Highway Asset Management Plan

Part 4:

Highway Maintenance Manual

Sections 4.5 - 4.7

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Contents

4.5 Highway Drainage Management

4.5.1 Introduction

The management of surface water falling or accumulating on the highway is an essential element of ensuring highway safety and prolonging the service life of the road. A lack of adequate highway drainage exacerbates the deterioration of the fabric of the road and can lead to the formation of potholes and carriageway rutting of the surface and a failure of the underlying structural layers of the pavement and subgrade. Excessive or ponding surface water can also pose a safety risk for road users. Efficient and effective highway drainage systems are a key component of highway maintenance, and the proactive management of the highway drainage asset provides a range of cost-effective benefits.

The highway drainage asset is probably best described as variable, and this is largely a reflection of the historical development of the highway network itself. Elements of the highway network, particularly in rural areas of Wales and the UK, will be historic or even of Roman origin. With the network developing rapidly during the Industrial Revolution when the movement of goods became a key necessity for economic growth, the drainage systems associated with that era contrast with the more modern roads which have drainage systems constructed to specific design standards and typically designed for a 1 in 5-year storm event. As a result of the historical development, much of the drainage network will not have been designed for the demands of a modern highway network or to deal with increasing adverse weather impacts. The highway drainage asset we now manage varies in both its design and condition.

The council maintains its highway drainage system for the purpose of draining water from the highway surface. The highway drainage system is maintained to ensure it is free flowing and discharges at a suitable location, but it should be noted that some water may escape into the ground especially where historical drains are present. The highway authority may have prescriptive rights to discharge water onto adjacent land.

Land or property owners adjacent to the highway can perceive they are owed a ‘duty of care’ to have the highway drainage protect their property in times of rainfall or storm, however this is not the case.

The principle that the owner of higher land can allow water on their land to drain naturally on to lower land does not apply to the highway. It is the duty of adjacent landowners to maintain their ditches adjacent to the highway, to keep their water off the highway, prevent a nuisance or obstruction of the highway and ensure any prescriptive rights of discharge from the highway remain operational.

Guidance on practical steps for property owners to protect their property can be found in the Council’s Sandbag Policy.

4.5.2 Drainage Asset Information

Highway drainage systems collect and convey surface water which is normally discharged into the nearest watercourse. This is usually the case in both urban and rural areas although the method of surface water collection and conveyance may vary.

In rural areas there will typically be a grip or channel through the verge to take surface water off the road and into an adjacent roadside ditch or other prescriptive point of discharge. The highway authority will generally have a right of discharge in this respect. The verge and grip will normally be maintained by the highway authority and the ditch or other off highway receptor will normally be maintained by the adjacent landowner. In some cases, a small system of road gullies may collect and pipe surface water to the ditch or watercourse. In urban areas, systems of road gullies will collect surface water which is discharged into a wider system of carrier drains and culverts to reach the nearest appropriate watercourse. Road gullies may be connected to dedicated highway carrier drains or combined surface water sewers maintained by the local Water authority.

Given the historical development of highway drainage systems there is an associated general lack of information about the extensive network of pipelines beneath our roads which form part of the larger drainage system. Whilst the surface features such as road gullies, grips and ditches are more easily observed, the myriad of underground interconnecting pipelines are more difficult, and more costly, to survey and assess. Our information base is continually improving, and current estimates indicate that we have around 60,000 road gullies connected to an underground network of over 1300km of pipework. The highway drainage asset has the following main components:

Asset type	Description	Quantity (estimated)
Road gullies / gratings	There are a number of different gully types including those with or without sumps and traps and those directly on the line of a carrier drain, piped to a carrier pipe, and those with simple outlets.	60,000 no.
Grips	Open channels typically cut through roadside verges	2900 no.
Chambers	Covered access chambers usually at regular intervals or the intersection of pipes, used for maintenance purposes. (Some chambers may be responsibility of utility companies)	5,000+
Drainage pipes	Below ground assets, pipework of various sizes. (Note: Limited data - estimates based on surveys carried out to date)	A roads 173km B Roads 180km C Roads 490km U roads 530km Total – 1373km
Ditches	Recorded ditches, primarily the responsibility of the adjacent landowner	8368 number. Length 760km

Drainage Condition

Asset condition information, particularly on the underground highway drainage system, is not generally available and the cost of acquiring this information for the full highway network is unaffordable. A library of information is slowly being developed along particular highways to investigate areas of concern and to enable the asset to be better managed.

