

GRASSED AND PLANTED AREAS BY MOTORWAYS

A REPORT BASED ON INFORMATION GIVEN
IN 1974/75 BY THE DEPARTMENT OF THE
ENVIRONMENT AND COUNTY COUNCIL
HIGHWAY DEPARTMENTS, WITH ADDITIONAL
DATA FROM OTHER SOURCES

J. M. WAY T.D., M.Sc., Ph.D.

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CHAPTER 1

INTRODUCTION

This report on the extent and other characteristics of grassed and planted areas associated with motorways, is written assuming that they are potentially important for the conservation of wild plants and animals. This idea was first publicly suggested by Williams-Ellis (1967), and coincidentally by Moore (1967). Williams-Ellis's booklet 'Roads in the Landscape' reflects the thinking at that time of the Ministry of Transport's Advisory Committee on the Landscape Treatment of Trunk Roads under its then Chairman, Sir Eric Savill. It was suggested specifically that '... the roadside verge, particularly on the motorway where pedestrians are forbidden, should become a nature reserve and provide a new and secure habitat for our wild flowers'. The Advisory Committee, referred to by its short title as the Landscape Advisory Committee, now reports to the Secretary of State for the Department of the Environment. Although the scope of its interests and of its functions have widened and changed since the early days of its formation, it continues under its present chairman, Sir George Taylor, to strongly support ideas on the natural development of motorway banks and verges, and of the importance of these areas for wildlife. Similarly in a number of letters and memoranda to Agent and Highway Authorities, the Ministry of Transport and subsequently the Department of the Environment have also supported these views.

Grassed and planted areas by motorways are here defined as the ground between the hard shoulder and the boundary fence. The term 'verge' is not strictly appropriate, especially as a considerable proportion is either made up of embankment, or cutting. The whole area (excepting ditches) is sown with grass at an early stage (Chapter 4), but subsequently substantial plantings of shrubs and trees may be made (Chapter 5). Of the grassland, some areas were managed by mowing or chemicals at least once per season up to 1975 (Chapter 7); other areas, after management during the establishment phase, have since been unmanaged and allowed to grow wild.

The first sections of motorway built after the Special Roads Act 1949 (HMSO, 1949) were completed in 1959 and subsequent statistics of the development of motorways are given in the annual reports of the Minister of Transport, and subsequently the Secretary of State for the Environment, entitled "Roads in England" (HMSO 1960 to 1975). There are some statistical differences over the precise mileage of motorway open at any given point in time, depending upon rounding-off errors and the date of collection of information - this report estimates a total of 1763 km (1102 miles) at the end of December 1974 (Chapter 2). In addition to the mileage of road to which motorway regulations apply (the criterion used in calculating the figure above), an unknown but possibly significant mileage of new ancillary roads has been built in connection with the motorways including link roads and junctions.

Specifications for the design of rural motorways have evolved over the years. A typical description and cross-sectional layout are given in the 'Layout of Roads in Rural Areas' (HMSO, 1968), and consist essentially of a 1.5 m (5 ft) verge, 3.2 m (10 ft 6 ins) hard shoulder and two or three 3.7 m (12 ft) lanes for each carriageway with a central reserve of 4.0 m (13 ft), giving overall dimensions of 28 m (92 ft) for a four lane, and 35.4 m (116 ft) for a six lane motorway. Specifications for the construction of motorways, including earthworks, establishment of grass and planting of hedges, are set out in the 'Specification for road and bridge works' (HMSO, 1969).

The Highway Authority for trunk road motorways is the Department of the Environment, operating through a headquarters in London and a network of Regional Controllers (Roads and Transportation). The majority of motorways have trunk road status, but a small mileage of local authority motorways (see Appendix Table 2.2) do not. The maintenance of trunk road motorways (for which 100% grant is paid) is delegated to Agent Authorities, who, in rural areas are the County Councils. Within County Councils the County Surveyor (or comparable officer) is responsible. In counties where there is a reasonable mileage of motorway a special appointment may be made for one officer to have full time day to day responsibility, but in other counties motorway maintenance may be only a part of the duties of existing Divisional or Area engineers having other county duties. This, as will be seen, makes for a wide range of different interpretations of policies and instructions, and to a wide range of approaches to their implementation.

This report is based on information supplied by the Department of the Environment and by County Council highway departments. All County Councils (with exceptions noted below) having responsibility for sections of motorway in England (and Gwent in Wales) were visited : where possible the visit was to the Officer having day to day responsibility, with the intention of gathering information about the practical problems and operations of motorway maintenance programmes. In all, 32 Council offices were visited, representing 29 Councils. 26 Councils were managing existing sections of motorway, two (Greater Manchester CC and West Midlands CC) were about to take over lengths of completed motorway from other authorities (Merseyside CC in the same category was not visited), and one (Oxfordshire CC) was about to take over a newly opened section of the M40 from the Department of the Environment and the Contractors. The London Boroughs of Barnet (M1) and Hounslow (M4) were not visited because much of the motorway in these boroughs was essentially urban (although not necessarily without grassed or planted areas); Devonshire was not visited as the only section of the M5 completed there was the Cullompton By-Pass (numbered A38(T)), not yet subject to motorway regulations. West Glamorgan CC in Wales was not visited for logistic reasons, and because of the rather short lengths of the very recently opened sections of the M4 and A48(M) in the Swansea-Port Talbot district. Since the data were collected parts of the M23 (London-Crawley Motorway) in Surrey, and the M55 (Preston Northern By-Pass) in Lancashire have been completed, but information about these and other sections of motorway opened after the end of 1974 are not included in this report.

