an initial assessment of the proposed Strategies against the NATA criteria.

15.1.2 Reference has been made to the following documents in preparing this section of the Report:

- a) EC Council Directive 85/337/EEC dated 27 June 1985, as amended by Council Directive 97/11/EC dated 3 March 1997;
- b) *A New Deal for Trunk Roads in England: Understanding the New Approach to Appraisal*, published by DETR, July 1998;
- c) *Guidance on the New Approach to Appraisal*, published by DETR, September 1998;
- d) Internal HA paper titled *Environmental Impact Assessment and the New Approach to Appraisal for Highway Projects* prepared by D Kerwick-Chrisp, undated; and
- e) *Design Manual for Roads and Bridges, Volume 11, Environmental Assessment*, published by DETR.

15.2 New Approach to Appraisal

General description

15.2.1 The Government has, through DETR, developed the NATA as an open framework to appraise and inform the prioritisation of trunk road investment proposals. The NATA takes account of a wide range of criteria but is largely based on the former cost benefit appraisal, using DETR's COBA or Urban Economic Appraisal ("URECA") computer programs, and environmental impact criteria. The application of the NATA is mandatory for all Targeted Programme of Improvement ("TPI") projects. The requirements of the NATA are also reflected in the Project Appraisal Report, which is used for all HA projects not included in the TPI, irrespective of value. Assuming any contract arising from this Study would be considered a 'project', the NATA would be applied to any contract arising from this study.

15.2.2 The approach works by assessing different proposals and different options for solving the same problem against the criteria (sometimes referred to as 'objectives') of: environment, safety, economy, accessibility and integration. Within the five main criteria or objectives, a number of sub-criteria or sub-objectives have been identified. These are shown in Figure 15.1 below.

Criteria	Sub-criteria
Environmental Impact	Noise Local Air Quality Landscape Biodiversity Heritage Water
Safety	None
Economy	Journey times and vehicle operating costs Journey time reliability Scheme costs Regeneration
Accessibility	Access to public transport Community severance Pedestrians and others
Integration	None

Figure 15.1 Criteria for the NATA

- 15.2.3 The impacts of a scheme are expressed against these criteria and sub-criteria either qualitatively (in words), quantitatively (using numbers) or as a summary assessment (a monetary value, a quantitative indicator or a textual ranking). An appraisal summary table (“AST”) is prepared for each project or option under consideration to allow decision takers a clear, systematic and consistent basis on which to found their decisions.
- 15.2.4 Although initially derived for assessment and prioritisation of road improvement schemes, the appraisal process is also recommended for use in the assessment of projects that do not include the construction of a new road. It is, however, recognised that information for such projects is likely to be incomplete or less precise than would be the case for a major road scheme. The *Guidance on the New Approach to Appraisal* provides comprehensive instruction as to the items to be considered against each of the criteria and sub-criteria, the development of worksheets and the recording of assessment.

Initial assessment of MCS Strategies against the NATA criteria

- 15.2.5 Figure 15.2 provides an initial assessment of the MCS Strategies 3 and 4 against the NATA appraisal criteria. Further, more detailed, assessment and development of AST's for recommended strategies will be required under Part B of the Study.

NATA appraisal criteria	Initial Assessment of MCS strategies
Environmental impact	<p><u>Noise</u></p> <p>N/A</p> <p><u>Local Air Quality</u></p> <p>Strategy 4 will deliver information direct to the car, this will eventually be capable of modifying engine performance to help reduce pollution levels.</p> <p><u>Landscaping</u></p> <p>Strategy 3 and 4 will require the erection of masts on HA land where none might otherwise be required. This will be mitigated by the fact that if HA do not allow masts to be erected on its land, then mobile network operators will reach deals for such masts to be erected on land adjacent to that owned by the HA, a possible change of use.</p> <p>Strategy 3 and 4 will deliver mast sharing and the use of existing HA structures to accommodate cellular aerials. Both actions will reduce the need for structures on adjacent land and therefore lessen the impact on the environment.</p> <p>Strategy 4 will deliver information direct to the motorist, in time this could remove the need for large structures to accommodate message signs and therefore reduce the impact on the environment.</p> <p>Extensive use will be made of existing buildings and infrastructure under all strategies thereby reducing the need for further construction on the HA's land.</p> <p><u>Biodiversity</u></p> <p>Strategy 3 and 4 both include for possible erection of masts for cellular aerials at various sites. Construction work may have an adverse impact, although this can be mitigated through careful selection and approval of sites.</p> <p>Similar considerations apply to installation of duct network for longitudinal cables. This is mitigated by the essential need for cable infrastructure to support the HA's objectives as road network operator.</p> <p><u>Heritage</u></p> <p>Similar to biodiversity above.</p> <p><u>Water</u></p> <p>Similar to biodiversity above.</p>
<p>Note:</p> <p>In assessing the strategies against landscaping, biodiversity, heritage and water, it should be borne in mind that DETR Guidelines are based on the construction of roads in areas where none currently exist. Any contract resulting from this Study would involve the erection of additional structures within the existing right of way and would, therefore, have an inherently much reduced environmental impact. Assessments should also be carried out, ideally, for each proposed site.</p>	