A programme of surveys has commenced on the more strategic sections of our road network and particular flood-prone locations to survey and assess the condition of the highway drainage system in place. The surveys are typically carried out by specialist contractors using camera survey techniques to record detailed location information of our drainage assets above and below ground, and also record a condition rating. The surveys record the service level (ability to carry water) and structural condition of the pipework (see table below). These surveys include an element of pipe cleansing in advance of the survey and can record photographic and video information to assist in prioritising and identifying solutions. Continuation of the survey programme is subject to budget availability.

Structural and service grade definitions

Grade	Structural Condition	Service Condition
1	No defects	Clear
2	Superficial defects	Superficial deposits with loss of performance
3	Minor defects	Performance slightly reduced
4	Major defects	Performance severely reduced
5	Not fit for purpose	Blocked or unsafe condition
9	Assessment attempted but not possible	Assessment attempted but not possible
0	Assessment not attempted	Assessment not attempted

The results of initial surveys confirm the benefits of an on-going programme of further investigation and drainage repairs, subject to available funding. The survey works identify areas for structural repair which can be prioritised and coordinated with other repair or improvement programmes where feasible. This proactive work to identify and repair defective drainage on high-risk routes improves road safety by reducing flood risk and reduces reactive and future maintenance burdens.

4.5.3 Maintenance and Repair

Drainage maintenance and repair can be categorised into 3 main areas:

- **Planned Maintenance –** Gully cleansing, grip clearance, ditch cleaning
- **General Maintenance and Minor defects** – often identified during routine inspections or following reports from the public and verified through further investigation. Repairs and maintenance are funded by revenue budgets and prioritised in line with the authority's defect categories (see 4.3.9)
- **Programmed Repair** – generally identified by significant failure, flooding, drainage condition surveys or escalated from minor repairs that cannot address the issue. Where available, Capital funding will be invested to deliver a prioritised programme of schemes in coordination with other highway programmes.

Gully cleansing

Gullies vary in design and construction, but typically have sumps designed to collect silts and debris to prevent materials entering the connecting pipelines, which can cause blockages. These gullies require periodic cleaning to remove any detritus and scheduled gully cleansing is undertaken across the County as available resources permit.

In addition to planned gully cleansing, reactive cleansing may be required due to identified blockages or flooding. Reactive cleansing may be carried out manually by our maintenance teams or by deploying a vacuum cleaning vehicle or high-pressure jetting vehicle.

Planned gully cleansing is carried out using vacuum action cleansing vehicles operating on pre-planned cleansing schedules. This small fleet of specialist vehicles operates on an area basis throughout the year, carrying out planned cleansing actions. These schedules also allow for an element of reactive cleansing in response to emergency flooding incidents. The gully cleaning schedules are prioritised across the county highway network using a risk-based approach and are kept under review as we improve our information systems and data.

Historically, a coarse target would be to clean all gullies on an annual basis, however it is known that some gullies will require more or less frequent cleansing. The frequency may be adjusted due to the increased likelihood of blockage or the impact of ponding or flooding presenting a greater risk due to its location. To optimise resources, cleansing frequencies are reviewed and varied according to risk with frequencies influenced by, but not limited to, the following factors:

- Road Hierarchy (see 4.2.2 for full details)
- Speed limits – Flooding or standing surface water can present a higher safety risk to the travelling public on higher speed roads. Cleansing frequencies may be adjusted accordingly

- Flooding history – Sites identified with a history of flooding or ponding water may benefit from an increased cleansing frequency

- Silt levels – Locations with recognisable patterns of high or low silt levels may allow frequencies to be adjusted

- Flood risk areas – These may be locations affected by tidal or river or groundwater flooding and may benefit from an increased cleansing frequency where appropriate

Cleansing frequencies

Our cleansing frequencies are subject to on-going review as the risk-based approach is refined and as information systems continue to be developed. The initial baseline frequencies are based on road hierarchies and are as follows :

Road Category	Description	Baseline frequency
CHSR	Strategic Route	12 months
CH1	Main distributor	12 months
CH2	Secondary distributor	12 months
CH3	Link Road	12 months
CH4	Local access road	12 months
CH5a	Minor road	24 months
CH5b	Lanes (includes back lanes)	24 months
CH5c	Green Lane or Track	Reactive
CH5d	Disused track	Reactive

(Note: local factors will increase or decrease these frequencies based on the above risk factors).