Data have also been used that were collected in 1970 at the time of a botanical survey of the M1 from Hendon to Leeds by the Nature Conservancy, with financial support from the Ministry of Transport, and also from subsequent physical surveys of parts of the M4, M5 and M6. In addition, continual reference has been made to 1 : 63,360 (one inch to the mile) and 1 : 50,000 maps of the Ordnance Survey; to the 1 : 625,000 (10 miles to the inch) OS Route Planning map of Great Britain 1975, published in 1974; to the Bartholomew Motorway Atlas of Britain (ed. Bladon, 1973) and to Motorways (Dunlop n.d. strip maps).

CHAPTER 2

DISTRIBUTION AND MILEAGE OF MOTORWAYS, WITH ESTIMATES OF ACREAGE OF GRASSED AND PLANTED AREAS

The distribution of motorways and their relationships to Local Authority boundaries (post April 1975) are shown in Appendix Figures 1 - 5.

Information on the mileage of motorways (Appendix Tables 2.1 and 2.2) refers to the sections open to traffic at the time of collection of the data for this report (November 1974 to January 1975). The sources of data are mileages given by the Agent Authorities themselves; mileages tabled in a Department of the Environment Press Notice dated 18 October 1974; mileages given in a DOE analysis of the completion dates of the Motorway network by Contract lengths dated 31 July 1973, and mileages given in the Department's reports "Roads in England 1973-74" (HMSO 1974). The most recent edition of the latter for 1974/75 (HMSO 1975) gives a figure of 1702 km (1064 miles) of motorways in England and Wales (excluding Local Authority motorways) up to the date of its drafting in 1975.

In Appendix Table 2.1, based mainly on DOE figures, a total of 1766 km (1104 miles) of motorway is given, including 83.8 km (52.4 miles) of Local Authority motorway. Appendix Table 2.2 on the other hand is derived largely from Agent Authority sources and gives a total of 1742 km (1089 miles), including 83.8 km (52.4 miles) of Local Authority motorway. The discrepancy of 24 km (15 miles) between the totals in the two tables is largely attributable to rounding-off errors. In Appendix Table 2.3 a total 1763 km (1102 miles) has been calculated, and as this is the mileage used for calculating acreages it will also be used in this report as the definitive figure.

The contract lengths for DOE purposes are described by place names, which usually coincide with a junction or an interchange. Agent Authorities, with two exceptions, take convenient interchanges or junctions as inter-Authority boundaries, and as a result one Authority may be working inside another's administrative boundary so far as motorway maintenance is concerned. The description of sections of motorway by place names can be confusing as some of these are only of local significance (such as Holcroft Lane on the M62 or Piffs Elm on the M5) and do not appear on one inch or 1 : 50,000 Ordnance Survey maps. For this reason (and because they are usually the Local Authority boundary for maintenance purposes) junction numbers are used in this report when describing sections of motorway.

In Appendix Tables 2.1 and 2.2 the Maintaining Authorities for the sections of the motorways are shown as they stand following the reorganisation of Local Government boundaries in April 1975 (after the collection of data for this report). The most significant changes have occurred in the Cheshire/Lancashire area, with a considerable mileage of motorway having been transferred from Lancashire to the new Greater Manchester County Council in particular. In other areas, the new County Council of South Yorkshire has taken over responsibility for two thirds of the M1 previously maintained by the West Riding of Yorkshire, together with the M18 and the A1(M) Doncaster By-Pass. The new West Midlands County Council and the Avon County Council have acquired lengths of motorway respectively from the neighbouring counties of Warwickshire and Staffordshire, and Gloucestershire and Somerset.

A number of counties visited provided estimates of the acreages of managed and unmanaged grassland, and of planted areas, associated with the lengths of motorway for which they were responsible. These have been compared with estimates made at Monks Wood from measurements taken from the hard shoulder to the boundary fence on the M1 (Hendon-Leeds), the M4 (Slough-Severn Bridge), the M5 (M6 interchange-

Strensham), and the M6 (M5 interchange-Manchester Ship Canal); involving 356, 150, 64 and 108 records respectively. There was good agreement between the estimates of acreages made from these cross sections of the land, and those derived by the Agent Authorities in other (unspecified) ways, except for the M4 in Wiltshire, where there was a discrepancy (County Council estimate 22.4 acres to the mile, Monks Wood 13.26). The Monks Wood figures do not include central reservations, nor land at interchanges, junctions and slip roads. Appendix Table 2.3 is based on figures derived from these two sources, or where no measured data exists (e.g. the M18) mean acreages per mile have been derived from other neighbouring areas where measurements have been made. For the M40 it was thought that the M2/M20 in Kent might be topographically comparable (the M3 in the Hampshire chalk might also be similar), rather than the physically closer sections of the M1 or M4. For Urban Motorways, that is motorways passing through built up areas, often with some proportion of their length on viaduct, a mean of 5.8 acres to the mile has been used based on 21 miles of the M6 Midland link from Junction 3 to Junction 7, including 'Spaghetti' junction at Gravelly Hill, formerly in Warwickshire. Nine miles of this length are on viaduct, but some other areas have sizeable cuttings and embankments.

In Appendix Table 2.3 a total of 5603.4 ha (13,839 acres) is estimated for 1763 km (1102 miles) of motorway (rounded off), giving an average of c.3.2 ha/km (12.6 acs/mile) for the existing motorway system. This is probably an under rather than an over estimate, but is almost double the minimum figure of 1.6 ha/km (6.5 acs/mile) quoted by Ward (1970).

It would be misleading to calculate average figures for the individual motorways as each one traverses a range of land types and all have been designed and built in sections over a number of years. However, it is interesting to note differences between the first 112 km (70 miles) length of the M1 from Hertfordshire to Northamptonshire, opened in 1959, and the greater land-take associated with the later sections from Leicestershire northwards, which probably reflects a change in policy as well as a change in topography. Likewise the relatively narrow cross-section of the earlier lengths of the M5 in Staffordshire (formerly) and Worcestershire, compared to later sections in Gloucestershire, also reflects a change in policy as the topography of the Severn Valley and its tributaries, in which the route runs for the most part, is comparatively unchanging.

