HIGHWAYS INFRASTRUCTURE ASSET MANAGEMENT PLAN (HIAMP)

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1. Background and context

1.1 Introduction

Plymouth City Council recognises that an effective and efficient highways infrastructure underpins the health of the local economy. It supports the vibrancy of local communities and enables the delivery of Plymouth City Council's vision, objectives and outcomes.

Taken together the highways infrastructure asset management by the Service forms the largest and most valuable public asset within Plymouth City Council's control with a gross value in excess of £1.5 billion.

Plymouth will manage its highways assets to deliver a safe and well-maintained network.

What is Highway Asset Management?

Asset management is defined as:

"A systematic approach to meeting the strategic need for the management and maintenance of highway infrastructure assets through long term planning and optimal allocation of resources in order to manage risk and meet the performance requirements of the authority in the most efficient and sustainable manner."

[Highway Infrastructure Asset Management Guidance – UK Roads Liaison Group (UKRLG)/ Highways Maintenance Efficiency Programme (HMEP), May 2013]

Although asset management covers every stage of an asset's lifecycle from acquisition to disposal, the asset management plan is focused on the management and maintenance aspects of highway infrastructure assets, since this is where the majority of the City Council's highway related activities and funding are focused.

A robust asset management plan provides answers to the following key questions:

- What assets do we have?
- What condition is it in?
- What do we want the asset to provide?
- How will we ensure that the asset provides what we want and what will it cost to achieve this?

The Benefits of Asset Management

Plymouth City Council sees the main benefits as of an asset management approach as:

- Making better informed decisions about investments. Decisions are made using a long-term 'whole-life' approach leading to optimum outcomes.
- Better understanding risks associated with these assets, not simply health and safety, but also financial risks, environmental risks and hazards which may affect the service it provides; for example, preventing the closure of a bridge.
- Aligning highway maintenance service provisions to the City Council's Corporate objectives.

- Aligning the service or value provided by the asset to customer expectations.
- Increasing transparency of the challenges faced and the performance of the asset as well as how we are meeting our statutory duties, leading to improved customer satisfaction, stakeholder awareness and confidence.
- Established clear levels of service.
- Understanding the consequences of changes to investment levels.

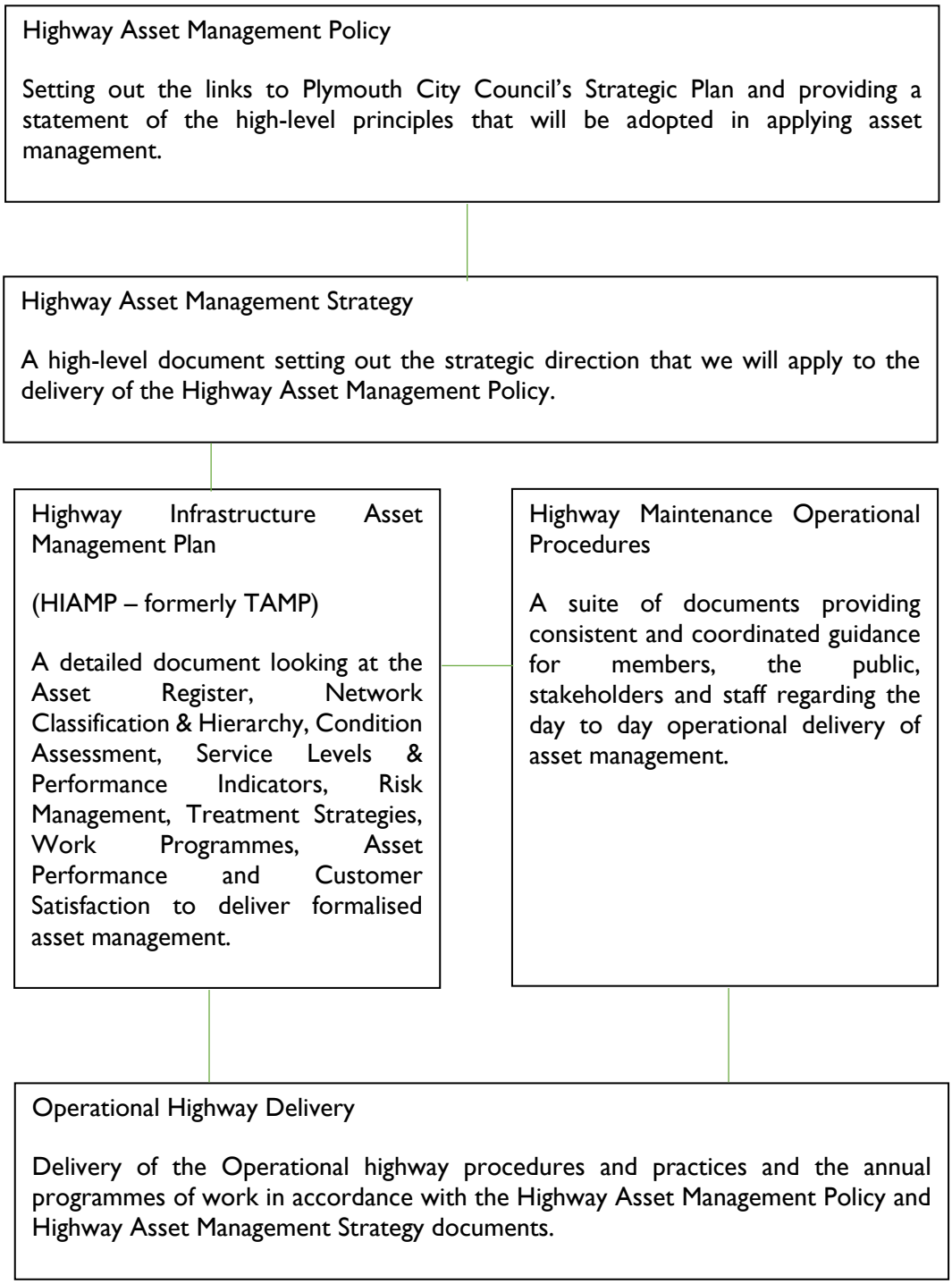
A key benefit of an asset management approach is to move decision making away from the imminent and the urgent to a planned regime where the needs of the asset are better understood so that appropriate preventative maintenance treatments can be planned within a wider whole-life approach. This enables decisions to change from those based on a worst-first priority to those that delivers greatest value.

Purpose of the Highways Infrastructure Asset Management Plan (HIAMP)

This Highways Infrastructure Asset Management Plan (HIAMP) is an integral component of the City Council's Asset Management Framework consisting of Plymouth City Council's Asset Management Policy, Strategy, HIAMP and Operational Procedures.

The Interdependencies within this Framework is illustrated in Figure 1.

Figure 1 – Highway Asset Management Policy



The purpose of the HIAMP is:

- To better understand risk and its impact on the asset. Assets are defined as items, things or entities that have potential or actual value to an organisation. Examples of highway assets are carriageways, footways, street lighting, etc.

- To provide a document that assists with decisions on maintaining the highway asset, including future levels of funding.

- To provide information on challenges and the actions to be taken to maintain the highway asset.

- To set out the asset management requirements in a clear and transparent manner.

- To provide a reference for staff and contractors on specific aspects of highway maintenance.

The document has been produced following the Highway Maintenance Efficiency Programme (HMEP)– Highway Infrastructure Asset Management Guidance Document (published in May 2013). This guidance provides the basis for a consistent approach and understanding of the implementation and delivery of asset management benefits. This HIAMP explains how the City Council is adopting each of the 14 recommendations in the guidance document. In addition, "Well-Managed Highways Infrastructure: A Code of Practice" was published in October 2016, this HIAMP has been produced in accordance with the recommendations of this Code of Practice.

The HIAMP will inform the review and development of all highway maintenance operational procedures. These procedures will shape the way Plymouth City Council will develop and deliver its highway maintenance service, which aims to deliver a safer highway network with improved travelling conditions for all users and to take greater care of the environment.

These procedures will enable the delivery of the HIAMP, Highway Asset Management Policy and Highway Asset Management Strategy and will:

- List Plymouth City Council's maintenance and management processes, such as gulley emptying and carriageway defects.

- Explain its maintenance and management strategies across all highway activities.

- Provide general information to illustrate Plymouth City Council's role in managing the highway network.

- Provide general information on minimum service standards, such as when and where they apply.

- Provide advice on consents and licences for activities on the highway (what is allowed on the highway network), such as skip licences.

- Identify constraints and enforcement measures (what is not allowed on the highway network), such as obstructions in the highway.

- In order to meet the requirements of the new Code of Practice these procedures will be reviewed, following adoption of the HIAMP, and implemented incrementally.

1.2 What are the highway assets?

Plymouth City Council's highway network comprises just over 857km of carriageway. This is mostly an urban network, either classified as A, B, C roads or unclassified local roads. The unclassified network represents 78% of the overall network length. The footway and cycleway network consist of 3,350 footways and cycleways covering 896.36kms. The highway asset also includes over 180 traffic signals and pedestrian crossings, 12 variable message signs and approximately 31,000 street lights. In terms of structures, Plymouth City Council is responsible for approximately 180 road bridges, foot bridges, underpasses, subways, culverts, and retaining walls. The highway asset also includes over 42,000 highway gullies, drainage, street furniture, road markings and soft estate.

Plymouth City Council, as the Highway Authority, has a statutory duty to maintain the highway network in a condition to enable the safe passage of the travelling public.

Plymouth City Councils highway infrastructure assets have been divided into key asset groups in line with the CIPFA reporting framework:

Table 1 – Asset Groups

ASSET GROUP	ASSET COMPONENT
Carriageway	Carriageways
Footways and Cycleways	Footways, Cycleways and shared surfaces
Structures	Bridges, culverts, retaining walls
Lighting	Street lights, illuminated traffic signs and bollards
Traffic Management	Traffic signals, Variable Message Signs (VMS) and control equipment
Drainage Infrastructure	Gullies, carrier drains, chambers and manholes
Street Furniture	Grit bins, public transport infrastructure, on street parking infrastructure, benches and other street scene elements.

This approach has been adopted to allow a clear understanding of budget allocation across the different asset groups and facilitate the recording of investment linked to expenditure on activities.

Identifying where money is invested allows Plymouth City Council to monitor performance against service delivery and the implementation of a continuous improvement process, within the constraints of available funds.

The Service is also responsible for the following other highway infrastructure assets not currently included within this system:

- Surface level and multi-storey car parks
- Park and Ride facilities

In order to maximise the effectiveness of Plymouth City Councils data management and provide a robust and consistent approach, all highways assets are being consolidated into a single asset inventory within the new Street Services Information Management System (SSIMS).

1.3 Asset management goals

Plymouth City Councils Asset Management Mission is:

> "To provide a highway network that is excellent value, giving our customers confidence in the investment decisions we make"

In order to achieve this Mission, the focus will be on achieving the following outcomes:

Best use of Highway Assets and new ways of working:

- Continuing to pursue a strategy that aims to deliver maximum benefits for the available resources by, where possible: moving away from reactive repairs to planned maintenance; considering the whole life cost of solutions to get the best balance between improvements, maintenance and repair; aiming to intervene with the right treatment at the right time.

- The optimisation and prioritisation of works based on assessed needs, derived from the defined levels of service.

- Continuing to seek further efficiencies and reduced costs by: planning the delivery of works to avoid unnecessary costs; working with partners to increase efficiency; grouping projects into work streams for delivery where this will bring benefits.

- Adopting collaborative and joint working initiatives to deliver effective and efficient services.

Quality Services focussed on customer needs:

- Keeping our city moving. Provide the optimum levels of planned maintenance activities over the lifecycle of all asset types. This will allow the effective coordination of works to reduce road closures and their impact, as well as providing maximum network availability and reliability, which supports the forward visibility of planned maintenance works.

- Engaging with the public and promoting understanding of the service to help manage public expectations and ensure that, as far as possible, the service meets the needs of local communities by: ensuring that Councillors are well informed about the service so that they can act as local advocates and meet local needs; making effective use of communication systems to allow the public easy self-service access to information about services, standards, planned works, etc.; the explicit consideration of customer expectations and defined levels of service.