NATA appraisal criteria	Initial Assessment of MCS strategies
Safety	<p>Strategy 4 will have potential to deliver more accurate and better targeted information (ref. benefits of Road Traffic Adviser) thus increasing safety of roads.</p> <p>Strategy 3 and 4 both have the potential to support early implementation of Triple Package measures on motorways and thus allow the benefits to be realised at an earlier date.</p> <p>Strategy 3 and 4 both have the potential to deliver more comprehensive cellular coverage, which should reduce the frequency of making (hands free) calls due to call drop outs and hence reduce driver distraction and improve safety.</p> <p>Strategy 3 and 4 could both result in an increase in roadside equipment and number of persons requiring access from motorways. This could represent an increased safety risk.</p> <p>Strategy 4 The delivery mechanism for in-car information (i.e. synthesised voice) should be less distractive than that provided by message signs. MS are currently limited by how much information can safely be delivered to motorists travelling at high speed (i.e. 3 lines of 20 characters) much more could be delivered safely by audible methods.</p> <p>Strategy 4 will deliver information direct to the car, this will eventually be capable of providing speed control thus improving safety.</p>
Economy	<p><u>Journey Times and VOC</u></p> <p>Strategy 4 will provide drivers with improved information, this will result in greater scope for making decisions on alternative routes to avoid delays or incidents thereby reducing journey times and vehicle operating costs.</p> <p><u>Journey Time Reliability</u></p> <p>Strategy 4 will provide drivers with improved information on road conditions, this will result in greater predictability of journey times when planning journeys.</p> <p><u>Scheme Costs</u></p> <p>Third party revenues arising under strategy 3 and 4 will offset construction and on-going maintenance costs of systems needed to meet the HA's requirements.</p> <p>Extensive and prompt adoption of inherently reliable, modern technology under strategy 3 and 4 will reduce maintenance and reconfiguration costs.</p> <p>Adoption of strategy 3 or 4 would allow better support of communications requirements for TCC project, thereby allowing accrual of benefits from that initiative.</p> <p><u>Regeneration</u></p> <p>Strategy 3 and 4 will facilitate an expansion of mobile phone networks and roll out of UMTS which will make it easier for travellers to conduct business and hence bring benefit to the economy.</p> <p>Strategy 3 and 4 could also improve mobile phone network coverage and/or capacity in areas adjacent to motorways that are not well served at present. This could aid development in those areas.</p>
Accessibility	<p><u>Access to Public Transport</u></p> <p>N/A</p>

NATA appraisal criteria	Initial Assessment of MCS strategies
	<u>Community Severance</u> N/A <u>Pedestrians and Others</u> N/A
Integration	In car information delivered under strategy 4 could deliver information on inter-modal public transport choices.

Figure 15.2 Initial Assessment of Strategies against NATA Criteria

THIS PAGE INTENTIONALLY LEFT BLANK

16.0 CONCLUSIONS AND RECOMMENDATIONS

16.1 Introduction

16.1.1 In the course of the study, KHHS have had extensive discussions with representatives of the HA's senior and middle management concerning the role of telecommunications within the wider strategy of the HA. We have found that although there is a clear vision of the HA as motorway network operator of the future, the nature of telecommunication services and the mechanisms used for their delivery have not been consolidated into that vision. Thus, although individual managers may have articulated their own views, there has been little consensus about what HA should be buying and how. Thus, having started out with clear instructions to examine and comment on various procurement options, we have had to move away from the "how?" question originally put to us, asking first "what?" and "why?".

16.1.2 This section summarises KHHS's conclusions to these questions, and then provides our recommendations.

16.2 The place of telecoms in the HA's strategic vision

16.2.1 The conclusion (explained in sections 4.1 to 4.3) is that the HA's future lies in it actively managing the motorway and trunk road network under its control, rather than in building new roads. Telecommunications are expected to be a key mechanism for the collection of traffic data and the primary means of communicating to road users. Thus, as we describe in section 4.4, telecommunications are at the heart of the vision of the HA actively managing the motorway network, and we conclude, in section 4.6, that on the basis of current technologies it is our firm expectation that this is best provided by means of a longitudinal fibre optic motorway communications network.

16.2.2 We also conclude in section 4.4 that communication with road users is on an evolutionary path, from the present roadside controls (informatory and mandatory signs and signals) to in-vehicle controls (driver information, road user charging, direct vehicle control, etc). This evolution will in turn demand increasing bandwidth over a more comprehensive and modern network. We describe what we believe to be the fundamental elements of this "target network" in section 4.7.