The two main factors influencing land-take for motorways in rural areas are the agricultural quality of the land, and considerations of geology and soil mechanics. The angles of cutting slopes for instance are largely governed by soil stability and problems of 'slumping' and erosion. Standard slopes were 1 : 1½ on the earliest motorway section, but were later changed to 1 : 2, which is the present standard. In Chalk areas and where other stable bedrock conditions are found, the slopes may be steeper, but in areas where there are unstable conditions they may be considerably shallower. So far as the agricultural quality of the land is concerned, it is sometimes possible to take more land for landscaping and other purposes in areas of low agriculture value (more often in upland regions), but in most parts of the country the land take is confined to the minimum compatible with the engineering standards currently in force.

CHAPTER 3

GEOLOGY AND LAND USEGeology

Lines of communication involving systems of road, rail and canal transport pass through many geological strata and soil types. In doing so the different rocks and soils contribute to the rich and diverse range of habitats for wildlife that are found.

So far as motorways are concerned, it is possible that variation in geology will be of less consequence for wildlife than for other roads. This arises partly because motorways have been laid down like a ribbon on top of existing rock and soil formations (sometimes using imported materials), and partly because they have generally been sited in low ground, avoiding 'difficult' geological strata. They have also avoided, so far as possible, high grade land or land having other desirable characteristics from landuse, landscape or conservation points of view. In this respect they are similar to railways and canals, but different to traditional roads, which follow natural drainage patterns and rarely have embankments or cuttings, although some have 'sunk' into the land as a result of erosion and wear.

An important concept in the construction of motorways has been the balancing of cut and fill (materials taken from cuttings to build up embankments), but nevertheless considerable quantities of imported material such as fly ash from power stations (M5 in Somerset) and colliery waste (three quarters of a million cubic yards on the M62 between Lofthouse and Ferrybridge in Yorkshire; HMSO 1972) have been used. Even with fill extracted from adjacent higher ground the materials often lie unconformably on the native soils and strata of the lower ground.

As with foundation materials, so also with the soils that are used (see Chapter 4) to provide rooting substrate for the initial grass cover. Although there is comparatively little long distance transport of these soils, nevertheless they are often so modified by stripping, storage, transport and spreading that many of their individual characteristics are lost. This is exacerbated by their being laid on highly compacted foundations, probably with different drainage characteristics from their native sites.

Because of these considerations it should not be assumed that the natural flora of adjacent areas, and especially the less common species of plants, will necessarily colonise the banks and verges of motorways, particularly in the short (10 years) to medium (50 years) term. This may be the case particularly for plant communities or assemblages associated with woodlands and old grassland. Differences will be more marked when chalk or limestone fill has been used in neutral or acid areas (such as valley bottoms), or acid material brought into base rich areas.

Although motorways may be independent in their early years of the soils and geology of their immediate surroundings, they are in other important ways strongly influenced by them. Thus the route that a motorway takes, its gradients and curves are consequences of geology. Outside the motorway boundary the landscape through which it passes, and thus the landscaping that it is necessary to do to it, are largely dependent on geology and soils.

Motorways in England and Wales do not continue on any one geological stratum for more than 40 km (exceptionally for about 90 km of the M1 between Nottingham and Leeds on Productive Coal Measures), and mostly not for distances of more than 20 km. Similarly there are rapid changes in the geology of the surrounding districts within 5 or 10 km of the routes. Consequently the work of those responsible for motorway landscaping is both made easier and more difficult. Easier because focii of interest are usually present within vision almost all the time (unlike some of the flat, unrelieved areas of countryside of parts of northern Europe, or the deserts and plains of North America); more difficult because of the responsibility of fitting the large engineering works of modern motorways into very diverse and often small scale landforms. The success with which this has been achieved can be seen in comparisons between aerial photographs of motorways and ground views. From the air, motorways and associated structures are obtrusive and often out of scale, whilst railways in comparison generally appear to be in scale, although aggressively linear. Ground views of motorways are usually impressive rather than displeasing, whilst extensive views of them from the surrounding countryside are remarkably difficult to obtain. Where views are obtainable most stretches of motorway are visually quite acceptable, although exceptions (notably when the motorway is on embankment) will be apparent.

In the accounts that follow only sedimentary ("solid") formations (Geological Survey, 1957) are discussed. These are the basis of the land forms throughout most of the country. Descriptions of superficial and drift deposits (including Glacial Boulder Clays, which are largely responsible for landform in much of the Midlands and some parts of the north of England), and of soils, are beyond the scope of this discussion. However, in so far as soils, together with the characteristics of the geology, determine (inter alia) vegetation, and vegetation plus landform synthesise into landscape, they cannot be ignored if a more detailed understanding is to be obtained.

M1 LONDON-YORKSHIRE MOTORWAY

The M1 begins on the Eocene London Clays and passes through a narrow band of the Reading Beds north-west of Watford, to cross the Vale of St. Albans on to the Chalk of the Cretaceous period in the Chilterns, and down past Luton. Gault clays outcrop in the region of Toddington Service area, and the Lower Greensand at Woburn. Between Ridgmont and a very narrow band of Middle Jurassic Cornbrash at Newport Pagnell the route runs through a region of Upper Jurassic Oxford clay. It continues through the Middle Jurassic Oolites south of Northampton onto the Lower Jurassic Lias clays and silts to the southwest and west of Northampton, with the Middle Lias appearing at Watford Gap. Northwest of Northampton to the north of Lutterworth the Lower Lias clays of the Northampton Uplands are crossed. Through the remainder of Leicestershire and parts of Derbyshire, to just south of Nottingham, the motorway lies mostly on Triassic Keuper Marls of the New Red Sandstone, threading its way through the pre-Cambrian Charnian series of Charnwood Forest in the vicinity of Quornden and Mountsorrel. Immediately in the area of Nottingham there is a small stretch of Keuper Sandstone, and of Permian Magnesian Limestone and Marls, before the route meets the Productive Coal Measures of the Carboniferous period, on which it lies for the remainder of the way to Leeds. It should be noted, however, that approximately from the Great Ouse at Newport Pagnell to the Trent at Nottingham, the landform is dominated by Glacial Boulder clays of Pleistocene origin. If these were stripped away a totally different landscape would emerge.