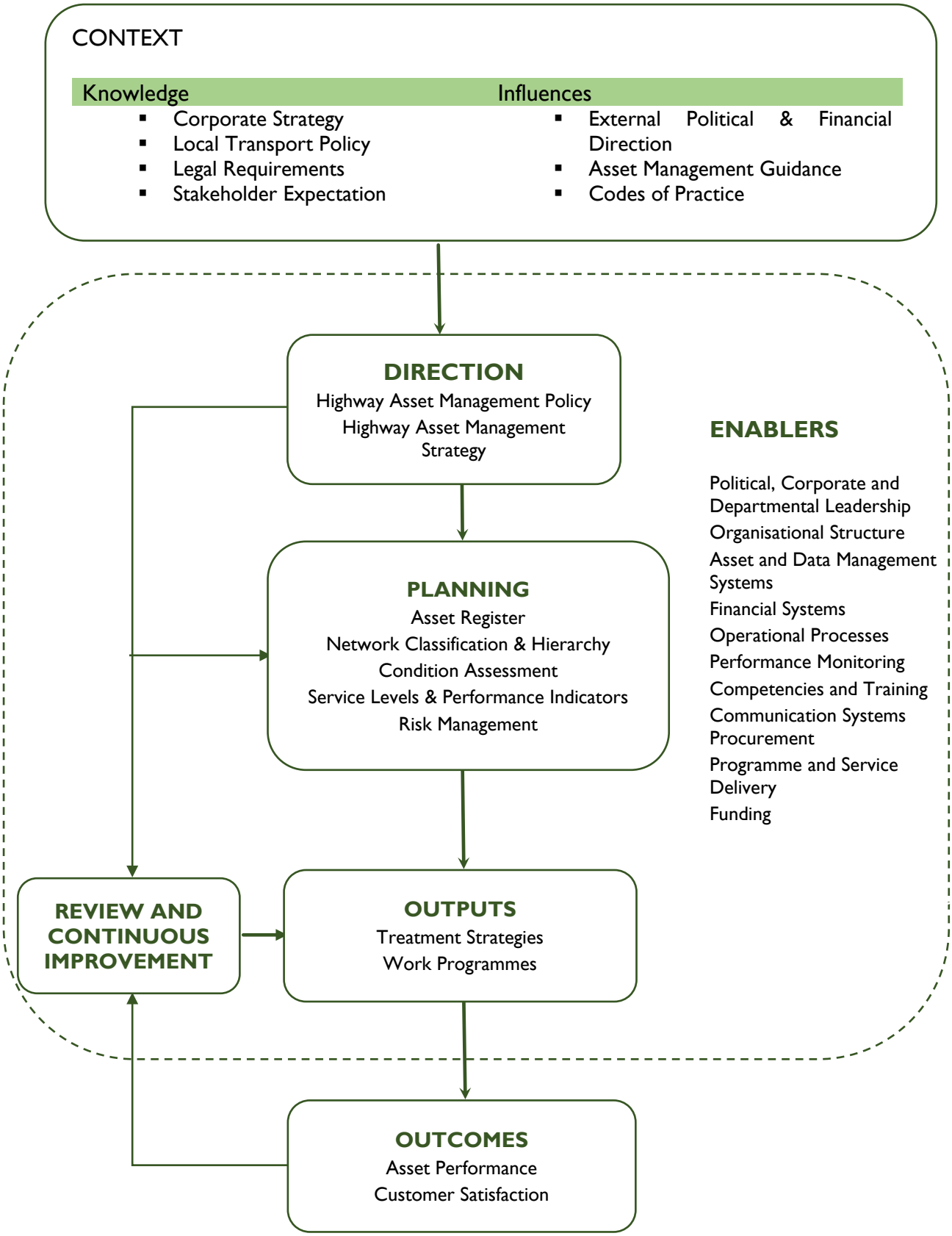
Meeting future Infrastructure needs and improved streetscene environment:

- Implementing our Local Transport Plan that will provide an integrated transport system that optimises cost over time, provides value to the community and environment, whilst keeping people healthy and supporting lower carbon transport choices. It will also integrate sustainable solutions and treatments, which minimise waste and landfill at the centre of our approach to highway maintenance.

- Providing a safe network supporting the delivery of road safety initiatives, to help to reduce road traffic accidents and giving our users confidence to feel safe on the network.

Our Asset Management approach is summarised in Figure 2.

Figure 2 – Asset Management approach



2. Current state of affairs

2.1 Historical investment summary

Funding for the highway infrastructure is in the form of either capital or revenue and can come from a variety of sources.

Capital investment must be spent on acquiring, improving or undertaking structural maintenance on assets. Capital expenditure adds to the value of the asset rather than just maintaining it. Capital investment comes from the central government via the Road Maintenance Grant and the Local Transport Grant as well as discretionary grants such as the Incentive Fund scheme and the Challenge Fund. Capital investment can also be raised from within Plymouth City Council through prudential borrowing or raising capital receipts.

Revenue funding is typically spent on all other areas that support the operation of the highway infrastructure such as routine maintenance, for example gully cleansing and energy for street lighting. Revenue expenditure covers day to day expenditure which maintains, rather than enhances, the value of the asset. Revenue funding comes from the central government revenue support grant and locally raised revenue such as council tax and business rates. Appendix A contains a breakdown of the overall expenditure on Highways Assets in recent years.

2.2 Network hierarchy

A network maintenance hierarchy based on the function of the road is a foundation of Plymouth City Council's Highways Infrastructure Asset Management approach for carriageway, footway and cycleway assets and enables risk-based maintenance strategies to be formed. Plymouth City Council has defined a local network hierarchy as recommended by the Code of Practice "Well Managed Highway Infrastructure" and this is presented in Tables 4 and 5.

The network can be presented in different ways according to different needs, for example:

- Road Classification is still used for the collection and presentation of carriageway condition data. Although this does not precisely reflect the road network hierarchy, it is produced in order to meet statutory reporting requirements.
- A Resilient Network is defined as to receive priority over other hierarchies to ensure economic activity and access to key services during disruptive events.
- A Winter Service Network is defined to manage which part of the network gritting treatment is needed during the winter.
- Traffic Sensitive Network is defined to support network management activities.

The network maintenance hierarchy has been formed in order to most appropriately represent the type and use of roads in the City. The hierarchies in the Code of Practice have been used as a basis with the following minor amendments:

Table 4 – Carriageway Maintenance Hierarchy

CATEGORY	TYPE OF ROAD	DESCRIPTION
Strategic Route Category 2	Trunk and some Principal "A" class roads between Primary Destinations.	Routes for fast moving long distance traffic with little frontage access or pedestrian traffic. Speed limits are usually in excess of 40 mph and there are few junctions. Pedestrian crossings are either segregated or controlled and parked vehicles are generally prohibited.
Main Distributor Category 3a	Major Urban Network and Inter-Primary Links. Short – medium distance traffic.	Routes between Strategic Routes and linking urban centres to the strategic network with limited frontage access. In urban areas speed limits are usually 40 mph or less, parking is restricted at peak times and there are positive measures for pedestrian safety.

CATEGORY	TYPE OF ROAD	DESCRIPTION
Secondary Distributor Category 3b	B and C class roads and some unclassified urban routes carrying bus, HGV and local traffic with frontage access and frequent junctions.	In residential and other built up areas these roads have 20 or 30 mph speed limits and very high levels of pedestrian activity with some crossing facilities including zebra crossings. On-street parking is generally unrestricted except for safety reasons. In rural areas these roads link the larger villages, bus routes and HGV generators to the Strategic and Main Distributor Network.
Link Road Category 4a	Roads linking between the Main and Secondary Distributor Network with frontage access and frequent junctions.	These are mostly residential or industrial interconnecting roads with 20 or 30 mph speed limits, random pedestrian movements and uncontrolled parking. They are of varying width and not always capable of carrying two-way traffic.
Local Access Road Category 4b	Roads serving limited numbers of properties carrying only access traffic.	These are often residential loop roads or cul-de-sacs.

The Footway Maintenance Hierarchy defined in Table 5 has been determined by the functionality and scale of use of the City's footways. In assigning the footways to a particular category, local factors have been considered. These include:

- Relative pedestrian volumes
- Historic accident data and other risk assessment
- Age and type of footway
- Character and traffic use of adjoining carriageway

Table 5 – Footway and Cycleway Maintenance Hierarchy

CATEGORY	DESCRIPTION
Prestige Walking Zones Category 1a	Very busy within the City with high public space and streetscene contribution and tourist destinations.
Primary Walking Routes Category 1	Busy urban shopping and business areas and main pedestrian routes linking interchanges between different transport modes.
Secondary Walking Routes Category 2	Medium usage routes through local areas feeding into primary routes, local shopping centres, large schools and industrial/commercial centres.
Link Footways Category 3	Linking local access footways through urban areas and the main routes and cul-de-sacs.
Local Access Footways Category 4	Footways associated with low usage, short estate roads to the main routes and cul-de-sacs.

Table 6 – Cycleway Maintenance Hierarchy

Category	Description
Primary Cycleway Category A	Cycle lane forming part of the carriageway, commonly a strip adjacent to the nearside kerb. Cycle gaps at road closure points (no entry traffic, but allowing cycle access).
Cycle Tracks Category B	Cycle track – a route for cyclists not part of, or adjacent to, the public footway, or carriageway, but within the highway boundary. Share cycle/pedestrian paths, either segregated by a white line or other physical segregation, or un-segregated.

2.3 Resilient Network

A Transport Resilience Review commissioned by the Department of Transport published its report in July 2014. Recommendation 35 states that:

"Each Local Highway Authority should make an early start in identifying a 'resilient network' to which it will give priority through maintenance and other measures in order to maintain economic and social activity and access to key services during extreme weather."

Taking into account the way various locations in the city are accessed by the public and the varying demands on arterial routes for both vehicular and pedestrian access, it was decided that there should be a separate resilient network for footways and carriageways. Plymouth City Council will give funding priority to maintain this network's condition.

The Resilient Network is mostly adjoining with neighbouring highway authorities and will be given priority through maintenance and other measures in order to maintain economic activity and access to key services.

2.4 Major Road Network

The DfT's Transport investment strategy sets out the government's priorities and approach for future transport investment decisions. The creation of a Major Road Network (MRN) across England is a key step in the delivery of the strategy. Plymouth City Council will give funding priority to maintain this network's condition above all else, including the Resilient Network. The MRN will help:

- Reduce congestion
- Support economic growth and rebalancing
- Support housing delivery
- Support all road users
- Support the Strategic Road Network (which is predominantly maintained by Highways England)

The MRN will allow for dedicated funding from the National Roads Fund to be used to improve the middle tier of our busiest and most economically important local authority "A" roads.

The DfT consultation ended in March 2018 and at present, Plymouth's MRN comprises of:

- On-slips and off-slips between Marsh Mills roundabout and Leigham Interchange
- Plymouth Road
- Gdynia Way
- Shapters Road
- Exeter Street
- Charles Street
- Cobourg Street

- Saltash Road
- Wolseley Road
- St Budeaux Bypass

Winter Maintenance

Plymouth City Council has a legal duty under Section 41 of the Highways Act 1980 to ensure that, as far as is reasonably practicable, safe passage along a highway is not endangered by snow or ice. The winter service is part of the overall highway maintenance service and therefore has a finite resource and this has to be taken into consideration when defining the level of service. From the 1 April 2017, South West Highways, as part of the Plymouth Highways Partnership, will fulfil the role of Winter Service Manager.

Details of the service can be found in the Winter Service Plan for the year, which is available on the Plymouth Highways Hub. The Winter Service Plan defines which parts of the network are treated and under what circumstances. Table 8 illustrates the arrangements for the season.

Table 8 – Winter Maintenance Route Coverage 2018/2019

PRIORITY 1	DESCRIPTION	NETWORK COVERAGE
Primary routes	Busy Principal Roads, the Resilient Network, access to hospitals, fire stations and schools	218Km
Secondary Routes	Busy local distributor and link routes	142Km

For operational integrity and route efficiency, sectors of Devon County Council's network are treated by Plymouth City Council and vice versa. For example, Plymouth City Council treats Woolwell Road, which is otherwise maintained by Devon County Council.

2.5 Stakeholders' Expectations

Plymouth City Council monitors stakeholder expectations using the National Highways and Transport (NHT) customer satisfaction survey, through ad-hoc consultation exercises and analysis of customer complaints and comments.

As part of the development of the Highway Asset Management Policy and Highway Asset Management Strategy, a consultation exercise was undertaken in which stakeholders were asked about the importance of a range of asset types, their maintenance and their importance. Plymouth City Council participates in the NHT customer satisfaction survey each year and the outcomes of this survey are used to inform asset management planning. As well as assessing the levels of customer satisfaction the survey asks customers about what levels of service are (or not) acceptable to reduce, those responses indicate a priority for our stakeholders. This is particularly relevant to this plan in the context of dealing with the financial challenges set out in Plymouth City Council's Medium Term Financial Strategy.