16.3 Current arrangements for the provision of the HA's communications

- 16.3.1 A key point to make in concluding on this Study is that the HA has been successful to date in providing itself with a sound and reliable communications system, capable of meeting its communications requirements as they have arisen. This is not a Study driven by a crisis in the current provision or the current operation, or by a specific, pressing, new requirement which is unaffordable under conventional public sector procurement. This Study is driven by a recognition that telecommunication technology is evolving rapidly and a desire to take full advantage of that progress and the benefits of private sector innovations. It also seeks to recognise and realise the commercial opportunities inherent in the HA's existing network. It is, therefore, a Study about positioning for the future rather than responding to an immediate need.
- 16.3.2 This Study has also recognised that there are limitations on the HA's ability in its existing form to deliver the communications developments required. The HA's core strategy for the short to medium term, the Triple Package, is described in section 2.6. The planning and prioritisation of Triple Package schemes is based on local requirements, with limited reference to national planning of the longer term strategic communications objectives and priorities of the HA. The roll-out is fragmented into small bespoke schemes which are designed and let to contractors on a case by case basis. Notable, also, is the consistent underspend by the HA of its CSR allocation in respect of investment in the Triple Package (for example, £70 million spent in 1997/98 against a budget of £90 million). There is therefore clearly a risk of current means of provision failing to keep pace with demand for new and upgraded systems requirements.
- 16.3.3 The TCC project presents a number of issues for the HA's motorway communications development. As we describe in section 3.3, the TCC project is the biggest single factor in determining the short to medium term MCS requirements. With two exceptions, there is no requirement, under current proposals (evidenced by the TCC ITT), that TCC Co should use the HA (and eventually MCS Co) for its communication services. TCC Co may have an existing network or it may plan to establish its own TCC motorway communications network. One of the aims of this Study is to provide the HA with a clear view of the plans and requirements of its communications network, so that it can make informed judgements on any such proposals in the TCC bids.
- 16.3.4 In looking forward and positioning for the future, one of the objectives of the Study is to ensure that the development of communications on the HA's road network remains under the HA's control (though not necessarily its ownership). As we discussed in section 5.5, we are aware that the private sector is developing in-vehicle communication systems and services, and it is inevitable that these will come to market sooner rather than later. The HA has the choice of either adopting a market chosen solution and attempting to fashion it to its own requirements, or to take an active role in its development driving it forward with the HA's own requirements at the forefront. Industry tends to move quickly, and if the HA leaves an opportunity on its road network unexplored, the void will quickly be filled, as the Trafficmaster example has shown.

16.4 Roadside to vehicle communications

- 16.4.1 A key finding in the Study of the “what”, is, as summarised in section 4.4, that the HA has an on-going strategic requirement for communications services at the roadside and into vehicles on its road network. The developing role of the HA as the road network operator, outlined in section 4, the developments in communications technology set out in Report 3B and the initiatives in the market in this area described in section 5.5, all lead us to this conclusion, and it is on this basis that the recommendations which follow have been made.
- 16.4.2 The development of a link, taking driver communications from the roadside where they currently end, in the form of VMS, EMS, emergency phones, CCTV and MIDAS equipment, and extending them into vehicles, will represent a step change in the capabilities of the HA to manage its road network. It will provide the HA with vastly superior, more detailed, more strategic information about the state of its road network, journeys being made on it, and a means of communicating specific information and instructions to individual drivers. It will also provide the vital capability the HA requires to be properly positioned for future developments in the form of road user charging, autonomous driver assistance, and, ultimately, fully automated highways.
- 16.4.3 Liaison with the TCC project team has confirmed the joint understanding that MCS Co would not be entitled to sell, or otherwise exploit with any third party, any journey time or other traffic data that it obtained as a by-product of roadside to vehicle communications. This should be the exclusive right of TCC Co. Any such data that was collected and processed by MCS Co should be provided via the HA or direct to TCC Co at agreed prices.

16.5 Separate provision of devices and the network

- 16.5.1 An early conclusion of our work, detailed in section 7.4, was that the operations of the network can be analysed into two very distinct areas - the transmission of data on the one hand and the origination and communication of information on the other. Technically, once the communications network is complete there is little likely to change significantly except for the addition of capacity by the use of upgrade technologies such as SDH. Regardless of the types of cameras, monitors and signs applied in managing the motorway network, the need for transmission services and the technology associated with it seems stable.
- 16.5.2 By contrast, the devices gathering data and then passing it back to the road user can be expected to change significantly over the next decade, reflecting the development of more demanding standards, exploiting the opportunities offered by new technologies and advancing the HA’s vision of more comprehensive and interactive communication between the network operator and the road user.
- 16.5.3 The distinction is a fundamental one as the network offers the prospect of a stable commodity service, readily capable of up-front definition and contractual agreement in a PFI style contract. The devices, however, are likely to change so much and so often that fixing the details of their provision and defining it up-front in a contract is likely to be very difficult and expensive.

16.6 Opportunities for private sector involvement

16.6.1 There is strong appetite for private sector participation in various aspects of the HA's communications systems. Commercial opportunities, set out in section 5, have been identified in the following areas:

- a) use of parts of the HA's fibre network to complement the private sector's existing or intended networks;
- b) management of the HA's communications facilities, and the provision of additions and upgrades to them;
- c) leasing of sites owned by the HA to set up masts for mobile phone services; and
- d) access to roadside to vehicle communication opportunities, including not only the provision of HA sponsored communication services but also other services identified by the private sector as adding value to the road user.

16.6.2 The opportunity to create a complete national network is fundamental to the appeal of the MCS to potential private sector operators and service providers. Without it, the HA's appeal to private sector telecommunications businesses will remain limited to the rental of mast sites - an option which does least to extract value from the HA's position and asset base. We have focused in the Study on those aspects of private sector participation which recognise the commercial value of the HA's natural position as national sponsor of sophisticated roadside to vehicle communication.