M2 MEDWAY MOTORWAY

The M2 runs alternately over the chalk of the Cretaceous and the predominantly sandy Woolwich and Thanet Beds of the Eocene, before ending just to the west of Canterbury on London Clay. The passing and repassing between the main strata makes this motorway one of the most diverse and scenically attractive.

M20 MID-KENT MOTORWAY - sections open in 1974 immediately to the north and east of Maidstone

These sections of the M20 lie at the foot of the chalk of the North Downs to the north and east of Maidstone, on Cretaceous Upper and Lower Greensands, Gault clays, and some small areas of the older Wealden Clays.

M3 LONDON-BASINGSTOKE MOTORWAY

Starting on the London Clays of the Eocene, and the Recent gravels and alluvia of the London Basin, the M3 passes onto the clays and sands of the Bagshot, Bracklesham and Bacton Beds between Chertsey and a point east of Hook. In the region of Hook the motorway comes back onto London Clay for a short distance and, after crossing a narrow band (less than 1 km) of the Reading Beds, it lifts onto the chalk between Hook and Basingstoke until its present end at Popham, north of Winchester. The M3 thus has three quite distinct sections of great contrast successively from London Clays, to the acid sands and clays of the Bagshot, Bracklesham and Bacton series, and finally onto the Hampshire chalk.

M4 LONDON-SOUTH WALES MOTORWAY

The M4 starts on London Clays and continues on them until it meets and alternates with Reading Beds in the region of Slough, past Maidenhead and south of Reading to Theale, essentially in the Thames Valley but not following the R. Thames itself. From Theale to Chieveley it crosses onto the Berkshire Downs, alternating between the Eocene Reading Beds and the chalk of the Cretaceous. From Chieveley to Wanborough, southeast of Swindon, it continues on across the chalk of the Berkshire and Lambourne Downs to Wanborough where it drops down into the Vale of the White Horse. In this area it crosses the Cretaceous Upper Greensand and Gault clays, and subsequently the Kimmeridge Clay of the Upper Jurassic to the west of Swindon. It continues through a narrow band of Jurassic Corallian stratum and an area of Oxford Clays near Brinkworth to a point east of Hullavington. At Hullavington it passes on Jurassic strata through a band of Cornbrash to Oolitic Limestone past Badminton and Tormarton, to drop sharply down at Tormarton, through narrow bands of Upper and Middle Lias Clays, to a rather broader band of the Lower Lias near Westerleigh. Thence it alternates between Triassic Keuper Marl of the New Red Sandstone, the Barren Upper Coal Measures of the Carboniferous, across more Keuper Marl onto Jurassic Lower Lias, and outliers of Carboniferous Limestone to the Severn Bridge. On the Welsh side of the River Severn it crosses an area of Keuper Marl to the south of Chepstow and onto Carboniferous Limestone south of Shirenewton, where it alternates with Keuper Marl to a point west of Magor. After this it crosses a narrow band of Upper Devonian strata, Keuper Marl and Lower Lias, to end up on the Lower Devonian to the west of Newport.

M40 LONDON-OXFORD MOTORWAY

Starts to the northwest of Uxbridge on London Clays and alternates between them and Reading Beds until it meets the chalk northwest of Beaconsfield. The major part of the route lies on the chalk of the Chiltern Hundred, passing Loudwater on Viaduct, south of High Wycombe to Stokenchurch and the Chiltern scarp at Aston Rowant, down to a point to the northwest of the junction with the A4009 and crossing the Icknield Way. Subsequently it crosses a band of Upper Greensand and Gault to a rather confused area of Upper Jurassic Portland Beds, Cretaceous Lower Greensand and Upper Jurassic Kimmeridge Clay in the Vale of Aylesbury, to its present end southeast of Wheatley.

M5 BIRMINGHAM-BRISTOL-EXETER MOTORWAY

The M5 starting in Birmingham runs over the Carboniferous Barren Upper Coal Measures to the south of the City, crosses the Bunter and Keuper sandstones of the Triassic period, and then passes onto Keuper Marls south of Bromsgrove. It remains on the Marls past Droitwich, Worcester and Upton-on-Severn, where it strikes south-east onto Lower Jurassic Lower Lias, by-passing Tewkesbury and Gloucester to the East, and continues down the Vale of Gloucester and Vale of Berkeley, almost as far as Berkeley on this stratum. Between Berkeley and Almondsbury the geology is very confused and for a distance of about 25 km passes successively over Keuper Marl, an Upper Cambrian stratum, a Silurian stratum, back onto Keuper Marl, across a Middle Devonian stratum followed by Carboniferous Limestone and lastly onto Jurassic Lower Lias. From Almondsbury southwards the route essentially lies on Keuper Marls past Avonmouth and Clevedon to south of Bleadon. Immediately southwest of Avonmouth the road runs side-long on a Carboniferous feature of Barren Coal Measures and Carboniferous Limestone, whilst there is also a small crossing of the Limestone again in the region of the Mendips. Subsequently the route crosses about 15 km of Lower Lias north and south of Highbridge, and back onto Keuper Marl north and south of Bridgwater, to cross about 3 km of Keuper Sandstone south of North Petherton. From Taunton to south of Wellington the route comes back onto Keuper Marl before passing over a 3 km stretch of Keuper and then Bunter Sandstone, finally continuing from just east of Sampford Peverell on Permian Sandstones to its present end north-east of Exeter.