Table 9 – Overview of the feedback obtained from stakeholder consultations

SOURCE	FEEDBACK	PRIORITIES
Policy Engagement	How to prioritise investments	Cost of ad-hoc repairs if not maintained regularly
		Risk to safety if not maintained regularly
		Impact on users if not maintained regularly
		Amount of use/wear received
	Where to focus resources	Major Road Network– strategic use
		Resilient network– high use
		Non-resilient network– average use
		City centre/shopping area pavements
	Importance to maintain	Roadside drains, gullies and culverts
		Carriageway
		Footways
NHT	Level of service to be retained (not acceptable to reduce)	Roads
		Gullies and drains
		Gritting and snow clearance
		Footways

The feedback reveals the following expectations in terms of priorities. Stakeholders expect that Plymouth City Council:

- Prioritise funding to manage the safety risk to road users and to limit the cost of reactive work.
- Focuses its resources on more highly used parts of the network while acknowledging the value provided by other parts of the network.
- Prioritises drainage maintenance to reduce highway flooding and standing water.
- Congestion "busting" to keep the city moving.
- Preserves its approach to winter service across the whole network.
- Maintain roads, highway drainage and pavements as a priority.

The expectation that funding is prioritised to limit the cost of reactive work is supported by the asset management goal of ensuring the optimal use of resources. Furthermore, the expectation that funding is also prioritised to manage safety risks to highway users is a key function of the highways maintenance service as it is a duty for the Highway Authority under the Highway Act 1980 and is now a key recommendation of the current Code of Practice (Well-Managed Highway Infrastructure). The expectation that resources should be focused on highly used parts of the network is supported by the asset management goal to "take account of… levels of use… to prioritise maintenance treatments and treatment choices".

Winter service is important to stakeholders and this is reflected in the priorities from both sources of feedback. The maintenance of carriageways, highway drainage and footways were similarly highlighted in both sources of feedback indicating a strong and consistent expectation about the service to be provided on these assets.

These priorities are acknowledged in this HIAMP and will be a fundamental consideration in future decisions concerning the management and operation of the Plymouth Network.

2.6 Keeping the public informed

Plymouth City Council keeps the public informed of its approach to highway infrastructure asset management through the use of a number of channels:

1. **Web Portal Firmstep**– this is the primary access channel to report defects or make comments about all aspects of the Highways Service with the reassurance that a reply will be forthcoming if contact information is provided;

2. **Firmstep Customer service centre (or 'Contact Centre')** – in order to better monitor the full extent of public contact, all forms of communication logged on Plymouth City Council's Customer Relationship Management System (CRM) for enquiry tracking and analysis. Customer service agents have access to all forms of highways service information and are briefed on numerous subject areas including asset management and relevant scheme details. The principle is that the Customer Service Centre handles as many queries as possible at this point. However, there will be the occasional need to refer detailed enquiries to Highways personnel;

3. **Twitter** – used as a method of getting out information that is likely to be of interest to a large audience such as details about gritting during the winter;

4. **Correspondence** to individuals and organisations – advisory letters and formal notices will be sent to affected frontagers in advance of works on the highway network where passage to and from private property is likely to be temporarily impaired. The intention is that letters or emails from individuals will be responded to within 10 working days (on the basis that many enquiries are of a detailed nature and require some form of investigation before a meaningful response can be sent);

5. **Media interaction** – issues relating to changes in policy, strategy, plans and new projects/programmes of work will often be accompanied by press notices. If these are considered to be of public interest, these issues will be picked up by the media. Individuals will be made available to provide details and undertake interviews or provide supplementary information as required;

6. **Weekly Member and Staff Briefings** – These briefings are composed according to the recipient audience but are irrespectively placed on the Plymouth Highways Hub for wider access and consideration internally;

7. **Scheme-specific communications** – letter drops to affected properties, combined with legal notices and on-site signage, inform the public of forthcoming works;

8. **Fixed and Mobile Variable Message Signs** – used to inform the travelling public of targeted information relating to the Network and other warning messages concerning weather and road safety issues;

9. **Customer Satisfaction Cards** – Deployed following works such as resurfacing to enable the customers affected to feedback on their experience.

Public Consultation

Public consultation is undertaken when it is deemed the public can influence the outcome of an issue. In the case of asset management, Central Government has linked the use of an asset management approach to funding allocation, as well as checking that such an approach is used to get the optimum level of investment into maintenance of the local highway infrastructure. In response, Plymouth City Council has adopted an asset management approach, but is keen that the public is given the opportunity to influence the detail that is contained in this Highway Infrastructure Asset Management Plan.

Firmstep

An online tool, Firmstep has been introduced to handle customer contact and is a tool that interacts with maps to help the public report issues. All submissions receive a reply back to the member of public through email, telephone or face to face contact. Analysis of public contacts through Firmstep provides data to inform service delivery and development. An approximate weighting of the most common types of highway defects reported by the public is summarised in Table 10.

Table 10 – Analysis of Customer Enquiries

DESCRIPTION	NUMBER OF REPORTS	% OF TOTAL	RANKING
Carriageway	3,320	35.49	1
Drainage	2,152	23.01	2
Ped areas	1,535	16.41	3
Lines/Studs Street	516	5.51	4
Furniture	441	4.71	5
Kerb	332	3.55	6

2.7 Carbon management

Plymouth City Council will aim to reduce carbon emissions resulting from highways maintenance activities by undertaking a number of initiatives. These include, but are not limited to; conversion to LED street lamps to reduce energy requirements; the increased use of recycled materials both through the application of Road Mender plant to recycle carriageway material and minimise waste and; the adoption of a data led approach to minimise the need for site visits when planning works and the increased adoption of electric vehicles to reduce vehicle emissions. Through the conversion to LED lamps alone, Plymouth City Council has reduced their carbon emissions by almost 6,000 tonnes per year. Plymouth City Council are also ISO 14000 compliant.

2.8 Lifecycle planning

Lifecycle planning is used in order to appraise the viability asset aspirations in the future. Lifecycle planning is the broad method that enables Plymouth City Council to model the future consequences of investments in our assets.

A lifecycle plan for a stock of assets can be formed into a process as shown in Figure 4. The "Define Requirements" stage sets out the function and scope of the assets and how this will meet the policy; in effect, how the asset will create value as well as the end of life options and costs e.g. disposal of the asset and associated costs. The "Measure Performance" stage considers what value the asset is providing; asset lifecycle modelling can be used forecast future performance. The "Identify Gaps and Risks" stage allows for all key information that is likely to prevent the asset providing the required value to be captured. The maintenance strategy and investment strategy describe how the asset will be managed and invested in respectively; performance gaps and risks can be mitigated using appropriate strategies.

Figure 4 – the lifecycle planning process

The following lifecycle plans are presented for each of the key asset groups.

3. Carriageways Lifecycle Plan

Function

To provide highway surface and carriageway infrastructure suitable for the type and volume of traffic.

Legal obligations

Highways Act 1980 and related legislation places duty to maintain carriageways on the highway authority.

3.1 Inventory information summary

Scale and size of asset

DESCRIPTION	LENGTH (KM)
Principal A Class Road	52.078
Classified Non-Principal B Class Road	42.620
Classified Non-Principal C Class Road	86.834
Unclassified Road	676.139
Total	857.671

There are manholes, access chambers and covers in the carriageway which are not owned by Plymouth City Council. These are generally the responsibility of utility companies and are covered by the provisions of the street works legislation. Defects on them are generally reported as part of the inspection regime for the carriageway.

Location and type of inventory

Information on carriageway locations, lengths and surface and structural and surface conditions of the carriageway is held on the Highway Inventory Management System (HIMS) database in electronic form.

Coverage of inventory data

Information on carriageway characteristics and condition is held in a UK Pavement Management System (UKPMS) database.

No information is currently held on conditions of kerbs, traffic islands, studs, road marking, traffic calming or road humps.

Reliability of inventory data

Carriageway information held on UKPMS database is usually reliable and generally up to date.

Any information held regarding kerbs, traffic calming and road humps are generally not up to date, except when associated with Traffic Regulation Orders (TROs).

System for managing and updating data

Information on carriageway conditions is regularly updated following completion of condition surveys, and following completion of major improvement and surfacing works.

New roads and associated works are added to the database following adoption of the roads.

Information held regarding kerbs, traffic islands, studs, road marking, traffic calming and road humps are not updated regularly.

3.2 Inspection and assessment regimes

Safety inspections

Safety inspections of the carriageway are carried out by driven and walked inspections in accordance with the Highways Safety Inspection Manual as summarised below.

Table 13- Safety Inspection Frequency

FEATURE	DESCRIPTION	CATEGORY	FREQUENCY
Carriageways	Strategic route	2	1 month
	Main distributor	3a	1 month
	Secondary distributor	3b	1 month
	Link road	4a	3 months
	Local access and rear lanes	4b	1 year
Footways	Prestige area	1a	1 month
	Primary walking route	1	1 month
	Secondary walking route	2	3 months
	Link footway	3	6 months
	Local access footway	4	1 year
Cycle routes	Part of carriageway	A	As for carriageways
	Remote from carriageway	B	As for footways
	Cycle trails	C	1 year

In addition, specific inspections are made in response to customer, staff and contractor reports.

Inspections of work carried out by utility companies and others are undertaken in accordance with street works legislation, which can include coring and other sampling.

Service and condition inspection regime

Condition inspections of carriageways are regularly carried out by means of Sideway-force Coefficient Routine Investigation Machine (SCRIM) and Surface Condition Assessment for the National Network of Roads (SCANNER) surveys to obtain information on skid resistance, carriageway surface characteristics and structural strength.

Condition surveys of kerbs, traffic islands, studs, road marking, traffic calming and road humps are usually only carried out in response to problems identified through safety inspections or reports from others.

Highways staff regularly monitor the condition of the network in order to identify and prioritise future maintenance and renewal work.

System for recording inspections

Records are kept of carriageway safety inspections.

Results of carriageway condition surveys are stored in the HIMS system to enable analysis of the data to inform investment and maintenance decisions.

3.3 Creation of new assets

New roads by developers

Private developers construct new roads which are adopted as public highways under Section 38 or similar agreements. The condition of the asset is inspected and approved before adoption and the local authority will not take custodianship until it is totally satisfied that the new asset is both constructed in accordance with predefined agreed maintainable specification and the asset has been safety audited to the City Councils satisfaction, in order to ensure it does not inherit future avoidable liabilities. Inventory data relating to the new asset is updated after adoption.

New roads by Highway Authority

New roads can be created as part of major improvement schemes carried out by the highway authority. The new asset is constructed in accordance with current design standards and future maintenance closely considered to ensure that items like materials and any future maintenance works are both affordable and products regularly available, with whole life costing being considered as part of the design process. Inventory data is updated following opening of a new road.

3.4 Key asset performance targets

Performance indicators

Performance measures for carriageway condition are:

DESCRIPTION	COMMENT
Condition of Principal Roads – SCANNER Survey	NI 168 (Previously BV 223)
Condition of Non-Principal Classified Roads – SCANNER survey	NI 169 (Previously BV 224a)

Condition of Non-Principal Roads – SCANNER	
Condition of Unclassified Roads – SCANNER	
Skid Resistance	SCRIM survey on main roads

Survey results are reported to the Department for Transport (DfT) where appropriate and used in the Performance Management Framework.

The survey data is used to calculate the estimated backlog of maintenance required on the network.

Potential targets

The Performance Management Framework currently has a target to maintain road conditions of the Resilient Network to a good standard and to maintain the rest of the Network at steady state or better.

3.5 Public perception of asset

Public perception

Historically there has been a high level of public dissatisfaction with the condition of the highway network as a result of low levels of investment in maintenance in the past.

The NHT survey indicates public satisfaction with roads in Plymouth is at the national average but also identified the City on the "most improved" in 2015.

Public expectation

The public expect to be able to use the carriageway at all times with minimum delays and disruptions to their journeys. The public expect road drainage to be working properly. The public expects potholes and safety defects to be repaired promptly.

3.6 Environmental and heritage considerations

Environmental

Roads are often located in areas of particular sensitivity, such as near schools, hospitals or residential areas where restrictions on working times and maintenance processes may need to be applied.