The baseline frequencies may be increased at locations where there is a higher risk of flooding or evidence of regular silt build up or decreased where the risk is deemed to be low.

Enhanced Cleansing

Locations known to present a higher risk of flooding impact may be designated as Priority Zones and be subject to enhanced maintenance as set out below:

Priority	Description
Priority Zones 1	Increased gully cleansing frequency – e.g. 6 monthly
Priority Zones 2	Enhanced inspection regime – e.g. weekly/monthly checks over winter period
Priority Zones 3	Enhanced maintenance regime – e.g. maintenance visits in advance of flood warnings or severe weather warnings

General Maintenance

In addition to planned gully cleansing, drainage assets are monitored and maintained in a number of ways:

- Highway Inspections – regular highway inspections (see 4.3.4) identify evidence of service or structural defects requiring additional maintenance work.
- Public/third parties – reports from the public or other parties (i.e. Police/Fire) by phone or online reporting systems of problems for further investigation. Includes out of hours Emergency response.
- Area Maintenance teams – cyclical maintenance activities carried out including clearing gully tops and manually cleaning gully chambers, grips and outlets by highway operatives.
- Additional specialist resources employed to tackle specific issues such as CCTV investigations, surveys, high pressure jetting or excavations to repair pipelines.

Programmed Repair

Where funding allows, a prioritised programme of remediation works will address known flooding and reduced drainage capacity. Ideally any drainage repairs shall be carried out in advance of other carriageway maintenance and resurfacing. Co-ordination with programmed improvement schemes shall be considered to avoid abortive works. Prioritisation will consider:

- Road Hierarchy (see 4.2.2 for full details)
- Speed limits – Flooding or standing surface water can present a higher safety risk to the travelling public on higher speed roads.
- Flooding history – Sites identified with a history of flooding or ponding water
- Flood risk areas – These may be locations affected by tidal or river or groundwater flooding and may benefit from an increased cleansing frequency where appropriate
- Maintenance regime – a reduction to the maintenance regime allowing better use of resources

4.6 Geotechnical Management

4.6.1 Geotechnical Introduction

Historically, geotechnical problems have only become manifest when failure occurs or starts to occur and either embankments collapse onto road or the road itself starts to subside. These failures are most frequent on steep-sided river valleys where the highway is cut into the hillside and can be very expensive to address. They also cause significant disruption with roads often being closed for many months.

The proactive identification and assessment of areas of higher geotechnical risk on the County's road network may provide a timely and cost-effective approach and minimise disruption to the travelling public. This proactive approach has been developed in Carmarthenshire with the help of Welsh Government funding to support more resilient networks across Wales. This approach also recognises the increasing frequency of extreme weather events and the necessity to ensure key transport routes remain open for use during these events as part of an emergency response. The approach aims to reduce the risk of failure of geotechnical features and assets on key routes with a proactive programme of inspection, assessment and management which has been initiated for key routes such as the A484.

The Geotechnical Asset Management Plan (GeoAMP) introduced in 2022 promotes and presents the planned programme of inspections, assessments and planned geotechnical works for Carmarthenshire's strategic highway routes based on a rolling five-year plan. The report is a working document and forms part of the authority's HAMP suite of documents.

The GeoAMP summarises the condition of Carmarthenshire's geotechnical assets (as far as surveyed) along the strategic road network, the management activities which have taken place over the past year, and planned activities over the forthcoming five years. It also summarises the areas of known geotechnical risk across the network and the ways in which these risks are reviewed and considered in the planning of geotechnical asset inspections and the management of these assets. The GeoAMP seeks to reduce geotechnical risk by maintaining an on-going programme of risk-based inspection and remedial actions, subject to funding.