In effect the sections of the M5 open in 1974 run for most of their length on Jurassic and Triassic Clays at low altitude down the Severn Valley, Vale of Gloucester and Vale of Berkeley, and again through the Somerset Levels. However the rather flat scenery of the immediate surroundings is relieved to the north of Almondsbury by the Jurassic Oolitic formations of the Cotswolds and outliers to the east, and by the Devonian and Silurian strata of the Malverns, Hereford and Worcester, and Gwent to the west. South of the R. Avon the Mendip, Quantock and Black Down Hills provide continuing interest.

M6 CATTHORPE-BIRMINGHAM-PRESTON-CARLISLE MOTORWAY

The M6 Midland Link strikes northwest from the M1 at Catthorpe in Leicestershire on Jurassic Lower Lias, moving onto Triassic Keuper Marl near Pailton, and continuing on this until it crosses a narrow band of Keuper Sandstone north of Coventry. From there it traverses about 15 km of Carboniferous Barren Upper Coal Measures and then comes back onto Keuper Marl east and northeast of Birmingham. Emerging to the northwest of the Birmingham-Wolverhampton conurbation on Bunter Sandstone, the route passes over a 3 km band of Keuper Sandstone onto Keuper Marl at Penkridge, and remains on this to the west of Stafford to a point about 10 km south of Newcastle-u-Lyme, where, over a distance of about 20 km (by-passing Newcastle) it crosses successively Bunter Sandstone, Barren Upper Coal Measures, Bunter Sandstone, Keuper Sandstone, and again onto Keuper Marl southeast of Crewe. It remains on the Marl through the Cheshire Plain past Sandbach, Middlewich and Northwich to High Legh, where it strikes a narrow band of Keuper Sandstone before crossing the Manchester Ship Canal onto Bunter Sandstone. From Makerfield to Ecclestone, by-passing Wigan, the route is on Carboniferous Productive Coal Measures. Thence, over about 4 km, it crosses Bunter Sandstone, Keuper Sandstone, back onto Keuper Marl south of Preston. The Preston By-Pass on up to Garstang lies on Bunter Sandstones, and from there to south of Halton, including the Lancaster By-Pass, the motorway is on Carboniferous Millstone Grit and Culm measures. From this point to Sedgewick the route is on Carboniferous Limestones, and from there to Tebay on Silurian rocks of the Ludlow series. At Tebay there is a narrow band of about 1 km of Carboniferous Basement Limestone Conglomerate before the Carboniferous Limestone itself, which carries the road up to Armathwaite, narrowly impinging on Permian series of the New

Red Sandstone to the west of Penrith; this series is crossed between Armathwaite and Wreay south of Carlisle. The final section of the Carlisle By-Pass lies on Triassic Keuper Marls and Sandstones.

Thus most of the M6 lies on the sandstones and marls of the Triassic, from the junction with the M1 in Leicestershire up to Garstang, north of Preston, and even at the end by Carlisle. Between Garstang and Carlisle, for a distance of c.70 km, the motorway crosses a series of hard rock strata of the Carboniferous and Silurian periods. However, as with the M1 motorway, for substantial areas of the countryside (especially northeast of Coventry, northwest of Birmingham, and from Stoke to Carlisle), surface features are mainly a consequence of overlying superficial deposits of Boulder Clays.

M62 LANCASHIRE-YORKSHIRE MOTORWAY

This road connects with the M57 in east Liverpool, in an area of Carboniferous Productive and Unproductive Coal Measures, but, although it touches on these strata again, the major part of the route round to the north of Manchester is over Triassic Bunter Sandstones, with minor excursions onto Keuper Marl and Keuper sandstone. For part of its route to the west of Manchester the deep peats of Chat Moss are crossed. From Middleton until it rises onto the Millstone Grits of the Pennines, the motorway crosses an extensive area of Productive Coal Measures, which it does again when it drops off the Millstone Grit at Elland and remains on the Coal Measures for about 40 km south of Bradford and Leeds, to meet the Permian Magnesian Limestone at Normanton. About 5 km of the Magnesian Limestone are crossed on an east/west axis, and some minor outcrops of Middle Permian Marls, before the present ending (1974) of the motorway on the Keuper Sandstones of South Yorkshire.

OTHER MOTORWAYS

Similar accounts could be written for other motorways (e.g. M18, M61, M55, M56); whilst potentially interesting routes will be opened up by the M11 from London-Cambridge, M23 London-Crawley, and the M27 Portsmouth-Southampton-New Forest, amongst others under construction.

Land Use

As mentioned earlier in this Chapter, motorways have been laid onto the countryside like a ribbon. In doing this the designers have been forced to select certain sorts of land for either engineering or social reasons. Thus built-up areas, grade 1 or 2 agricultural land, woodlands, parks, nature reserves and Areas of Outstanding Natural Beauty have been avoided wherever possible, as also have hilly localities and routes involving too many structures or major earthworks. In Text Table 1 an analysis has been made of the 'neighbouring landuses' recorded in the 1970 survey of the M1, and the 1973 surveys of the M4, M5 and M6 (see Chapter 2). These can be compared (Text Table 2) with data extracted from the very few maps of the Second Land Utilisation Survey of Britain that have been published that cover parts of motorway routes. In both tables the land uses have been divided between those where there is little or no wildlife interest (arable fields, improved grassland and housing/industry/newly disturbed land), in contrast to land of potential wildlife interest, including rough or unimproved grassland, woodland (whether natural or planted), wastes/railways, and old roads/gravel pits.