The use of recycled materials in road construction, and techniques to reduce the environmental impact of construction work associated with highways maintenance has increased in recent years. The increasing costs of material being sent to landfill sites provide further incentive to increase reuse of materials where feasible, especially in instances where hazardous material is found within the construction of the carriageway.

Heritage

A number of roads are located in conservation areas and where justified may require the use of specific materials to enhance the appearance of that particular location.

3.7 Risk assessment

Key risks

Carriageways are high risk areas. They are inherently dangerous places because of the volume and speed of traffic using them. There are risks of serious injuries, claims and prosecutions as a result of inadequate or inappropriate maintenance and care.

Carriageway defects such as potholes or structural damage to the carriageway can result in accidents or damage to vehicles, particularly for motorcycles and cyclists. Inadequate surface texture can result in vehicles skidding or losing control.

Deterioration of the carriageway condition can lead to structural failure, resulting in the closure of the road for safety reasons.

Worn road markings and missing studs can lead to driver uncertainty. In some cases, missing or obscured lines may make enforcement of legal orders difficult.

Risk management

A programmed and targeted maintenance regime significantly reduces the risks associated with highways, and can improve road safety and reduce claims against Plymouth City Council. Within the limited funding it is important to target repairs and maintenance works at those areas most in need.

Maintenance work on the carriageway will be carried out by competent contractors with a trained workforce following the correct procedures.

3.8 Disposal or downgrading of asset

Stopping up of highways

In order to dispose of surplus highway, it is necessary to follow specific legal procedures and the need does not often arise. Generally, the ownership of a stopped-up highway would revert to the adjoining landowners.

Change of use and downgrading

Sometimes carriageways can be closed to vehicular traffic and become pedestrian only areas following the implementation of traffic orders or other legal procedures.

Traffic islands, traffic calming features and road humps may be added or removed from the network as part of traffic management and local safety schemes.

3.9 Asset condition and performance

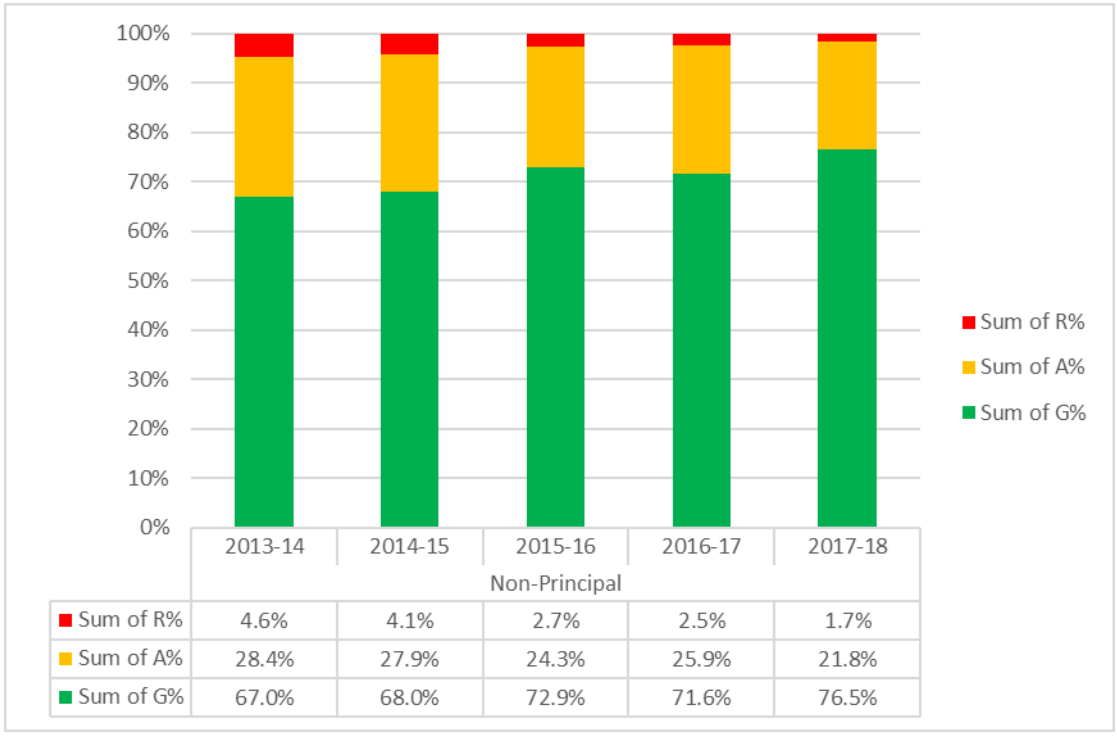
Replacement value

An approximate replacement value of £1.5 billion has been calculated for the Carriageway asset group. This represents the largest element of the highways network in terms of replacement value.

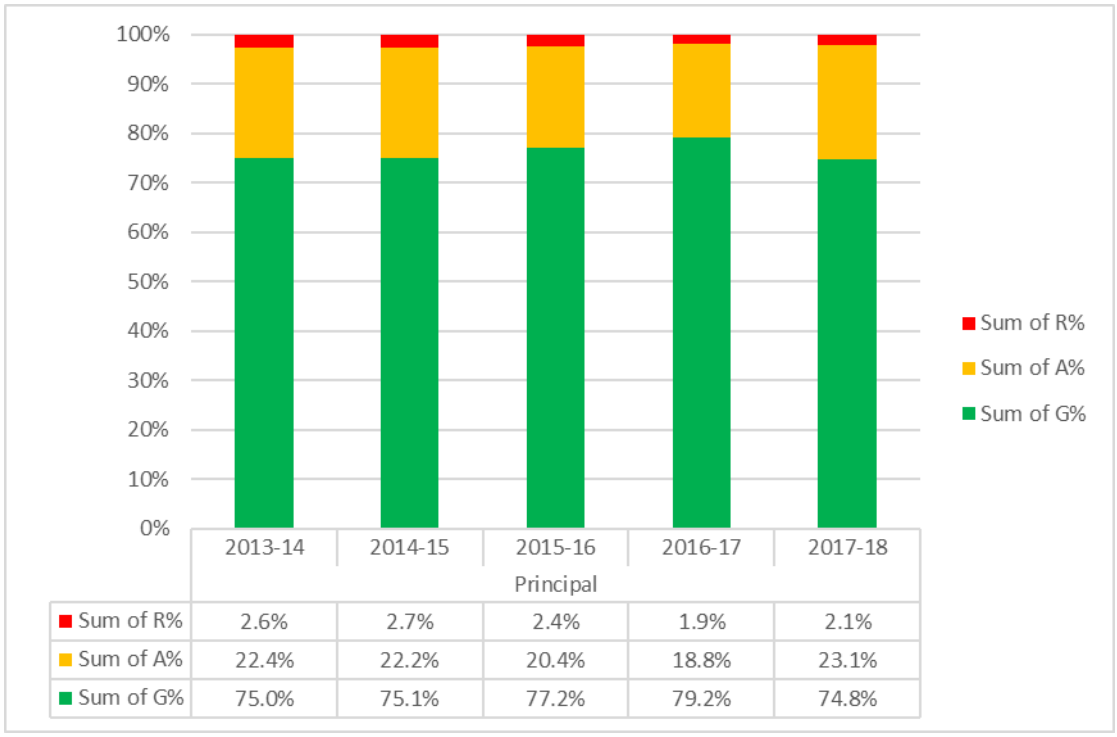
3.10 Asset condition

The historic condition of the road and carriageway asset group represented by the condition grades is summarised as below. R% refers to the percentage of the network likely to require maintenance

soon. A% refers to the percentage of the network that should be investigated to determine the optimum time for planned maintenance treatment. %G refers to the percentage of the network in a good state of repair.



	2013-14	2014-15	2015-16	2016-17	2017-18
	Non-Principal				
Sum of R%	4.6%	4.1%	2.7%	2.5%	1.7%
Sum of A%	28.4%	27.9%	24.3%	25.9%	21.8%
Sum of G%	67.0%	68.0%	72.9%	71.6%	76.5%



	2013-14	2014-15	2015-16	2016-17	2017-18
	Principal				
Sum of R%	2.6%	2.7%	2.4%	1.9%	2.1%
Sum of A%	22.4%	22.2%	20.4%	18.8%	23.1%
Sum of G%	75.0%	75.1%	77.2%	79.2%	74.8%

	EXCELLENT	GOOD	AVERAGE	POOR
Condition of A class roads – the percentage of principal roads where maintenance should be considered.	<3%	3% - 5%	6% - 10%	>10%
Condition of B and C class roads – the percentage of non-principal classified roads where maintenance should be considered.	<6%	6% - 10%	11% - 14%	>14%
Condition of minor roads – the percentage of unclassified roads where maintenance should be considered.	<10%	10% - 15%	16% - 20%	>20%

The forecast condition of the asset group with the levels of future funding identified in Plymouth City Council's Medium Term Financial Strategy and are detailed in Appendix A.

3.11 Maintenance strategy

Reactive maintenance regime

Carriageway defects are attended to in accordance with the response times set out in the Highways Inspection Manual. Generally, serious damage or defects are repaired or signed within 24 hours. Other defects are usually repaired within a week or 28 days, depending on the type and location of the defect, or less serious defects may be monitored.

The public can report potholes and carriageway defects through the Firmstep system or by email or telephone. Defects are inspected by Plymouth City Council staff and programmed for repair if required.

Repairs are allocated to the Term Maintenance Contractor who are required to achieve the Policy response timescales. A first-time permanent repair is advocated wherever possible.

Routine maintenance procedure

A programme of routine maintenance of the highway network is carried out, which includes minor repairs to carriageway surfaces, lining renewal and maintenance of traffic calming features as resources permit.

Planned maintenance procedure

A programme of planned maintenance on the highway network is carried out annually, with the schemes including carriageway reconstruction, resurfacing and micro surfacing.

The principles of asset management are being applied to Plymouth City Council's road network in order to ensure there is timely intervention to make best use of the resources available. This includes carrying out a programme of micro surfacing to prevent deterioration of the network.

The need for major works is identified by assessments taking into account condition surveys and accident records, stakeholder needs, local engineering input, coordinator opportunities and engineering risks. The intention is that the application of asset management principles should continue to be applied to the roads asset to remove the backlog and continue to maintain the condition of the network at a steady state whilst improving the condition of the Resilient Network.

Structural investment

A programme of capital renewal expenditure as set out below would be required in the medium term to prevent to achieve these ambitions, this can be found in Appendix A.

Optimised treatment strategies based on strategic treatment types will be applied to a defined set of carriageway types defined by hierarchy. Each treatment strategy is designed to maximise the serviceable life of assets by intervening as late as possible to minimise whole life costs.

4. Highway Structures Lifecycle Plan

Definitions

The term 'highway structure' is used throughout to refer collectively to the following structure types. These definitions are aligned with Design Manual for Roads and Bridges (DMRB) BD2/12.

- A bridge, buried structure, subway, culvert and any other structure supporting the highway with a clear span or internal diameter greater than 0.9m.
- An earth retaining structure where the effective retained height is greater than 1.5m.
- Retaining structures where the effective retained height is less than 1.5m and culverts with a clear span or internal diameter less than 0.9m are maintained as part of the drainage, carriageway or footway assets as appropriate.

Legal

Plymouth City Council has a general duty of care to users and the community to maintain the highway structures in a condition that is fit for their purpose.

The majority of highway structures carrying or supporting the adopted road network are maintainable at public expense. However, where a highway passes over or under a highway structure that is not maintainable at public expense it is important that the Plymouth City Council has an agreement with the owner of the bridge to clarify the demarcation of maintenance responsibilities.

Generally culverts constructed as part of a highway scheme are maintainable by the highway authority.

All bridges over highways with less than 5.0m headroom at any point over the carriageway are referred to as 'low bridges'.

All bridges carrying the adopted road network that fail an assessment for the 40 tonne European standard are referred to as 'weak bridges'. As such they will be subject to load mitigation measures in order to reduce the loading effects on them to an acceptable level.

Most retaining walls, which directly support the highway or support land supporting the highway and are within the highway boundary, are maintainable at public expense. For retaining walls outside of this definition it is important for Plymouth City Council to have an agreement with the owner of the wall to clarify the demarcation of maintenance responsibilities.

The Planning Act (1990) requires the authority to compile a list of buildings of special interest.