16.7 Potential constraints

16.7.1 The opportunities are tempered by a number of legal constraints and uncertainties explained in section 6. These concern principally whether the Secretary of State (as contracting party for the HA) has sufficient powers to enter into the commercial arrangements contemplated. This issue needs to be considered as a matter of urgency in particular given the proposal that the HA could let a contract for the installation of telecommunications masts to a managing agent in the interim.

16.7.2 There are also concerns regarding the HA's ability to provide exclusive rights to MCS Co to use or establish communications networks as part of an MCS project. Such rights will only be exclusive to the extent that the HA refuses its consent under the New Roads and Street Works Act 1991 to public telecommunication operators (PTOs) that request access. Such refusals of consent or a promise to refuse consents could be subject to challenge by such PTOs.

16.7.3 The right of the HA to charge for consent to access its land is generally excluded or limited by the relevant legislation to reasonable administration costs. This may not be a significant issue if the arrangement is structured in such a way that any such charge is deducted from the fee payable to the private sector partner. There are strong arguments that this would not be interpreted as charging for access.

16.7.4 The application of general principles of administrative law make it difficult to reach a definitive view on these constraints, in particular whether the Secretary of State has the necessary powers. KHHS have raised the possibility of primary legislation to clarify these issues with DETR's lawyers. In the absence of such legislation, the HA's only alternative is to formulate, test and then publicise a clear policy on these matter.

16.7.5 The collection, processing, sale and use of data are activities which MCS Co may undertake. As commercial opportunities in these areas are developed (alongside the TCC project), data protection and confidentiality issues will need to be monitored to ensure compliance.

16.7.6 Section 17.3 sets out the next steps required to address these legal constraints.

16.8 Advantages of private sector involvement

16.8.1 Despite the potential legal hurdles, KHHS believe that there are considerable benefits in developing the HA's requirement for the target network and ultimately for roadside to vehicle communications with the private sector.

16.8.2 In section 7.5, we have reviewed the potential procurement methods through which the private sector could be involved. These include an outsource arrangement, a joint venture, a PFI, PPP or a conventional procurement. We concluded that there are a number of attributes of the HA's MCS requirement that lend it to a PFI arrangement. We therefore developed and reviewed two Strategies, Strategy 3 and Strategy 4 on this basis, and it is on these that we have based our recommendations which follow.

16.9 Recommendations

16.9.1 KHHS has identified six key recommendations which are explained and provided below.

16.10 MCS PFI

16.10.1 KHHS developed two Strategies for an MCS PFI:

- a) Strategy 3 is a PFI for a national motorway communications network, the target network described in section 4.7, up to the roadside verge, with the right to exploit surplus fibre capacity for commercial services and the requirement to develop a managed telecommunications mast sharing service; and
- b) Strategy 4 is as for Strategy 3, but with the additional obligation to provide a roadside to vehicle link, which we have concluded above is the ultimate strategic requirement of the HA. MCS Co would also be provided with the right to exploit surplus capacity on this link for commercial services.

- 16.10.2 There are basically two different technological solutions for the delivery of the roadside to vehicle links: a licenced radio solution which we have characterised as a UMTS solution; and an unlicensed radio solution such as DSRC. Two iterations of Strategy 4 were developed to reflect these two possibilities.
- 16.10.3 The strategic reasoning behind a roadside to vehicle PFI project has been summarised in the conclusions above, but we have also prepared a financial analysis which looks at the risk adjusted NPV costs to the HA of these strategies, and compares them to appropriate PSCs in each case and against a Do Minimum Strategy, Strategy 2. The results of this analysis are summarised in Figure 16.1 below.

Retained HA NPV costs	Strategy 2	Strategy 3 PSC	Strategy 3 PFI	Strategy 4 PSC UMTS	Strategy 4 PFI UMTS	Strategy 4 PSC DSRC	Strategy 4 PFI DSRC
	£'m	£'m	£'m	£'m	£'m	£'m	£'m
<i>Mean project risk adjusted costs</i>	-	(56.4)	(39.4)	(56.4)	(34.0)	(56.4)	191.8
<i>Mean total HA risk adjusted costs</i>	(520.6)	(547.3)	(530.3)	(547.3)	(524.9)	(547.3)	(299.1)

Figure 16.1: NPV of HA risk adjusted retained costs by Strategy

- 16.10.4 The first line sets out the potential NPV risk adjusted costs to the HA of the MCS Co PFI project. The second line puts these costs in the context of the HA's entire communications risk adjusted costs, including the road devices costs (which form the substantial majority of the expenditure) and the HA's business communications costs.
- 16.10.5 The results demonstrate that, a PFI Strategy should provide value for money over its equivalent PSC option. They also show that a Strategy 4 PFI has the potential to provide the HA with the lowest cost communications network, with the DSRC option, in this analysis, providing the most cost effective solution²⁴.
- 16.10.6 Note that this analysis does not take account of the wider socio-economic benefits, included in NATA, which we expect to arise from the Strategies and which we believe would increase the benefits of the PFIs over the PSCs, of Strategy 4 over Strategy 3, and of both Strategies over Strategy 2.
- 16.10.7 In making a recommendation to the HA on which Strategy to pursue, there are two key points to make:

²⁴ Since there is no existing DSRC network in the UK, this option assumes that MCS Co would be the sole national operator (at least initially) of the beacon-based roadside to in-vehicle communications services. Thus it would capture all subscription revenues from motorists using the service. With the UMTS option motorists are not assumed to subscribe to MCS Co, but to their usual mobile operator. Thus, MCS Co would only make a small margin on telematics communications traffic carried over the operators' networks.