If all grassland is taken together (it is not possible to differentiate on the Land Utilisation Maps, and the Monks Wood records are a matter of judgement) there is close agreement between the overall acreages given in the two tables for the various categories. About one third of the land take overall is arable land, one third grassland and one third other land uses. The differences between the motorways

reflect broad regional differences, although it is difficult to make generalisations about individual motorways as each one crosses so many differing land types. Each motorway may have its own character and one that is not easy to analyse statistically. So far as land use is concerned these differences depend on topography, soils, and climate: thus the northern parts of the M1 are more likely to be comparable to the Yorkshire sections of the M62 than the southern parts of the M1.

The data in Text Tables 1 and 2 are taken from both sides of the carriageway. Because motorways very rarely slice through woodland (there are notable exceptions such as the M3 in Surrey and Hampshire, the M2 through the coppice woodlands of Kent, the M40 at Aston Rowant, the M50 Ross Spur in Hereford), most of the data for woodland represent occurrences on one side of the motorway only where, at a given point, the route has followed the edge of a wood, or has taken off a corner. Similarly, in urban areas, motorways (which may often follow a line that has been protected from development for other purposes for some time) more often follow the edges or boundaries of built-up land, than force their way through established housing.

Excluding grassland, about 20% of the land use on one side or other of the motorways surveyed were woods, railways, canals, gravel pits and other non-agricultural areas of possible wildlife value. For colonisation by wildlife of newly disturbed land, nearby sources of seeds and plant propagules are necessary. Thus, on the one hand the most important wildlife habitats have generally been undisturbed by the construction of motorways, and along a proportion of their length there are areas that will be rich sources of propagules. On the other hand because 80% of the neighbouring land use is intensively managed by agriculture, there will generally be a poor chance of natural invasion for the greater proportion of the length of the motorway system. Invasion of these areas by native plants will have to come from farther afield, or, in the long term, by natural spread along the motorway corridor.

Comparisons can be made between the 20th Century development of motorways, and the 19th Century development of railways. Although the criteria for the choice of routes for the railways may have been different to the present day motorways, many of the engineering characteristics are the same. There are grounds also for supposing that the biological interest of motorways may develop in the same way, although management, especially with regard to burning of the banks, may be different. However, it is also possible that the modern efficiency of agriculture, and intensity of management of the countryside generally, have substantially reduced the area of wildlife habitats available as a source of propagules for motorway land, in comparison to the situation during the period when the railways were developing.

Text Table 1. Percentage occurrence of different land uses by motorways. From Monks Wood surveys (direct records).

Land use	M1	M4	M5	M6	Average from all data weighted for different lengths of individual samples
	Hendon-Leeds	Slough-R. Severn	M6-Strensham	M5-Manchester Ship Canal	
Non-Wildlife Habitats (Crops)	35	35	19	22	31
(Improved grass (including orchards))	20	18	34	53	26
(Industry/housing)	15	12	20	12	15
Wildlife Habitats (Unimproved grass)	8	19	17	4	11
(Woodland)	6	9	2	5	6
(Wastes/Roads & Rlys/ gravel pits etc.)	15	8	8	4	11

Text Table 2. Percentage occurrence of different land uses by motorways. From maps of the Second Land Utilisation Survey of Britain (indirect records). Data taken at every grid line (approx. 1 km intervals on the road).

Land use	M1	M5	M6	M6	A1(M)	A1(M)	Average from all data weighted for different lengths of individual samples
	Map 287	Map 281	Maps 558 and 515	Maps 713 and 724	Map 654	Map 801	
	Harpenden 11 km	Gloucester 11 km	Stafford / Stoke 19 km	Lancaster/Grange 21 km	Doncaster 11 km	Durham 11 km	
Crops	59	22	10	5	40	34	34
Grass	5	47	63	66	14	37	37
Woodland	0	0	8	5	9	10	9
Wildlife habitats	19	12	13	21	14	12	11
Non-wildlife habitats	19	19	5	3	23	7	10

CHAPTER 4

GRASS AND HERBACEOUS PLANTSA. Establishment of grass

After the construction of earthworks it is desirable to establish a grass cover as soon as possible so as to avoid erosion. For this purpose a standard grass and clover mixture is sown by the contractors, often some months before the carriageway itself is laid, or the motorway opened to traffic. There is no general rule specifying the season when seed should be sown, but as contractors have a responsibility to re-seed if the first sowing fails, the work is likely to be carried out under reasonably favourable conditions. On the other hand, contractors (who are usually responsible for cutting grass during the construction period of the motorway), will on occasions delay sowing as long as possible in order to avoid the expense of grass cutting.

Specifications for preparing the ground, adding fertilizers and sowing are contained in the official 'Specification for Road and Bridge Works' (HMSO 1969). These are used as a basis in the preparation of contracts. Clearly it is not possible to be very precise in a contract about the exact soil tilth to be achieved, nor the weather conditions, nor time of year at which seed shall be sown. Basically the contractor is required to lay topsoil to a specified depth, usually ten cms (four ins), and subsequently to apply a suitable fertilizer or fertilizer mixture before sowing a grass/clover mixture containing:

<u>Lolium perenne</u> (Perennial Rye grass) S23	27.25 kg	60 lb
<u>Festuca rubra</u> (Red Fescue) S59	9.0	20
<u>Poa pratensis</u> (Smooth Meadow grass)	9.0	20
<u>Cynosurus cristatus</u> (Crested Dogs tail)	9.0	20
<u>Trifolium repens</u> (White Clover) S100	4.5	10
	<hr/>	<hr/>
	50.75	112

This mixture is sown at a rate of 454 gms per 75 square metres (16 ozs per 90 square yards, approx 1/5 oz/sq yd) on flat verges and central reserves, and 454 gms per 50 square metres (16 ozs per 60 square yards, approx 1/4 oz/sq yd) on side slopes.

The specifications indicate that stones and other debris, above a minimum size, are to be removed so as to avoid subsequent damage to grass cutting machinery. This is less important now as flail machines are not so prone to damage as the cylinder mowers that were used at one time. However, besides damage to the machine, a danger exists with some mowers, notably those with horizontal rotary cutters having fixed blades, where loose stones can be hit and flung out of the back of the machine with considerable force.