The GeoAMP has been prepared in general accordance with the requirements of *Design Manual for Roads and Bridges CS641 – Managing the maintenance of highway geotechnical assets* and is an evolving document that continues to be developed as further parts of the network are surveyed.

4.6.2 Geotechnical Setting

Topography & Geomorphology

This section introduces the Geotechnical setting with focus on areas to the north of the County where initial surveys have been completed. The GeoAMP annual updates will contain similar detail across the county as surveys progress.

The topography of the general area is largely influenced by Carmarthen Bay in the south and the hills to the north of Carmarthenshire. Increased elevations are typically found transecting the northern region of the network in an approximate west to east orientation. The elevations of the northern extent from west to east are approximate 64 m Above Ordnance Datum (AOD) and 216 m AOD, respectively.

It consists of an incised plateau which forms the watershed between northward-flowing tributaries of the Afon Teifi and southward-flowing tributaries of the Afon Tywi (Towy). The plateau rises towards Brechfa Forest in the east of the network.

Hydrology

There are 86 main watercourses affecting the landscape within Carmarthenshire and these have an influence on the underlying geology and the risk to the highway network. Main rivers are defined as statutory watercourses designated by Natural Resources Wales.

Natural Resources Wales carries out maintenance, improvement or construction work on main rivers in Wales to manage flood risk.

Every other open watercourse in Wales is known as an ‘ordinary watercourse’ and the County Council (as the Lead Flood Authority) or Natural Resources Wales (as the internal drainage board) carries out maintenance, improvement or construction work on ordinary watercourses in Wales to manage land drainage.

A map showing the extent of main rivers in Carmarthenshire is shown in Appendix A. Further details are available from Natural Resources Wales.

Geology

The geology relevant to strategic routes on the highway network and which have previously presented a number of geotechnical failures, including the A484 north of Carmarthen, are summarised below.

Superficial Geology

Glacial and peri-glacial deposits comprising Glacial Till, Glaciolacustrine deposits, Glaciofluvial deposits, and Head Deposits are commonly encountered across the southern extent of the network. Localised tills (Diamicton) are known to also be found within the A4069, A478 and A4066 extents.

Glacial till consists of a heterogenous mixture of clay, sand, gravel, and bounders varying widely in size and shape.

- Glaciolacustrine deposits consist of sands, silts and clays of deltaic origin, shoreface sand and gravel and lake bottom varved, fine-grained (fine sand, silt and clay) sediments.
- Glaciofluvial deposits consist of Sand and gravel, locally with lenses of silt, clay or organic material.
- Head deposits consists of gravel, sand and clay depending on upslope source and distance from source. Locally with lenses of silt, clay or peat and organic material.

Localised occurrences of River Terrace Deposits and Alluvium are present across the network and are associated with various watercourses.

- River Terrace Deposits consists of sand and gravel, locally with lenses of silt, clay or peat.
- Alluvium consists of clay, silt, sand and gravel.
- Tidal Flat deposits, Blown Sand, and Raised Storm Beach deposits are present along the coastal extent of the A484 approaching Llanelli, and are associated with Cardigan Bay.

Tidal Flat deposits normally consist of consolidated soft silty clay, with layers of sand, gravel and peat.
Raised Storm Beach deposits consist of mainly gravel and rarely sand.

Solid Geology

The solid geology of the network north of Carmarthen is dominated by sedimentary strata.
The geology south of Carmarthen is the westernmost part of the South Wales Coalfield, comprising the Millstone Grit, Lower, Middle, and Upper Coal Measures. The Coal Measures Group is generally described by British Geological Survey (BGS) as ‘Alternation of sandstone, grey siltstone and grey mudstone, with frequent coal seams and seat earth horizons’.

Hydrogeology

Glaciofluvial and head deposits, river terraces and modern alluvial deposits constitute the main aquifers within the district. The primary porosity of the bedrock is very low; groundwater flow and storage are predominately within joints and fault-related fractures.

4.6.3 Inspections

Initial Geotechnical Principal Inspections were carried out by consultant geotechnical engineers between December 2021 and February 2022 in accordance with *Design Manual for Roads and Bridges, CS641, Managing the Maintenance of Highway Geotechnical Assets*. Fieldwork surveys were undertaken in two respects:

- Site-based fieldwork for Principal Inspections was carried out in accordance with CS 641, recording all relevant inventory and classifying all geotechnical features. Recorded using

photographs, sketches and quantitative data of features where appropriate, with approved inspection data provided in spreadsheet format. Significant new defects or marked deterioration of existing known defects are reported immediately.