- a) first, the risk of specifying the technology to be used in any solution for the HA's roadside to vehicle requirement (i.e. UMTS or DSRC) is a commercial risk to be borne by the private sector (the two options have been modelled here simply to give an idea of the potential range of benefits to the HA); and
- b) second, whilst Strategy 4 would appear to deliver the most benefit to the HA, the decision whether or not to pursue a PFI contract which includes the expansion of its current network from the roadside into vehicles (i.e. the roadside to vehicle link) need not be taken at this stage, and is one which can be tested directly in the market through the procurement process.

16.10.8 The second point is that the requirements and commercial aspects for Strategy 3 are more certain and established than those for Strategy 4. Also, conveniently, Strategy 4 forms a natural technical and operational extension to Strategy 3. Therefore, whilst KHHS believe that Strategy 4 will ultimately deliver better value for money than Strategy 3, the more prudent course of action for the HA is to develop Strategy 3 as its baseline requirement, and specify Strategy 4 as a variant requirement, and invite bids on this basis. In this way, it can publicise the requirement, but defer any decision on whether to proceed with the roadside to vehicle links until it receives bids in up to two years' time.

16.10.9 This has several advantages:

- a) it leaves time for the technological solutions to be developed, and for many of the risks of specifying the requirement at this stage to be eliminated;
- b) it will have a galvanising effect on the market, and focus developments towards including the requirements of the HA; and
- c) at the time of making the decision a better picture of the financial implications for the HA will have become available.

Recommendation 1

16.10.10 KHHS recommend that the HA develops an ITT for the PFI procurement of Strategy 3 with Strategy 4 as a variant requirement.

16.11 Telecommunications mast sites interim measures

16.11.1 The opportunity for the siting of telecommunications masts on the HA's property, described in section 5.4, forms part of Strategies 3 and 4. This is a significant opportunity, capable of generating substantial cash benefits for the HA, and forms a key aspect of the two Strategies. However, it is an opportunity with a limited timeframe, shorter than that of the procurement timetable for a PFI. Some form of interim arrangement needs to be considered if the opportunity is not to be lost by operators finding alternative sites for their masts, or, equally, if the risk of PTOs challenging the HA's current policy on the matter is to be removed. Either way, Ministers are increasingly demanding action on the issue.

- 16.11.2 KHHS believe that the solution is likely to lie in some form of mast managing arrangement whereby a private sector partner is contracted to manage the erection and maintenance of suitable GSM, GPRS and, in time, UMTS masts, and manage the access to and sharing of these sites by mobile telephone operators. A key requirement of any such arrangement is that it be capable of being transferred into MCS Co in due course, and is compatible with the communications network plans of any such MCS Co operator.
- 16.11.3 There is considerable uncertainty as to the lawfulness of such interim arrangements, as discussed above, and the first action would be to establish the HA's policy in respect to such arrangements, and to test again the possibility of primary legislation to clarify the position.
- 16.11.4 KHHS also note that it may be useful to establish a national register of protected streets. In addition, the HA may wish to reconsider the classification of certain high standard APTRs and decide as a matter of policy whether these should be reclassified as protected streets, given their critical role in the HA's core network.

Recommendation 2

- 16.11.5 KHHS recommend that the HA establishes a plan for progressing interim arrangements for the letting of telecommunications mast sites on its property.**

16.12 Business communications

- 16.12.1 The Study has endorsed the HA's current plans to procure an ATM based office WAN service and to migrate its existing network connections accordingly. The Study has also observed that, given the geographical locations of the HA's offices which are by and large in the immediate or general proximity of the NMCS, the HA may be able to obtain cost reductions in combining the WAN provision with a Strategy 3 or Strategy 4 MCS contract.
- 16.12.2 It is important, therefore, that if the HA Business Information Systems Division ("BIS") decides to proceed with an ATM-based office WAN service procurement, the contract for its provision should not extend beyond two years, since MCS bidders will be allowed to bid for this business as part of their overall MCS solution. Preferably any interim contract for ATM services should be terminable at no more than 3 months notice and renewable annually.