4.1 Inventory Information Summary

Specific asset types

Plymouth City Council's inventory currently comprises the following Highway Structure, divided in to those on Highway Maintainable at Public Expense (HMPE) and those that are not:

ASSET TYPE	HMPE	NON-HMPE	TOTAL
Bridge	35	62	97
Parapet	7	0	7
Culvert	56	48	104
Footbridge	26	40	66
Other	0	6	6
Subway	48	10	58
Tunnel	4	4	8
Viaduct	1	8	9
			355

Retaining walls do not currently appear in the current inventory as they have historically been managed on a reactive basis because of the sheer number involved and the lack of definitive ownership documentation. Our forward plan will be to identify and catalogue retaining walls. Working with Plymouth City Council's legal department, potential landowners will be identified to bring clarity regarding maintenance responsibilities.

Type of Inventory and Location

Currently all information on Plymouth City Council's Highway Structures is held on a variety of storage mediums.

As part of Plymouth Highways' Data management strategy, we have recognised the importance of holding this information on a singular asset management register which is designed specifically to handle the detailed itemisation, asset management and modelling of highway structure assets. The system that has for this purpose in Plymouth is currently Bridgestation, which has been selected carefully in order to fully integrate with the wider HIMS suite of products.

Reliability of Inventory data

Plymouth City Council acknowledges that the reliability of the current data is questionable, however data is being migrated to BridgeStation. As part of this process any data that is in question will be verified to remove any uncertainty.

There are currently 21 structures whose ownership is not established, these structures will be investigated and maintenance liability established.

Asset Condition

The *overall* current condition of Plymouth City Council's Highway Structures stock can only reliably be established from recent inspections. As part of the population of Bridgestation, recent inspections will be imported and a programme of regular inspections will be established.

From these previous inspections it can be said that Plymouth City Council's Highway Structures are generally in a good condition.

The condition of *individual* Highway Structures can be reported more accurately. Through the regime of inspections, the condition of each individual element of a structure is recorded. Each element is given a severity and extent value.

- *Severity* being the degree to which a defect or damage affects the function of the element or other elements on the bridge.

1	As new condition or has no significant effect on the element (visually or functionally).
2	Early signs of deterioration, minor defect/damage, no reduction in functionality of element.
3	Moderate defect/damage, some loss of functionality could be expected.
4	Severe defect/damage significant loss of functionality and/or element is close to failure/collapse.
5	The element is non-functional/failed.

- *Extent* being the area, length or number of a/the bridge element that is affected by the defect or damage.

A	None	No significant defect
B	Slight	not more than 5% of surface area/length/number
C	Moderate	5%- 20% of surface area/length/number
D	Wide	20% - 50% of surface area/length/number
E	Extensive	more than 50% of surface area/length/number

- Permissible combinations are as follows:

		SEVERITY				
		1	2	3	4	5
EXTENT	A	1A				
	B		2B	3B	4B	5B
	C		2C	3C	4C	5C
	D		2D	3D	4D	5D
	E		2E	3E	4E	5E

These individual element *severity* and *extent* values, combined with a complex interaction of variables, contribute towards the calculation of two condition factors for the overall structure. These factors are known as the Bridge Condition Indicator (BCI) scores and are defined as:

- BClav: The *average* BCI score for a structure taking into account the condition of all structural elements on the structure. This score provides an overview of the structure condition.

BCIcrit: The BCI score for the *critical* load bearing element of a structure that is in the worst condition. This score provides an indication of the criticality of the structure with regard to its load carrying capacity.

An average value for Plymouth City Council's whole bridge stock, known as the Bridge Stock Condition Index (BSClav), can also calculated based on the BClav scores for each Highway Structure. However, as stated above, the reliability of the current inventory data can't be guaranteed therefore any reporting of a BSClav score at this stage would be misleading. Once BridgeStation is fully populated and all data verified Plymouth City Councils BSClav can be reported accurately.

Individual defects, identified through the regime of inspections, are currently added to a 'Work Bank' which is a list of maintenance work required to bring the structures up to standard. The BCI scores for each individual element and each highway structure are then used to establish appropriate intervention timescales and to prioritise maintenance actions.

Creation of New Assets

Private developers construct bridges which are adopted as public highways under Section 38 or similar agreements. The condition of the asset is inspected and approved before adoption, and inventory data is updated after adoption.

New structures can be created as part of major improvement schemes carried out by the highway authority. The new asset is constructed in accordance with current design standards. Inventory data is updated following opening of the new road.

Disposal of Asset

Sometimes roads can be closed to vehicular traffic and become pedestrian only routes. In such cases the asset could be considered to become a footway bridge for the purpose of asset management. In other cases obsolete or derelict structures may be filled in or demolished entirely. In all cases the Inventory data is updated following the course of action taken.

System for managing and updating data

With the adoption of BridgeStation, information will be regularly updated in a format fit for the challenges of the current asset management approach. It is a complete asset management tool for Highway Structures within which all important files can be uploaded and stored against each highway structure. The management tools within the software enable the user to search, interrogate and report on the data in order to:

- Prioritise the programme of inspections
- Review Bridge Condition Indicator (BCI) scores that are automatically calculated and reported for each highway structure.
- Produce prioritised lists of maintenance actions.
- View GIS mapping to aid the preparation of the inspection and works management programmes.
- Produce the required asset valuations; Whole Government Account (WGA), Gross Replacement Cost (GRC) and Depreciated Replacement Cost (DRC), which will support senior management and council members in future bids to central Government.
- Provide senior management and council members with Lifecycle planning deterioration models based upon inspected elements and predicted and/or desired levels of investment.
- A Gap analysis of the data stored in order to track progress and identify missing or erroneous data.
- Build financial and condition reports made up of the fields specified and/or data filters applied.

This approach enables stakeholders to make effective and informed decisions and to understand the impact of those decisions on the asset and the subsequent level of service and performance required to maintain the assets in a fit for purpose state.

Asset Value

Once all asset data has been migrated into BridgeStation and then verified, accurate figures for the GRC and the Depreciated Replacement Cost can be reported directly from the system, providing even greater confidence.

4.2 Inspection and Assessment Regimes

Safety Critical Inspections

With respect to safety critical elements of Highway Structures, inspections are carried out on foot and would identify defects within the road surface, drainage systems, bridge parapets and any vehicular restraint systems that may be in place as protection for weak cantilevers and/or as pier protection. Frequencies of inspections are summarised below:-

DESCRIPTION	FREQUENCY
A, B, and some C Class roads	6-monthly
Most C Class and some Unclassified	Annually
Some C Class and Unclassified	Bi-annually

In addition Safety Inspections are made in response to calls and FIRMSTEP reports from others. These are carried out as and when reported and the risk to the general public of the reported deficiency.

Additional Safety Inspections may be undertaken following flooding or adverse weather conditions.

Where assets or elements of assets are not maintained at public expense, the owners are responsible for ensuring the safety, integrity and adequacy of those structures for use by the public. Where the highway authority cannot be reasonably confident that an adequate inspection regime is in place, such as those of Network Rail or the Canal and River Trust, they are expected to carry out 'duty of care' inspections on these structures.

Service and Condition Inspection regime

Primary guidance for the inspection of highway structures is taken from the DMRB Volume 3, Section 1; BD63-Inspection of Highway Structures. The five types of inspection carried out by Plymouth City Council are:

TYPE	USED FOR	FREQUENCY
General Inspection	Used to provide information on the physical condition of all visible elements of a highway structure	Carried out at 24 month intervals. When a General Inspection coincides with a due Principal Inspection only the latter is carried out
Principal Inspection	Used to provide information on the physical condition of all inspectable parts of a highway structure	Carried out every 6 years. However, this interval can be varied up to a maximum of 12 years subject to a risk assessment.
Special Inspection	Used to provide detailed information on a particular part, area or defect that is causing a concern	Special Inspections may comprise a close visual inspection, testing and/or monitoring. The frequency of inspections is risk based and may involve a single one-off inspection of a programmed series inspections
Inspection for Assessment	Used to provide information required to undertake a structural assessment	Guidance on Inspections for Assessment is given in BD21 which recommends that they be carried out in conjunction with a Principal Inspection

Assessment

Where previous assessment results can't be found a structural review in accordance with BD 101/11 will be carried out.

4.3 Risk Assessment

Key Risks

Delivery of a safe and well maintained highway network is an authority's statutory duty. With regard to highway structures the issue of safety is paramount and the following criteria are used in the prioritisation process. In order of importance these are:

- Assessment rating
- Condition
- Risk of sudden failure

- Consequence of sudden failure
- Adequacy of parapets and alignment

Despite the importance of route hierarchy, safety is the primary consideration in any prioritisation process.

There is a risk of a bridge collapsing, but this is generally reduced to a low risk if an adequate regime of inspection and maintenance is carried out.

Environmental considerations

Bridges often cross rivers with nature conservation designations or be located in sites of particular environmental sensitivity. Ecological assessments may be required prior to maintenance work, with special measures taken to reduce adverse environmental impact.

There is the possibility that bridges contain lead based paints or asbestos in their construction and in such cases particular procedures must be followed with regard to these materials.

Heritage structures

Highway Structures may have Listed Building status or be located in conservation areas. Where this is the case any required maintenance works will not be carried out without prior consultation and consent from the appropriate trust/organisation. Restrictions on the types of material used and the methods of construction to be adopted may exist.

Risk Management

A programme of bridge inspections and a targeted maintenance programme significantly reduce the risks associated with highway bridges. These works can improve road safety and reduce claims against Plymouth City Council. Within the limited funding available it is important to target repairs and maintenance works at those areas most in need.

Risk to the highway structures is managed at a number of different levels. There are high level risks that effect the whole authority; risks affecting the management of the highways infrastructure and operational risks that effect the individual highway asset.

BridgeStation can be interrogated in order to identify:

- Which assets are critical to the functioning of the network
- What could affect the delivery of the required performance
- The level of funding, both current and required for defined performance levels
- The level of risk that is acceptable (As Low As is Reasonably Practical – ALARP)
- Options to mitigate all risks that are deemed unacceptable

A subsequent risk assessment (register) and qualitative risk matrix allowing identified risks to be analysed in a systematic manner to highlight which risks are the most severe and which are unacceptably high.

A Risk Action Plan will then be developed that incorporates the risk assessment and qualitative risk matrix in order to identify mitigation actions, the resources available and the timescales involved.

Maintenance work on bridges must be carried out by competent contractors with a trained workforce following the correct procedures.

4.4 Maintenance Regimes

The Business Case and Annual Plans

Plymouth City Council's approved Business Case is a programme of planned maintenance that covers the financial years from 2016/17 to 2019/20. The maintenance work is undertaken using capital funding and progress is reported annually in the Performance Management Framework.

In brief the current Business Case for Highway Structures is as follows:

	2017/18 (£'000)	2018/19 (£'000)	2019/20 (£'000)
Highway Structures	1,506	1,325	635

The intention is that with the application of asset management principles the maintenance work and improvements will be managed to maximise efficiencies when planning investment in order to achieve improved and safe asset stock.

Planned Maintenance

Due to historic underinvestment the defects to certain highway structures have worsened to such a degree that they now warrant significant investment to repair. Such schemes generally involve strengthening and/or replacement works with a significant investment required.

Routine Maintenance

A programme of routine maintenance has also been developed from the Condition Inspection results. The attributed BCI scores will be used to prioritise work according to need and these can then be repaired in line with the availability of funding.

Such works can include patching of specialist surfacing to footbridges, brickwork re-pointing, and vegetation clearance and re-painting of masonry and/or parapet guardrails.

Reactive Maintenance

The public can report defects and damage through the Firmstep system, by email or by telephone. Defects are inspected by Plymouth City Council staff, and if appropriate, programmed for repair. Repairs may be carried out by Plymouth City Council's contractor, but some work may require specialist contractors or sub-contractors. In such instances, repairs cannot be carried out within short notice.

System for recording maintenance date

Following the introduction of BridgeStation, a record of all maintenance works specific to Highway Structures will be held in electronic format which will be updated shortly after completion of the work.

4.5 Performance measurement

BCI and BSCI scores

Each individual structure has its own BCI score which is based on its condition at the time of the inspection. As a guide, the BCI scores represent the following:-

- 100 – 95 Asset or Bridge stock in Very Good condition;
- 94 – 85 Asset or Bridge stock in Good condition;
- 84 – 65 Asset or Bridge stock in Fair condition;
- 64 – 40 Asset or Bridge stock in Poor condition;
- 39 – 0 Asset or Bridge stock in Very Poor condition.