Details are also given in the specifications for turfing, but because of expense significant areas of grass are unlikely to be established in this manner on motorways. Hydraulic mulch seeding (hydro-seeding) is sometimes used, where a mixture of seed, organic material (with or without fertiliser), and mulch or other additions, are sprayed onto an area. There are various commercial variations of this technique which are particularly useful for seeding difficult ground, steep slopes, rock cuttings (where desired) and other places inaccessible to more conventional methods. Because all the elements required for germination and initial establishment are contained in the mixture, hydro-seeding is also useful for places where soil preparation and soil quality are inadequate.

The application of fertilisers is specified to aid initial establishment of grass, but their use subsequently is not recommended. Likewise, for the first two seasons after establishment a moderately intensive programme of mowing was prescribed (in instructions issued by DOE to Agent Authorities but altered in 1975 - see Chapter 6), in order to encourage the development of a dense, weed-free sward. During the establishment period selective weedkillers may still be used with the Department's permission.

Non-standard seed mixtures have been used in some special areas and examples of these are to be found on a) the M3 for one mile where it crosses Chobham Common, b) the M40 from approximately Junction 5 to the B4009 crossing (about two miles) where a special Chalk grassland mixture was sown in the area where the Chiltern scarp is crossed, c) on the Pennine stretch of the M62 where a moorland mixture (see Text Table 3) was used, d) on the M2 in Kent on the chalk cutting immediately south of the Medway crossing where Sainfoin (*Onobrychis viciifolia*), and other calcicolous herbs were included. In these instances changes were made in the hope of establishing vegetation more appropriate to the area than that of the standard mixture. However, none of these alternatives have been used extensively, and the standard rye grass mixture has been almost universally sown.

The initial seeding of motorway areas has usually been satisfactory (although occasionally reseeded has been necessary), and erosion has been controlled. No vegetation cover can be expected to control slip erosion caused by an instability in the soil subsurface profile, but if a reasonable cover is established gully and surface erosion are minimised. With poor cover, isolated plants may themselves be the focus for the start of gully erosion.

Contractors are usually liable for the maintenance and making good of Trunk Road motorways for a 12 month period after completion, but this does not include grass mowing. At the end of this time the motorway is handed over to the Agent Authority by the Department of the Environment. In some instances, however, Agent Authorities have insisted that the contractors make at least one cut before handing over, partly to ensure that stones and debris have been properly collected. With Principal road (Local Authority) motorways other arrangements may be made, although general practice is likely to follow the national pattern.

Regardless of what is sown, the grassed areas (taken here as all earthworks including those subsequently planted with bushes and trees) are invaded sooner or later by wild plants. In most instances a grassland sward, bearing little relationship to the sown mixture, develops within five years. This is likely to contain a greater or lesser number of other herbaceous plant species depending upon management, sources of propagules and a range of edaphic and climatic variables (see also Chapter 3). It can therefore generally be argued from a floristic point of view that the composition of the original seed mixture is relatively unimportant, except in the earliest establishment phase.

B. Introduction of herbaceous plants

There is interest in encouraging the diversification of the flora of the motorway verges, and numerous proposals have been made for introducing the seeds of a range of additional species to the standard mixture. There are a number of difficulties, however, including expense and the lack of commercial quantities of suitable seed. As much of the seed of even 'wild flowers' is obtained from abroad, there are scientific and conservation fears about the introduction of non-indigenous genetic material. Thus, attempts have not been made to artificially introduce herbaceous wild plants on a wide scale on the motorways by seeding or by planting as part of the official policy.

Text Table 3. Special grass seed mixtures used on different stretches of Motorways.

M3 Chobham Common		
5 kg	11 lbs	<u>Poa pratensis</u> (Smooth Meadow grass)
2.75 kg	6 lbs	<u>Agrostis tenuis</u> (Common Bent)
25.5 kg	56 lbs	<u>Festuca rubra ssp rubra</u> (Red Fescue)
10 kg	22 lbs	<u>Festuca ovina</u> (Sheep's Fescue)
5 kg	11 lbs	<u>Agrostis canina ssp montana*</u> (Brown Bent)
2.75 kg	6 lbs	<u>Deschampsia flexuosa</u> (Wavy Hairgrass)
<hr/> 51 kg	<hr/> 112 lbs	

* unobtainable, Agrostis stolonifera (Creeping Bent) used instead.

M40 Chiltern Scarp	
14%	<u>Festuca ovina</u> (Sheep's Fescue)
14%	<u>Poa pratensis</u> (Smooth Meadow grass)
14%	<u>Festuca rubra ssp rubra</u> (Red Fescue)
14%	<u>Agrostis tenuis</u> (Common Bent)
6%	<u>Trifolium campestre</u> (Hop Trefoil)
5%	<u>Trifolium repens</u> (White Clover)
5%	<u>Trifolium pratense</u> (Red Clover)
14%	<u>Onobrychis sativa</u> (Sainfoin)
14%	<u>Poterium sanguisorba</u> (Salad Burnet)
	<u>Anthyllis vulneraria</u> (Kidney Vetch) and <u>Lotus corniculatus</u> (Birdsfoot Trefoil) were originally specified but were unobtainable.

M62 Pennine mixture		
22.75 kg	50 lbs	<u>Deschampsia flexuosa</u> (Wavy Hairgrass)
16.75 kg	37 lbs	<u>Festuca ovina</u> (Sheep's Fescue)
12.25 kg	27 lbs	<u>Festuca rubra</u> S59 (Red Fescue)

Nevertheless, some wild species have been planted on a restricted scale: in two instances when attempting to establish 'safe' colonies of endangered plants for conservation purposes, and in a third for generally diversifying the flora and adding to public amenity.