- 16.12.3 Business telephony is an essential service currently provided reliably and cost-effectively through the public telephone network. Although new technologies and services offering voice over broadband data networks (based on ATM or IP transmission) are emerging, they are not yet mature. Our advice is that it would be technically and commercially very risky to consider moving the HA's business telephony on to ATM, perhaps as part of a BIS decision to proceed with an ATM-based office WAN service. However, guaranteed service quality will become a reality for voice over broadband data networks over the next two to three years, before any new MCS arrangement is expected to be in place. Thus, business voice telephony services could be included in the MCS requirements. However, there should be no obligation on bidders to carry voice over the motorway communications network (i.e. bidders could offer their own existing network, if any). The service must be 100% reliable and there would be uncertainties over the capabilities of the network to meet this requirement and costs associated with voice-over-data service provision.
- 16.12.4 Notwithstanding this advice, KHHS recognises that ATM networks could currently provide reliable 'permanent virtual circuits' to connect between existing PABXs in each office. This would, in effect, use an ATM network to provide point to point transmission paths for voice between the various offices. If the HA favours such an approach, it will need to consider the impact on existing agreements for use of the GTN.

Recommendation 3

- 16.12.5 **KHHS recommend that the provision both of an ATM-based office WAN service and, separately, the provision of business telephony service over the WAN, should be offered as a variant requirement in any ITT for the PFI procurement of Strategy 3 or the Strategy 4 variant.**

16.13 Existing Triple Package and SDH programmes

- 16.13.1 On the basis of the HA's experience with previous PFI procurements, the most relevant being the TCC procurement, KHHS believe that an MCS PFI procurement could take as much as two and a half years from the date of this report, with a contract being signed in approximately June 2002. It is important that during this period the HA's existing plans are not put on hold pending the outcome of this procurement. We believe that, in general, the value of the communications network and the opportunities it provides will be enhanced in the eyes of potential MCS bidders by continuing with the existing Triple Package and SDH programmes. In any case, these programmes are important to ensure that the HA has a viable network, should a PFI procurement not proceed.
- 16.13.2 KHHS believes, however, that there is merit in developing a strategic plan for the communications services to cover the period up to, and beyond, the inception of an MCS PFI contract.
- 16.13.3 For the triple package and RMC contracts, the strategic plan would cover:

- a) the current Triple Package programme, reviewing the planned schemes in the light of, among other things, their value to any MCS contract; and
- b) the opportunities for the setting up of framework agreements with a small pool of suitably equipped and skilled contractors based on a regional or national basis for the delivery of triple package schemes and first line (repair by unit or module replacement) maintenance services for roadside devices.

16.13.4 It is noted that any action in respect of triple package delivery would require close liaison with the HA team developing the new road maintenance contracts (since they are also considering how RMC contracts could be repackaged). KHHS understands that the HA recently conducted a study to examine the pros and cons of combining the RMC function into the future road maintenance contracts ("MAC"s) (Ref. OW report number L377/070). The HA will need to establish whether best value for money can be obtained by combining it with the road maintenance function or as part of the framework agreements suggested above.

Recommendation 4

16.13.5 **KHHS recommend that the existing Triple Package programme and RMC contracts should be continued in the short term. Reviews of the scope, planning and prioritisation of Triple Package schemes, provision of first line maintenance services for roadside devices and the method of their procurement should be carried out.**

Recommendation 5

16.13.6 **KHHS recommend that the existing proposal for a new (SDH) transmission network be progressed.**

16.13.7 In addition, development of the strategic plan should include an assessment, to be added to the SDH business case, of the costs and functionality of different choices of transmission technology and their relative ability to meet the HA's requirements. This would be based on illustrative quotes obtained from suppliers of SDH, ATM and IP-based transmission equipment.

16.14 Roadside communications devices

16.14.1 As the financial analysis summarised in section 14.3 above indicates, the largest portion of the HA's communications budget is spent on the provision and maintenance of roadside equipment. In section 12, we have described the current arrangements for the design, purchase, storage, installation and maintenance of this equipment and have highlighted the currently fragmented nature of responsibilities in respect of each of these tasks. The result is, we believe, that the HA is missing out on efficiencies which could be gained by making suppliers more accountable for the whole-life costs of the devices. Strategy 5 focuses on this aspect of the HA's communications operation.

- 16.14.2 KHHS recognise that there are operational considerations in suggesting that suppliers of equipment should be responsible for first line maintenance. For safety reasons, the HA does not wish to increase the number of contractors with access to the roadside beyond the existing RMC and NTMC maintenance arrangements. However, the HA is also already examining ways of making suppliers of devices responsible for second line (repair of units or modules by sub-assembly replacement) and third line (repair of sub-assemblies by component replacement) maintenance in the project for procurement of a new, Type 354, emergency roadside telephone.
- 16.14.3 Strategy 5 is outlined in brief in this report. It was decided by the Project Steering Committee that to devote much time developing it as part of this Study would divert attention from the main purpose of the Study, which is to develop the opportunities in the motorway communications network. It was also noted by the Steering Committee that Strategy 5 is already being explored in other guises by the HA in other projects, such as the NMCS telephones project. It was also noted that any action in respect of Strategy 5 would require close liaison with the HA team developing the new road maintenance contracts (since they are also considering how RMC contracts could be repackaged). It was, therefore, agreed to outline the Strategy and the opportunity in this report, and to promote its further development within the HA.
- 16.14.4 KHHS understands that the HA recently conducted a study to examine the pros and cons of combining the RMC function into the future road maintenance contracts (Ref OW report number L377/070). The HA will need to establish when further developing Strategy 5, whether best value for money can be obtained by combining it with the road maintenance function or as part of a design, build and maintain contract as discussed under Strategy 5.