If maintenance work is carried out following the general course of inspections it would be expected that the BCI score for the structure would increase accordingly. Likewise, the BSCI score as this is directly dependant on the BCI scores. The same bracketed scores and definitions apply to the whole bridge stock (BSCI) as they do to the individual asset (BCI).

Key Performance Indicators (KPIs)

Key Performance Indicators (KPIs) are taken from the NHT Performance Management Framework.

Performance Management Framework

In order to be aligned with over 12 authorities, Plymouth City Council will be adopting the performance management framework established through the CQC membership working group of the NHT and endorsed by Steve Berry.

Corporate Goals

The infrastructure supports road safety and other health objectives and contribute to the Corporate Goal of "Keeping our City Moving".

Public Perception

Generally the condition of bridges on the highway network does not currently appear to be a major concern of the public. Damaged parapets or those in poor condition are however particularly noticeable to drivers.

Public Expectation

The public expect highway bridges to be available for use at all times with minimum delays and disruptions to their journeys.

KPI CRITERIA

CRITERIA
% of Bridge stock in very good condition
Average (BSClav) in accordance with the Bridge Conditions Indicators issued by ADEPT
Critical (BSClcrit) in accordance with the Bridge Conditions Indicators issued by ADEPT

5. Drainage Infrastructure Lifecycle Plan

Function

To facilitate the removal of surface water from the highway and reduce flood risk by ensuring the drainage system performs efficiently and effectively.

Legal obligations

- Highways Act 1980 and related legislation places the duty to remove surface water from the highway on the highway authority.
- The Flood and Water Management Act (FWMA) 2010 now requires Local Authorities to manage flood from ordinary watercourses, surface water and ground water in their area. Plymouth City Council is now the Lead Local Flood Authority for the City of Plymouth.
- In addition, this plan is aligned to the Highways Maintenance Efficiency Programme (HMEP) Guidance on the management of highway drainage assets (November 2012) and the UKRLG Code of Practice for Well-managed Highway Infrastructure 2017.

5.1 Inventory information summary

Scale and Size of Asset

Table 1- Asset Inventory (Gullies)

DESCRIPTION	NUMBER OF GULLIES
"A" Classified Roads	2598
"B" & "C" Classified Roads	5714
Unclassified Roads	31213
Service Lanes/Footpaths	3102
Total	42627

Table 2- Asset Inventory (Other Drainage Assets)

DESCRIPTION	NUMBER
Culverts	81
Pumping Stations	2
Manholes	TBC
Soakaways	TBC
Rain Water Conductors	TBC

Location and type of inventory

Information on gullies is held on the Highway Inventory Management System (HIMS) database in electronic form. HIMS is currently being updated with information on culverts and manholes.

Coverage of inventory data

Location and condition data is available for culverts and gullies. Information on other drainage assets such as pipes is incomplete.

Reliability of inventory data

Gully and culvert information held on the HIMS database in electronic form is reliable and up to date.

As part of an invest-to-save initiative an inspection-led regime is being adopted in conjunction with the use of SmartWater[1], a risk-based prioritisation model, to focus gully cleansing activity on those gullies that need cleansing while utilising an Internet of Things (IoT) based approach. The prediction model will be verified through both re-inspection and real-time performance measurement through use of strategically placed sensors in gullies.

System for managing and updating data

Maintenance crews have tablets on which they enter the accurate GPS location, using Ordnance Survey maps as a reference for accurate positioning to record detailed measurements of the gully-pot. In addition, they record precise silt level measurements on arrival and departure and whether the gully is running or in need of additional work. One or more photographs of each gully is also being captured.

[1] SmartWater is a propriety product developed by InTouch Ltd in conjunction with DfT, Lancaster University and several Councils including Bristol City Council where a 2 year pilot has concluded with significant service improvements and financial savings having been achieved.

5.2 Inspection and assessment regimes

Safety inspections

Safety inspections of the highway network are carried out by driven inspections in accordance with the Highways Safety Inspection Manual. Inspectors will be expected to identify problems with covers and gratings, but not all drainage problems would be apparent. Inspection of HMPE culverts are undertaken on an annual basis with the exception of those in 'hotspot' locations which are inspected at least once a week. There is currently no inspection regime for non HMPE culverts.

Table 3- Safety Inspection Frequency

FEATURE	DESCRIPTION	FREQUENCY
Culverts	HMPE	Annually
	Non HMPE	No inspection regime
	'Hotspots'	At least weekly
Gullies	HMPE	Following reported problems
	Non HMPE	No inspection regime
	'Hotspots'	At least weekly

HMPE gully inspections are made in response to councillor, customer, staff and contractor reports.

There is currently no inspection regime for non HMPE gullies.

Service and condition inspection regime

Highways staff regularly monitor the condition of the network in order to identify and prioritise future maintenance and renewal work. Our risk-based approach places emphasis on inspection and assembly of trusted data upon which to best prioritise routine and cyclic cleansing activity, detailed surveys e.g. CCTV and development of minor improvement schemes where the benefit:cost ratio is high.

System for recording inspections

Results of gully condition surveys are stored and analysed in real-time within the SmartWater system before being transferred on a regular basis into the HIMS system to enable works orders to be issued and for future analysis and sharing with other departments and external agencies as needed.

5.3 Creation of new assets

New drainage systems by developers

Where private developers construct estates which are adopted as public highway under Section 38 or similar agreements the condition of the drainage assets are inspected and approved before adoption. Inventory data is updated after adoption and entered into the SmartWater model.

New drainage systems by Highway Authority

Where new assets are constructed or existing assets altered as part of flood alleviation or general maintenance works the new asset is constructed in accordance with current design standards and the HIMS inventory data is updated on completion.

5.4 Key asset performance targets

Performance Management Framework

- Existing
- % of blocked gullies cleared within timescales each month
- For consideration
- % gullies blocked
- Number of emergency call outs
- Tonnage of contaminated waste
- Number of complaints
- Number of recorded flooding incidences

Potential targets

The gully asset management approach will reflect this in the prioritisation of cleansing activity on the primary and resilient network routes within the targeted cleansing programme.

Corporate Goals

The infrastructure supports road safety and other health objectives and contribute to the Corporate Goal of "Keeping our City Moving".

5.5 Public perception of asset

Public perception

Historically there has been a high level of public dissatisfaction with the condition of drainage assets on the highway network as a result of low levels of investment in maintenance in the past.

Public expectation

The public expect to be able to use carriageways and footways at all times with minimum delays and disruptions to their journeys and/or access to their own or other properties. The public expects any incidents of flooding to be responded to promptly.

5.6 Environmental and heritage considerations

Environmental

The use of SmartWater also ensures that we will only cleanse those gullies that need cleansing. We will therefore reduce the consumption of clean water and the volume of contaminated waste generated from the cleansing process. The SmartWater system will also be able to accurately estimate the carbon reduction and quantities of various contaminants as a result of using the system.

Heritage

A number of gullies and manholes are located in conservation areas and where justified may require the use of specific materials to enhance the appearance of that particular location. e.g. ironwork quality and sensitivity to materials that form part of the gully setting e.g. cobbles

5.7 Risk assessment

Key risks

Culverts, in particular are high risk areas. They are inherently dangerous places because of their position adjacent to moving and potentially deep water. There are risks of death, serious injuries, claims and prosecutions as a result of inadequate or inappropriate maintenance and care.

Whilst gullies could be considered less of a risk the potential for injuries, claims and prosecutions remain particularly in respect to cyclists and motorcyclists. Damaged or missing gratings or covers can create a serious safety hazard. Also the presence of standing water adjacent to a flooded gully accelerates the deterioration of the carriageway which gives rise to formation of potholes and subsequent vehicle damage claims, loss of amenity value which impacts on the economic activity in the area and also the temporary and permanent repair costs in replacing the pavement asset.

Blockages in both asset types are the main risk although missing or damaged gully covers is also a potential risk.

Risk management

A programmed and targeted maintenance programme significantly reduces the risks associated with highway flooding and can improve safety and reduce claims against Plymouth City Council. Within the limited funding it is important to target repairs and maintenance works at those areas most in need.

The SmartWater gully asset management service adopts a proactive approach and relies on establishing trusted data which, when run through a sophisticated risk-based algorithm, allows the critical gullies to be targeted for cleansing.

Key locations, such as known flood hotspots and other identified potentially vulnerable areas will also have sensors installed. The sensors will provide flood alerts, record silt build up and enable the contractor to respond before problems impact the network, thus reducing complaints and expensive reactionary emergency call-outs. As a result, public perception of the performance of the gully asset should improve.

The dissemination of warning messages to the public, professional partners and the emergency services will be undertaken.

Maintenance work on drainage assets will be carried out by competent contractors with a trained workforce following the correct procedures. As cleanses are completed the record and details

observed will be added to the SmartWater system via hand-held tablets. These provide a date stamp and GPS location verification for the activity, which, in conjunction with associated photographic records provide a full audit trail.

Plymouth City Council have identified a number of locations that are prone to flooding for a variety of reasons and these locations are inspected on, at least a weekly basis and more regularly if forecasted rainfall exceeds agreed intervention levels. A programme is currently being rolled out to install sensors in these locations which will provide live information regarding the silt levels and leaf coverage of gullies in these locations to allow us to become proactive rather than reactive and improve public perception.

The sensors installed will provide real-time performance of the asset at these vulnerable locations. When combined with external weather data we will also have a 5-day forecast available in order to be able to cleanse the gully ahead of weather conditions that could cause problems.

Minor works prioritisation

The improved quality of the gully asset data from the more detailed inspections coupled with the use of sensors to record actual performance in different weather conditions will also serve to improve the identification of root causes of poor gully network performance, for example identification of capacity issues and location of blockages etc between gullies or to outfalls.

5.8 Disposal or downgrading of asset

Removal of Drainage assets

In respect of a drainage system care will be taken to ensure that the stopped -up asset does not form an integral part of the remaining drainage asset.

5.9 Asset condition and performance

Replacement value

An approximate replacement value of £17 million has been calculated for gullies and £1 million for highways culverts. A more detailed analysis is available in Appendix A

5.10 Asset condition

The historic condition of the drainage asset group represented by the condition grades is summarised in Appendix B, due to the varied nature of the asset,

The forecast condition of the asset group with the levels of future funding identified in Plymouth City Council's Medium Term Financial Strategy. Is available in Appendix A.

5.11 Maintenance strategy

Reactive maintenance regime

Drainage defects, especially where serious damage or performance failure has occurred are repaired or signed within 24 hours. Other defects are usually repaired within a week or 28 days, depending on the type and location of the defect, or less serious defects may be monitored. Defects assessed to require an emergency response will be attended to within 2 hours of the report being received.

The public can report flooding or blocked gullies through the Firmstep CRM system or by email or telephone. Potential defects are inspected by Plymouth Highways staff and programmed for repair if appropriate.

The gully sensors installed at hotspots will also trigger reactive cleanses but these should be undertaken before the public have need to complain and before the problem starts to impact the accessibility, amenity and/or the safety of the network.

Once identified, repairs are allocated to the contractor who will assign it to the appropriate maintenance gang in order to achieve the Policy response timescales.

Routine maintenance procedure

The routine maintenance schedule for gullies will be determined using SmartWater. This adopts a proactive inspection approach followed by a risk-based approach to cleansing, targeting only those gullies that need cleansing. This targeted group is identified using an algorithm based on multiple factors from physical observation and measurements of gully condition, and location to tree, topography, and weather data.

Planned maintenance procedure

A programme of planned maintenance on the highway drainage assets is updated continually, with potential schemes being prioritised by an agreed risk matrix to ensure transparency and best use of the resources available.

The SmartWater system produces focussed work schedules to target only those gullies that need attention, namely gullies that are blocked, close to becoming blocked and a contingency cleanse of a number of other gullies that need to be undertaken in order to provide the 100% confidence level that all essential gullies are cleansed. In a first iteration of implementing the system we would expect the three categories of gullies identified to equate to 20-25% of the gully stock based on empirical evidence of a number of years of research and also implementation of this system in other local authorities. Subsequent iterations of the system should see the numbers of gullies that need to be targeted reduce toward 10% and maybe even lower.

The need for major works is identified by assessments taking into account condition surveys and accident records, stakeholder needs, local engineering input, coordinator opportunities and engineering risks. The intention is that the application of asset management principles should continue to be applied to the footways asset to remove the backlog and continue to maintain the condition of the Network at a steady state whilst improving the condition of the Resilient Network.