- Office-based “virtual inspection” Desk-based reviews of low-risk sections of route (previously identified in the desk study task) in accordance with CS641. Review utilised both Google Street View data, Google Earth, and the client-provided access to the Vaisala platform of videoed carriageway edges; approximately 60%inspections were completed on site, whilst the remaining 40% were completed remotely via virtual inspection.

The strategy for the frequency and targeting of inspections is the utilisation of a risk-based approach as recommended by CS 641. Risk is assessed on the likelihood of “failure”, where “failure” represents a condition that would require remedial works in order to allow the earthwork to perform its duty.

Assessment of the likelihood of “failure” has been based on the asset’s condition, geological composition and height. It is considered that the risk-based approach to inspections ensures that the focus of the inspections is biased towards those with known or potential problems.

Using the risk-based approach, assessment criteria, a target inspection frequency of 1, 2, 5 or 10 years can be assigned to every earthwork on the network. It is not practical for individual assets to be inspected due to logistics. Therefore common inspection frequencies are grouped into sections (or routes). This may result in some assets being inspected on a higher frequency than suggested by the methodology.

An annual review of all classified features is recommended to be carried out with prioritisation, and the likelihood and consequence of failure assessed as part of potential scheme development, considering the priorities of the County Council and wider programmes of work. It is noted that the frequencies are subject to change based on the additional sections in main distributor roads or latest inspection information.

The risk-based approach is recommended to dictate which future routes are to be inspected during future Principal Inspections. The remaining network can be assessed if required to determine earthworks which have outstanding inspections on an annual basis. Route sections of earthworks with similar inspection due dates can be compiled and used for the future annual inspection period.

4.6.4 Monitoring, Maintenance and Scheme Development

In addition to the GeoAMP reports, a database of Geotechnical Assets and identified defects will be maintained. The database will assist the authority in improving records of geotechnical issues and prioritising surveys and works in coordination with other work programmes.

The extent of inspection, monitoring and remediation programmes will be dictated by available resources. Priority will be given to addressing known defects and failures either through remediation work or regular monitoring where appropriate. In addition, a modest programme of further survey to collate inventory and condition information will continue as resources permit.

4.7 Highway Emergency Response

4.7.1 Emergency Planning

Major incidents normally require a multi-agency approach which is managed under separate arrangements in accordance with the Council's Emergency Response Plan. The Highways' Emergency Response service is managed in conjunction with the Emergency planning procedures where appropriate and as a stand-alone response to localised emergency which do not trigger a multi-agency response.

The regional Emergency Planning Duty Officer (EPO) provides a 24hr single point of contact during Major Incidents for the Emergency Services and other agencies who may require the support of Ceredigion, Carmarthenshire and Pembrokeshire County Councils and voluntary agencies. Major Incidents are as defined below.

Major Incidents:

The definition of a major incident is "An event or situation with a range of serious consequences which requires special arrangements to be implemented by one or more emergency responder organisation

If one organisation declares a Major Incident, it doesn't necessarily follow that it will be a major incident for all organisations. However, informing other responder organisations of the declaration will make them aware of the severity and impact of the incident on the declaring organisation.
Details on Emergency planning can be found on the Councils web pages.

4.7.2 Emergency Response – Highways Service

The Highways and Transport Division provides an out of hours service to deal with Highways, Vehicle Fleet, and Waste Services related incidents in line with the overall responsibilities of the Department.

Duty Officers are on a standby rota 365 days a year in order to respond to service requests from Emergency Services and also service requests from the public. All out of hours calls are received by Llesiant Delta Well-being who provide a front-line call management service for the authority. The on-call Duty Officer will assess the need for appropriate action and prioritise a suitable response whilst making best use of resources.

Where an incident occurs that is likely to cause significant disruption or impact for a prolonged period the Senior Management Team and the Council's Press Office will be notified.