Recommendation 6

- 16.14.5 **KHHS recommend that the HA continues to review on a project by project basis the purchase of its roadside equipment with a view to introducing whole life cost principles into its design, purchase, integration, assembly, storage, provision and maintenance (other than first line maintenance) through the use of PPP and PFI type arrangements.**

16.15 APTR

- 16.15.1 The majority of the discussion within this Report has concentrated on motorways. The HA is responsible for the operation and maintenance of all trunk roads in England, i.e. APTRs as well as motorways.
- 16.15.2 Report 3A identified that many of the assets available for exploitation on motorways are also, in theory, available on APTR. The legal review of matters pertaining to assets identified that it is likely to be the designation of motorways as 'special roads' which has been used by the HA to restrict use of land adjacent to motorways by third parties such as statutory undertakers.

- 16.15.3 There is currently minimal provision of motorway communications services on APTR and the investigations carried out by KHHS in preparing Report 2 have identified no immediate or short term requirement for such provision.
- 16.15.4 The study held meetings with two HA teams and have established the following with respect to this issue. The TSS Network Communications Strategy Team (NCST) is about to commence work within this financial year to re-consider the criteria and economic case for providing network control facilities (e.g. MIDAS, VMS etc) on the APTR core network. The 10 year strategy team are aware of the work being conducted by the TSS NCST and are considering options for their inclusion in the 10 year strategy.
- 16.15.5 The MCS PFI contract will be specified to allow the motorway communications services to be extended to the APTR during the term of the contract. In essence the contract structure will allow services to be called off whenever and wherever they are required.
- 16.15.6 It is likely that the MCS Co will want to develop commercial communications services on the APTR network independent of the HA's requirements. The HA could benefit from these developments, particularly if any roadside to vehicle communications link is based on mobile phone technology.
- 16.15.7 While it may seem practical for assets on APTR to be exploited by MCS Co for their own purposes, the following matters could have an adverse effect on the commercial viability of such exploitation:
- a) many statutory undertakers (including PTOs exercising Code powers) have already installed services in verge areas of APTR raising issues of co-ordination of works, avoidance of accidental damage;
 - b) existing installations have been carried out under Code powers with no payments being made to the HA (other than the HA's expenses);
 - c) existing coverage of mobile operators includes urban areas served by APTR and provides adequate capacity for more remote areas where there is reduced demand for services;
 - d) market players have shown little interest in implementing a new fibre based network along the HA's roads;
 - e) absence of infrastructure such as EMS poles, gantries and associated power supplies makes it less convenient for additional aerials to be installed; and
- security issues and risk of vandalism make it less attractive for equipment to be installed adjacent to APTR.

THIS PAGE INTENTIONALLY LEFT BLANK

17.0 NEXT STEPS

17.1 Introduction

17.1.1 Following on from our six core recommendations set out in section 14, we set out in this section the immediate actions which we believe should be carried out as a result of this Study. We also provide some commentary on the type of HA involvement which we believe will be necessary in taking the project forward.

17.2 Decision on the Study recommendations

17.2.1 As we have noted in the relevant sections of this report, the telecommunications and vehicle markets are moving rapidly in the areas under consideration in this Study. The opportunities which currently present themselves are subject to a number of external factors such as the further roll-out of fibre, GSM and GPRS networks by the telecommunications operators, the auction of UMTS licences in 2000, and the on-going development of in-vehicle communications by telecommunications operators and vehicle manufacturers. We, therefore, recommend that the HA moves rapidly to reach decisions on the Study's core recommendations so that it and KHHS can progress the next steps detailed below.

17.3 Deployment of telecommunications masts

17.3.1 There is reasonable uncertainty as to whether the Secretary of State has sufficient powers to carry out the arrangements recommended for the deployment of telecommunications masts, particularly the interim measures we have recommended. There is a need to consider this issue again, establish the HA's policy in respect to such arrangements, and to test again, the possibility of primary legislation to clarify such powers.

17.4 Consultation with industry

17.4.1 The HA has already considered the possibility of further consultation to progress the project, and, in particular, the idea of an industry conference in the first half of 2000 to publicise the decisions arising from this Study. KHHS support the concept of an industry conference, but advises that the HA's policy on mast deployment must be established before this conference is held.

17.5 Liaison with TCC

17.5.1 The potential of TCC bidders to offer solutions which cross into the scope of activities envisaged as part of the MCS has been highlighted by KHHS. TCC bids were submitted at the end of November 1999. The extent to which this potential has been realised will need to be evaluated. The impact it could have on MCS provision will need to be assessed urgently so that decisions can be made about where the interfaces between TCC and MCS should be drawn and appropriate action taken.

- 17.5.2 Separately, the requirements TCC bidders have expressed in their bids for video links to PCOs will need to be identified, since this is a key factor in sizing and planning the interim SDH network and the MCS requirements.

17.6 Development of ITT

- 17.6.1 The timetable for an ITT, the proposed project in the ITT and related issues need to be addressed. This will form the core on-going activity if the HA decides to adopt the Study's recommendations.