Capital investment

A programme of capital renewal expenditure as set out below would be required in the medium term to achieve these ambitions, note that further details of future projections will be available in Appendix A.

YEAR	2017/18	2018/19
Expenditure	£150,000	£60,000

The detailed data acquired through the SmartWater inspections and the observations noted as part of the cleansing operations coupled with the live performance data obtained through sensors will also be used to develop the individual and collective business cases for capital investment in improvement works for the drainage network.

The SmartWater system, by focussing on inspections and then targeting only a small fraction of the gully stock for cleansing, generates potential savings that ensure the system is self-funding and/or generates a return on the investment made which can in the short term be invested in the network.

6. Footways and Cycleways Lifecycle Plan

6.1 Function

To provide pedestrian and cycleway infrastructure suitable for the type and volume of traffic.

6.2 Legal obligations

Highways Act 1980 and related legislation places duty to maintain footways and cycleways on the highway authority.

6.3 Inventory information summary

Scale and size of asset

DESCRIPTION	LENGTH (CENTRELINE KM)
Category 1a – Prestige Walking Zone	6.76
Category 1 – Primary Walking Route	24.26
Category 2 – Secondary Walking Route	50.93
Category 3 – Link Footway	153.47
Category 4 – Local Access Footway	664.93
CATA – Primary Cycleway	
CATB – Cycle Tracks	
Total	896.36

There are manholes, access chambers and covers in the footway and cycleway which are not owned by the Highway Authority. These are generally the responsibility of statutory undertakers and are covered by the provisions of the street works legislation. Defects on them are generally reported as part of the inspection regime for the footway or carriageway.

Location and type of inventory

Information on footway and cycleway locations, lengths and surface and structural and surface conditions are held on HIMS in an electronic database.

Coverage of inventory data

Information on footway condition is held in HIMS. Information on cycleway condition, as a separate asset type, is not available.

Reliability of inventory data

Footway information held on HIMS is usually reliable and generally up to date. Information held regarding kerbs and footway markings is generally not up to date.

System for managing and updating data

Information on footway conditions is regularly updated following completion of condition surveys and following completion of major improvement and surfacing works.

New footway, cycleway and associated works are added to the database following adoption.

6.4 Inspection and assessment regimes

Safety inspections

Safety inspections of the footway are carried out by walked inspections in accordance with the Highways Safety Inspection Manual as summarised below. Cycleways are inspected either as a walked inspection (in the case of shared pedestrian/cycle pavement) or driven (in the case of on-road cycle lanes).

Table 14- Safety Inspection Frequency

FEATURE	DESCRIPTION	CATEGORY	FREQUENCY
Carriageways	Strategic route	2	1 month
	Main distributor	3a	1 month
	Secondary distributor	3b	1 month
	Link road	4a	3 months
	Local access and rear lanes	4b	1 year
Footways	Prestige area	1a	1 month
	Primary walking route	1	1 month
	Secondary walking route	2	3 months
	Link footway	3	6 months
	Local access footway	4	1 year
Cycle routes	Part of carriageway	A	As for carriageways
	Remote from carriageway	B	As for footways
	Cycle trails	C	1 year

In addition, inspections are made in response to customer, staff and contractor reports.

Inspections of work carried out by statutory undertakers are undertaken in accordance with street works legislation, which can include coring and other sampling.

Service and condition inspection regime

Condition inspections of footways and cycleways are regularly carried out by means of a visual assessment to obtain information on footway surface characteristics and structural strength.

Highways staff regularly monitor the condition of the network in order to identify and prioritise future maintenance and renewal work.

System for recording inspections

Records of footway and cycleway safety inspections are kept within HIMS.

Results of footway condition surveys are stored on HIMS to enable analysis of the data to inform investment and maintenance decisions.

6.5 Creation of new assets

New footways by developers

Private developers construct new footways and cycleways which are adopted as public highways under Section 38 or similar agreements. The condition of the asset is inspected and approved before adoption. Inventory data is updated following adoption.

New footways by Highway Authority

New footways and cycleways can be created as part of major improvement schemes carried out by the highway authority. The new asset is constructed in accordance with current design standards. Inventory data is updated following opening of a new footway.

6.6 Key asset performance targets

Condition surveys are regularly undertaken to inform and develop deterioration modelling. It is anticipated that benchmarking would be developed to ensure sufficient levels of funding are provided to meet (as a minimum) steady state levels.

6.7 Public perception of asset

Public perception

Historically there has been a high level of public dissatisfaction with the condition of the highway network as a result of low levels of investment in maintenance in the past. In recent years there has been a significant increase in public satisfaction.

Public expectation

The public expect to be able to use the footway and cycleway at all times with minimum delays and disruptions to their journeys. The public expects safety defects to be repaired promptly.

6.8 Environmental and heritage considerations

Environmental

Footways and cycleways are often located in areas of particular sensitivity, such as near schools, hospitals or residential areas where restrictions on working times and maintenance processes may need to be applied.

The use of recycled materials in footway and cycleway construction, and techniques to reduce the environmental impact of construction work associated with highways maintenance has increased in recent years. The increasing costs of material being sent to landfill sites provide further incentive to increase reuse of materials where feasible.

Heritage

A number of footways are located in conservation areas and where justified may require the use of specific materials to enhance the appearance of that particular location.

6.9 Risk assessment

Key risks

Footways and cycleways are high risk areas. They are inherently dangerous places because of their position adjacent to carriageways as well as the volume of pedestrians and cyclists using them. There are risks of serious injuries, claims and prosecutions as a result of inadequate or inappropriate maintenance and care.

Defects such as potholes or structural damage can result in accidents to pedestrians and cyclists.

Deterioration of the footway condition can lead to structural failure, resulting in the closure of the footway for safety reasons.

Risk management

A targeted maintenance programme significantly reduces the risks associated with footways and cycleways and can improve safety and reduce claims against Plymouth City Council. Within the limited funding available, it is important to target repairs and maintenance works at those areas most in need.

Maintenance work on the footway will be carried out by competent contractors with a trained workforce following the correct procedures.

6.10 Disposal or downgrading of asset

Stopping up of highways

In order to dispose of surplus highway, it is necessary to follow specific legal procedures and the need does not often arise. Generally, the ownership of a stopped-up highway would revert to the adjoining landowners.

Change of use and downgrading

Sometimes footways can be closed to pedestrians following the implementation of traffic orders or other legal procedures.

6.11 Asset condition and performance

Replacement value

An approximate replacement value of £182 million has been calculated for the footways & cycle tracks asset group. This represents the second largest element of the highways network in terms of replacement value.

Asset condition

	EXCELLENT	GOOD	AVERAGE	POOR
Condition of footways – the percentage of surveyed length of footway that is Structurally Impaired or Functionally Impaired.	<10%	10% - 15%	16% - 20%	>20%

The historic condition of the footway and cycleway asset group represented by the condition grades is summarised as:

CATEGORY	2014	2017
Grade 1 Free from Defects	8.30%	15.85%
Grade 2 Signs of Surface Wear	11.05%	33.62%
Grade 3 Mid Life	76.43%	38.02%
Grade 4 Functionally Impaired	3.76%	8.55%
Grade 5 Structurally Impaired	0.46%	3.96%

Based on this classification the condition of footways and cycleways is good.

The forecast condition of the asset group with the levels of future funding identified in Plymouth City Council's Medium Term Financial Strategy. This can be found in Appendix A.

6.12 Maintenance strategy

Reactive maintenance regime

Footway and cycleway defects are attended to in accordance with the response times set out in the Highways Safety Inspection Manual. All defects are risk assessed and response times assigned – 2 hours for the most serious defects posing risk to life, whereas those considered to be exceptionally low risk will be monitored rather than repaired straight away.

The public can report potholes and other defects through Firmstep, by email or telephone. Defects are inspected by Plymouth City Council's staff and programmed for repair.

Repairs are allocated appropriately in order to achieve the Policy response timescales. A first-time permanent repair is advocated wherever possible.

Routine maintenance procedure

A programme of routine maintenance of the highway network is carried out, which includes minor repairs to footway surfaces and tree management as resources permit.

Planned maintenance procedure

A programme of planned maintenance on the highway network is carried out annually, with the schemes including footway and cycleway reconstruction, surfacing and slurry sealing.

The principles of asset management are being applied to the City Council's footway and cycleway network in order to ensure there is timely intervention to make best use of the resources available.

The need for major works is identified by assessments taking into account condition, footway classification and network importance. The intention is that the application of asset management principles should continue to be applied to the footways asset to maintain it (as a minimum) at steady state levels.

Structural investment

A programme of capital renewal expenditure as set out in Appendix A would be required in the medium term to achieve these ambitions.

Optimised treatment strategies, based on strategic treatment types, will be applied to a defined set of footway types defined by hierarchy. Each treatment strategy is designed to maximise the serviceable life of assets by intervening as late as possible to minimise whole life costs.

7. Street Lighting and Lifecycle plan

Function

To provide carriageway and footway lighting promoting safety, security and to encourage the concept of a safe environment for all highway users and to enable people and vehicles to be seen.

Legal Obligations

Plymouth City Council as a Local Authority has discretion to provide street lighting under a statutory power. Following installation and adoption, the lighting arrangement has been established and a duty of care exits to ensure that it is maintained and in serviceable condition. An Authority would be negligent if its' street lighting apparatus was in such state of disrepair as to cause 'collapse' this could result in personal/material injury and loss of reputation.

7.1 Inventory Information Summary

Scale and size of asset

UNIT TYPE DESCRIPTION	TYPE	TOTAL
Beacon	B	344
School flasher	F	42
Lit bollard	I	1274
Street Light	L	30878
Refuge beacon	R	126
Illuminated sign	S	2391
Zebra Flood	Z	173

Total includes structure mounted and subway lighting.

Location and type of Inventory

Information on lamp column locations, size, lamp type and column construction is held in Mayrise in electronic form.

Mayrise is a management tool that provides a central depository within which all important data can be uploaded and stored.

Coverage of Inventory Data

Good information on all lighting equipment is held in terms of equipment, age and condition.

The management tools within Mayrise enable the user to search, interrogate and report on the data in order to:

- Issue, report and update Maintenance programmes.
- Review asset prioritisation, age to intervention and consequence if failure occurs.
- Produce prioritised lists of issued works.
- View GIS mapping to aid the preparation of the inspection, design and works management programmes.
- Assist in the production of the required Whole Government Account (WGA) asset valuations (Gross Replacement Cost and Depreciated Replacement Cost).
- Provide lifecycle planning.
- A Gap analysis of the data stored in order to track progress and identify missing or erroneous data.
- Build reports made up of the fields specified and /or data filters applied.

Reliability of Inventory Data

Information held on Mayrise is usually reliable and up to date, particularly for newer equipment.

System for Managing and Updating

Information is regularly updated following maintenance and improvement works and is also updated following adoption of new lighting columns and associated works following the completion of developments by others.

7.2 Inspection and Assessment Regimes

Safety Inspections

Inspections of columns are undertaken in connection with other maintenance work such as lamp replacement.

Inspections are made in response to Firmstep reports by the public and others.

Safety inspections of the Highway Network are carried out as driven and walked inspections by the Highway Inspectors as part of the regular patrolling of the network, and this would include reporting of serious damage to columns.

Service and Condition Inspection Regime

Inspection regimes are based on a 3 yearly general maintenance and visual inspection/6 yearly general maintenance, visual inspection and electrical in service condition report on a cyclic arrangement.

To ensure robustness of the process, regular structural and electrical inspection and tests are performed by:

1. Roch NDT – Structural Inspections sampling column type / age / location

2. Maintenance Contractors – General condition, update / confirmation of recorded inventory asset – 3 yearly

3. Maintenance Contractors – General Condition, electrical integrity, update / confirmation of recorded inventory asset – 6 yearly

The effectiveness of these visits are monitored and separate records are kept of subsequent referrals raised. Work orders are raised following site audit visit, these are time based dependant on severity and location (risk evaluation) – Emergencies are responded to within 2 hours or 24 hours.

System for Recording Inspections

All defects identified through the inspections are recorded within Mayrise, reviewed by Plymouth City Council and issued for remedial action accordingly, in addition, 3rd party reports are processed within the Mayrise SLCM system.