Leicester <u>M1</u>	<u>Aquilegia vulgaris</u> (Columbine)
Nottingham <u>M1</u>	<u>Crocus nudiflorus</u> (Autumn Crocus) <u>C. purpureus</u> (Spring Crocus) <u>Aquilegia vulgaris</u> (Columbine) <u>Polemonium caeruleum</u> (Jacob's Ladder) <u>Tulipa sylvestris</u> (Wild Tulip) <u>Narcissus pseudonarcissus</u> (Wild Daffodil) <u>Campanula latifolia</u> (Giant Bellflower) <u>Digitalis purpurea</u> (Foxglove) <u>Fritillaria meleagris</u> (Fritillary) <u>Primula veris</u> (Cowslip) <u>P. vulgaris</u> (Primrose)
Hereford & Worcester <u>M5</u>	<u>Ulex europaeus</u> (Gorse) <u>Sarothamnus (Cytisus) scoparius</u> (Broom) <u>Thymus serpyllum</u> (Breckland Thyme) <u>Campanula rotundifolia</u> (Harebell) <u>Erica cinerea</u> (Bell Heather) <u>Calluna vulgaris</u> (Heather) <u>Digitalis purpurea</u> (Foxglove) <u>Primula vulgaris</u> (Primrose) <u>Carum carvi</u> (Caraway) <u>Achillea millefolium</u> (Yarrow) <u>Chaerophyllum temulentum</u> (Rough Chervil) <u>Poterium sanguisorba</u> (Salad Burnet)

In the examples given above all the plants were established from seedlings raised elsewhere, their subsequent establishment being treated as a small scale horticultural operation. However, gorse and broom are easy to establish from seed, and would be especially suitable for including in mixtures sown by hydro-seeding. Heather and ling, which might also be thought to be suitable species for this technique have not, in practice, been found to be very successful.

An account of the natural invasion of plants into grassed and planted areas along the M1 (arising from a survey in 1970) is to be discussed in a subsequent report. Botanists have not otherwise had an opportunity to study the natural invasion of these areas except for general observations on the natural spread of gorse and broom on the M20 in Kent, the M1 in Bedfordshire and elsewhere; of cowslips, primroses and bluebells in some areas; and the widely publicised colonies of Wild Daffodils on the M50 in Hereford and Worcester.

When asked about their attitudes to planting wild flowers in grassed areas along motorways, seven (Bedfordshire, Derbyshire, Leicestershire, Nottinghamshire, Wiltshire, Hereford & Worcester, South Yorkshire) of the 29 Authorities visited were sympathetic to the idea, and a further eight were sympathetic with reservations about the practicability of any proposals. None were opposed and the remainder felt that they would wish to be guided by the Department of the Environment, without having any particular views themselves. Disquiet usually centred on how and by whom the plantings were to be made, rather than what was to be done. Several Councils were concerned that an exercise of this sort should not involve them in any additional maintenance commitment. There were fears expressed by three or

four Councils about drivers being distracted by the sight of wild plants, or of travellers stopping on hard shoulders to view or pick them. On the other hand, a number of Authorities thought that colourful stands of plants would break the monotony of the motorway and actually make driving safer; also that the people who picked plants mostly climbed over boundary fences or at bridges to do so. It was suggested that planting sites should be selected where it was difficult for people from outside the motorway to gain access in this way.

CHAPTER 5

PLANTING AND MAINTENANCE OF TREES AND SHRUBS

The Ministry of Transport, and since 1971 the Department of the Environment, have been responsible for the planting of very considerable numbers of trees and shrubs by motorways (Text Tables 4 and 5). These purely amenity plantings have been described as the most extensive of their kind since the great landscaping period of the 17th and 18th centuries. As we, in the 20th century, are now benefiting from the designs of 100 to 200 years ago, so it is to be expected that the greatest effects of motorway plantings made over the last 16 years will be apparent in two or three generations time. Nevertheless, some of the older plantings on the M1 and the M6 are already beginning to give an extra dimension to the shape of the motorway corridor.

Text Table 4. Annual total numbers of trees and shrubs planted by motorways 1963/64 to 1973/74 (detail from DOE records).

1963 - 64	402,328
64 - 65	419,711
65 - 66	529,133
66 - 67	568,918
67 - 68	597,537
68 - 69	816,899
69 - 70	844,114
70 - 71	1,162,311
71 - 72	1,221,499
72 - 73	1,602,645
73 - 74	1,596,653
<hr/>	
Total	9,761,748

The purpose of this work extends beyond the straightforward establishment of trees along roadsides. The plantings are designed to merge the inevitable linearity of the motorway (the scale of motorway construction makes this particularly apparent) into the contours of the countryside. They are also designed to break up the line of a motorway, especially when it is on embankment, as seen from the surrounding countryside; to soften the sometimes hard appearance of bridges and structures, and to hide ugly places both on and off the route. In addition, shrubs and trees are claimed to have a value in deadening the noise of traffic, so that proposed plantings (together with other earthworks) are often an important consideration in the choice of the line for a motorway, especially in built-up areas.

In the design of planting schemes and choice of species to be used, the Ministry of Transport, and later the Department of the Environment, have been advised by the Landscape Advisory Committee (see Chapter 1). The composition of the Committee has gradually changed over the years, reflecting its changing interests from the details of landscaping new projects, to environmental considerations on a much wider scale. In the past the Committee has been a prime mover in establishing the principles and practices of motorway tree and shrub planting and if it now spends less time on horticultural and silvicultural discussion, this is largely because these principles and practices have been established. The Committee still maintains a general interest in planting schemes and makes regular inspections, especially in areas where difficulties in tree establishment or other problems have arisen. It has close contact with the Department's Landscape Architects, and the professional Horticultural Advisor (an appointment dating from 1947), who is the officer responsible (inter alia) for the detail of planting plans, and for contracts for the supply and planting of material.