17.7 Continued development of existing communications

- 17.7.1 Strategic plans need to be developed for the communications network to cover the period up to the inception of an MCS contract. As noted in the previous section, these would cover:

- a) the current Triple Package programme, reviewing the planned schemes in the light of, among other things, their value to any MCS contract;
- b) the opportunities for the setting up of framework agreements with a small pool of suitably equipped and skilled contractors based on a regional or national basis for the delivery of triple package schemes and first line (repair by unit or module replacement) maintenance services for roadside devices;
- c) the choice of transmission technology in the SDH business case; and
- d) the procurement of roadside devices through PPP or PFI type contacts where the supplier is given 'whole life' responsibility for the device, including second and third line maintenance.

17.8 HA staffing requirements

- 17.8.1 It is anticipated that the majority of work needed to develop the recommended procurement strategy will be undertaken by consultants under Part B of the Study. In order to minimise any delays and ensure that all relevant matters are given due consideration, the consultant will need to work closely with the HA to develop a set of tender documents that allow the aims of the Study to be achieved as far as is practical. This is seen as being an iterative process that continues the development of ideas proposed in this Report and refines the financial model to allow a more accurate view to be taken of the commercial implications of the final solution.

- 17.8.2 In order to maintain the required degree of partnership between the consultant and the HA, it is envisaged that the HA will retain an internal 'project team' to manage the further development and implementation of the recommendations of this Report. This project team will not necessarily require a full time involvement from all disciplines but will require a clear understanding of the process to ensure that undue delays are avoided and maximum benefit is made from the opportunities available for exploitation of the HA's assets under any PFI contract.

17.8.3 As work progresses, the emphasis will switch from more technical aspects, which dominated the data gathering stages of the Study, to commercial and legal aspects that will dictate the scope and format of the contract which is eventually placed. The technical aspects will need to be developed as the form of the deal that is taken to the market place evolves, not least to ensure that appropriate transition measures are established. Operational considerations will also need to be considered to derive a plan for implementation that does not detract from the HA's strategic role of maintaining, operating and improving the trunk road network.

17.8.4 It is expected that the HA's project team will include representatives from FS, QS, NCS and PS directorates. Particular areas where these directorates are expected to have an involvement are described in the following paragraphs.

FS

- a) development and refinement of financial model for preferred option and PSC;
- b) transfer of risks from the HA to MCS Co, where appropriate;
- c) verification of revenue streams;
- d) generation of business case to allow procurement of contract to proceed;
- e) overview of procurement arrangements;
- f) assessment of risks presented by legal constraints;
- g) more detailed assessment of assets and potential for commercial exploitation; and
- h) development of payment mechanism(s) appropriate to the scope of contract.

QS (Non-Roads Procurement)

- i) overall preparation of tender documents;
- j) requirements for bonds, insurances, penalties, payment methods;
- k) amendment of existing contracts, including possible early termination and handover issues;
- l) review and agree draft PFI contract for MCS Co; and
- m) prequalification process.

QS (TSS)

- n) development of specification of services and associated documentation;
- o) agree minimum build out of fibre optic/SDH network;

- p) development of transition issues;
- q) assemble as-built information for current systems and equipment; and
- r) specification and measurement of performance requirements for HA motorway communications services.

NCS

- s) issues relating to CDM Regulations; and
- t) interfaces with Term Maintenance Contractor and Managing Agent.

PS

- a) review NCP and agree which schemes should be included in PFI contract; and
- b) agree changes in scope and co-ordination issues relating to implementation of Triple Package schemes.

17.8.5 In addition, the HA will need to manage the consultant's activities to agree the scope of work to be carried out, the budget for the work and the programme for completion. It is envisaged that work will proceed on the basis of approved Task Authorisation Forms ("TAF"s). Each TAF will cover a clearly defined part of the overall work required and will include an agreed ceiling price for the consultant to carry out that work.

17.8.6 The current regime of regular progress meetings, maintenance of payment schedules and project plans, participation at Steering Group level, and presentations to senior management are envisaged to continue throughout Part B of the Study. In addition, there will be a need to increase awareness of the project and the direction in which it is heading both within the HA and to the telecommunications industry players who would be expected to participate in the contract that results. To this end a number of workshops for the HA's staff and seminars for industry are envisaged at an early stage once the necessary approvals have been obtained and instructions given to proceed with Part B of the Study.

APPENDIX 1

Workshop participants and interviewees

THIS PAGE INTENTIONALLY LEFT BLANK

KHHS would like to thank the following for their support and participation in the preparation of this Final Report through the workshops and interviews held.

Attendees at the Options Workshop 1 (London, 2 July 1999)

Names Redacted under
Sec 40 of the FOIA
Exemptions 'Personal
Information'

Attendees at the Options Workshop 2 (Bristol, 9 August 1999)

Names Redacted under Sec 40 of the FOIA Exemptions 'Personal Information'

Attendees at the Risk Workshop (Bristol, 2 December 1999)

Names Redacted under Sec 40 of the
FOIA Exemptions 'Personal
Information'

Interviewees for this report

Names Redacted under Sec 40 of the
FOIA Exemptions 'Personal
Information'