Duty standby arrangements

Summer period (1st April to mid-October) - Single tier system. 2 Duty Officers in place covering distinct operational areas. The Duty Officer liaises directly with operational gangs in arranging a response to incidents and arranges additional resources such as external contractors as required.

Winter period (mid-October to 31st March) - Two tier system. A single Duty officer is in place and will also deal with Winter service management and incidents. The duty officer is supported by 2 Duty Supervisors who liaise directly with operational gangs and arrange additional resources as required, in addition to supervising the front-line Winter service operations.

The duty rota operates on a pre-arranged daily rota with a shift period as follows:

- Weekdays: 16:00 to 8:00am following day
- Weekends/Bank Holidays: 8:00am to 8:00am following day

The scope of incidents that may arise is varied however incidents that are regularly dealt with include:

- Winter Service – response to adverse weather and precautionary treatments in advance of predicted freezing or snow
- Road Traffic Collisions – make safe & clear debris, follow up recharges
- Road closures and set up of diversionary routes
- Oil/Fuel spillages
- Fallen or unsafe trees blocking/affecting the highway
- Carriageway & Footway defects – Potholes etc.
- Flooding
- Waste or refuse causing a hazard on the highway including discarded drug paraphernalia
- Damage to highway furniture, signs, safety barriers, lighting columns
- Dead animals on the highway

In addition to highways matters, the on-call team may on occasion support the Fleet management service. In the first instance Careline will direct calls to the on-call Fleet Technician. Where the technician requires additional guidance or assistance he may contact the Duty Officer for situations including:

- Broken down vehicle requiring fitter to attend
- Council vehicle involved in Road traffic collision or incident
- Recovery of vehicle and or passengers by authority approved contractor
- Access to Depots/premises
- Liaise with Police as required
- Access to vehicle tracking system

The Duty Officer will prioritise incidents in accordance with the defect categories (4.3.9) and where

appropriate arrange for a priority response out of working hours. Where possible, all actions are recorded on the highways management systems.

During periods of high demand, including adverse weather events, additional resources may be deployed. This is generally agreed in advance with Senior Managers following official Weather and Flood warnings or where events escalate in magnitude.

Subject to the scope and duration of the weather warning , management and supervisory resources may be increased by placing additional Supervisors or Duty Officers on standby. During the summer period we may revert from a single tier system (single Duty Officer) to a two-tier system (Duty Officer/s and Duty Supervisor/s). In certain circumstances, shift working arrangements may be implemented.

For significant incidents the Duty officer will coordinate with Tactical Coordination Group (TCG) when instigated.

4.7.3 Operational response

During normal working hours the Highways Service has in place a dedicated workforce based at regional highway depots across the County. Outside of working hours, and during normal conditions, there will be 4 mobile operatives (2 per operational area) on standby at all times. Operatives are generally home-based outside of working hours and are contacted by telephone to attend to incidents as directed by the Duty Officer (Summer) or Duty Officer/Duty Supervisor (Winter).

The mobile gangs are equipped with general tools, chainsaws and material for dealing with small oil spillages and also sharps boxes for the clear up of drug paraphernalia. Additional equipment can be accessed at all the regional highway depots.

During periods of high demand, including adverse weather events, additional resources may be deployed. This is generally agreed in advance with Senior Managers following official Weather and Flood warnings. Subject to the scope and duration of the weather warning , operational resources may be increased to place additional mobile teams on standby. For more severe warnings, and subject to availability, we may deploy gully emptiers and sweepers and also engage additional internal and external resources such as cleansing crews or specialist Arboricultural contractors, to assist the Highways teams.

4.7.4 Public Reporting System

The service has established an online customer reporting system that allows defects or incidents to be reported simply and accurately and registered against the maintained highway network. The on-line reporting system allows for efficient reporting and transfers information directly into a computer management system. Customers are advised to pass any Emergency or Urgent issues to us by telephone (via Llesiant Delta Well-being) so that the on-call teams can be alerted immediately. Details will be entered by call handlers onto the highways management system. Customers will be provided with a call reference and if email details are provided, will be updated as the response is completed, within appropriate timescales.

The efficient capture of service requests supports the introduction of electronic work instruction that are increasingly being utilised to issue and record work operations.

Appendix A – Main Rivers in Carmarthenshire

Main Rivers in Carmarthenshire