7.3 Creation of New Assets

New Street Lighting assets by Developers

Private developers construct roads which include street lighting, and which are adopted as public highways under Section 38 or similar agreements. The condition of the asset is inspected and approved before adoption, with the Mayrise information being updated.

New Street Lighting assets by Highway Authority

New roads can be created as part of major improvement schemes carried out by the highway authority. The new lighting assets are installed in accordance with current design standards. Inventory data is updated following opening of new road or structure.

7.4 Key Asset Performance Targets

Performance Indicators

Key Performance indicators (KPI's) are being developed into measure effectiveness of operation against:

- Minor works faults
- Major works faults
- Emergency works – 2 hour and 24 hour attendance
- Failure of repairs
- Routine lamp replacement – where applicable
- Electrical/structural inspection and clean
- Electrical inspection and test
- Effectiveness of night scouting
- Accident incident rate – to include for near misses

Potential Targets

Street Lighting contributes to 3 Corporate targets through its LED replacement programme. The programme consists of replacing 31,000 lamps and will be completed in February 2019. The LED lamps are on average 2.7 times more energy efficient and they produce zero light pollution. This has contributed to an annual energy saving of nearly 11GWhrs, a carbon emission saving of nearly 6,000 tonnes and a reduction in light pollution of between 10% and 25%.

7.5 Public Perception of Asset

Public Perception

Generally street lighting does not appear to cause particular concern to the public, but the public promptly report lights not working to Plymouth City Council through the Customer Care Unit.

Public Expectation

The public expect street lighting to be functioning and of a suitable type for the location.

7.6 Environmental and Heritage Considerations

Environmental

Street lighting may be located in areas of particular sensitivity and particular care may be required with regard to scheme design or replacement of existing units.

Management of supply chains and delivery processes ensure consideration is made to the impact our street lighting installation has on the environment, such measures include:

- Vehicles compliant to Euro 6
- Minimising lighting hours by the use of 35/18 photo electric cells where possible
- Recycling waste in compliance to 'The Waste Electrical and Electronic Equipment Directive' (WEEE Directive) European Community Directive 2012/19/EU
- Recycle waste to minimise land fill
- Use BS/EN approve materials to ensure quality components to improve life expectancy
- Selection of sustainable components
- Minimise light pollution, intrusion, light spill and threshold glare through design and selection
- Energy usage and Carbon production monitored and actively reviewed against target

Carbon

Projects aimed at the reduction of emissions are under constant review, amongst current initiatives are:

- Reduction of lighting hours by the use of 35/18 photo-electric cells

- Adoption of LED technology
- Dimming light output
- Remove of redundant lighting arrangements

Heritage

Street lighting may be located in areas such as conservation areas or high amenity areas where particular types of column or fixings may be desirable.

All listed Street Lighting installations are designed to suit the environment in which it sits, there are notes as an attachment within Mayrise SLCM which record particular details on the asset which would include heritage and consistency of character considerations.

7.7 Risk Assessment

Key Risks

The main risk associated with street lighting is the structural failure or collapse of a column onto moving traffic or pedestrians. Other serious risks include those associated with electricity and the power supply or the non-functionality of apparatus.

Risk Management

The targeted inspection regime reduces the risks associated with the structural failure of columns. Regular testing of equipment reduces the risks associated with electrical wiring and equipment.

Risk is evaluated and modelled by use of our 'street lighting computerised [asset] management system' (S'CM) as described below and mapped with to the 'Resilient Network' infrastructure. This allows for pre-emptive intervention based on a number of limiting factors as detailed

1. The level of risk that is acceptable (As Low as is Reasonably Practical – ALARP)
2. Reputational Impact
3. Legal Liability
4. Critical function of the network
5. Budgetary Constraints (funding)

Maintenance work on lighting columns must be carried out by competent contractors with a trained workforce following the correct procedures.

Core Qualifications / Competencies

- G39 – Working in the vicinity of DNO/IDNO equipment
- New Roads and Street Works Act 1991, the installation, renewal, maintenance and inspection of underground apparatus in any street or road Maintained by SWQR
- IPAF – MEWP operator training and assessment
- HESA approved Highway Electrical Training and Assessment Portfolio

- British Standard BS 7671 "Requirements for Electrical Installations. IET Wiring Regulations" certification
- BS5489 – Lighting Design Competency – Institute of Lighting Professionals (ILP)

CPD training to include internal and external competency uplift is also controlled by the section manager and reviewed during 1:1 performance reviews.

7.8 Disposal or Downgrading of Asset

Removal of Street Lighting

When street lighting is removed it is important that the work is carried out by competent contractors and is co-ordinated with the electricity supply organisation as necessary.

7.9 Asset Condition and Performance

Replacement Value

An overall replacement value of £34 million has been estimated for the Street Lighting asset group.

Mayrise is used to produce valuations of the Gross Replacement Cost (GRC), Depreciated Replacement Cost (DRC);

7.10 Asset Condition

The condition of the lighting columns on the city's highway network remains a concern because of the age of the stock and the lack of a replacement programme over the years. Some records of the age of the equipment are held but information is not complete.

Based on current backlog, we would require a capital investment of approximately £13.2M to replace 11077 street light units that fall outside their designed life expectancy, given that as the only criteria. However, given on-site assessments of asset condition, it is estimated that this backlog is approximately of £7 million as approximately 20% of the asset as ben found to be in need of replacement, rather than the 38.5% that is past it the initial design life expectancy.

Historic / Current maintenance programmes have identified 5% of lighting stock falling as C1* defective, and we are able to break these down on an age profile as follows:

ASSET	<20 YEARS OLD	20-25 YEARS OLD	26-30 YEARS OLD	31-40 YEARS OLD	41+ YEARS
Column / Signage	25%	20%	4.2%	17.6%	32%

[BP6] * C1 = Category 1 = Urgent requiring immediate attention (within 2 Hrs)

At the current rate of investment, this will take 66 years to achieve.

The costing has been calculated with the following assumptions:

1. 49.6% of lighting stock are over the designed life expectancy of 30 Years

2. Water side locality has detrimental effect of protective coating and steel work

3. Reduction of 18% of total affected units allowing for over engineered lighting stock and sheltered position with low footfall

4. Average unit price of £1200.00 to replace lighting column / post assembly

Clarification of Asset Condition

	EXCELLENT	GOOD	AVERAGE	POOR
Condition of street lighting – the percentage of street lighting columns which have undergone structural testing and have failed the test.	<1 in 5,000	>1 in 1,000	1 in 200	>1 in 200

The current condition of the street lighting stock is Average.

7.11 Maintenance Regimes

Reactive Maintenance

Serious defects are generally attended to within two hours by the Street Lighting Maintenance Contractor. Sites are made safe by signing or repair.

Routine Maintenance

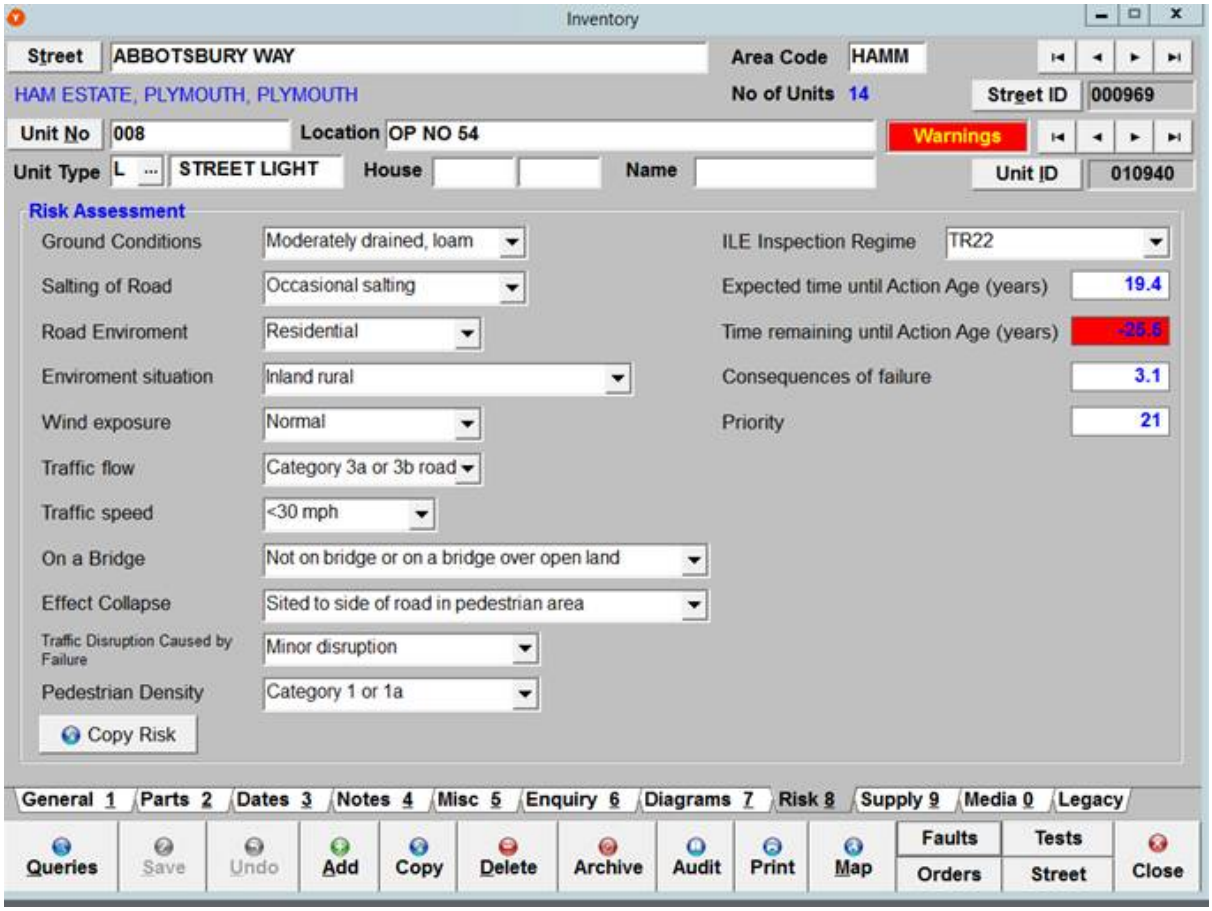
Routine maintenance is carried out by the specialist street lighting maintenance contractor on a regular programme. There is a three and six yearly programme of lamp replacement.

Planned Maintenance

The Street Lighting Computerised [asset] management System (SLCM) allows for the capture of inventory data that includes for condition and location. This is then calculated to produce an action, together with consequence and priority ratings – this is compiled as a report which and mapped against the resilient network to allows for an informed decision to be made. We are then able to target available funds to the asset replacement requirements.

In addition to the intrusive inspection we populate risk profiling on a locative basis as per example below. The fields can be populated 'back office' or 'on-site' utilising a hand held unit that captures the information and later uploaded onto our SLCM system.

SLCM Screen shot of relative enquiry



A programme of planned maintenance is being developed, the associated costs can be found in Appendix A. The costs for the previous 2 financial years are set out in the below table:

YEAR	2017/18	2018/19
Expenditure	£600,000	£580,000

8. Traffic Signals and Information Systems Lifecycle Plan

Function

To provide information to drivers and control vehicular movements at junctions and other locations on the network and controlled pedestrian crossings.

Legal obligations

There is no statutory requirement to install traffic signals however the Highways Act 1980 and related legislation places duty to maintain Traffic Signals in a safe condition on the highway authority.

Inventory Summary

Scale and size of asset

DESCRIPTION	NUMBER
Traffic signal Junction	119
Signal controlled pedestrian crossings	60
Car park counters	9
Car park guidance signs	18
Free text Variable Message Signs (VMS)	12
Automatic Number Plate Recognition (ANPR) cameras across 5 sites	25
Traffic count sites	9
Traffic management CCTV cameras, maintained in house	32

Location and type of Inventory

The detail of these assets is held in electronic records on the Imtrac system.

Coverage of Inventory Data

Good information on all signal and electronic equipment is held in terms of type and equipment age. More limited information is available on condition.

Reliability of Inventory data

Traffic signal and other electronic equipment data held on Imtrac is usually reliable and up to date

System for managing and updating data

Information is regularly updated following inspection, maintenance and improvement works.

Information is updated following adoption of new signal equipment and associated works following the completion by others.

8.1 Inspection and assessment

Safety Inspections

Safety Inspections of the highway network are carried out by driven inspections in accordance with the Highways Safety Inspection Manual. These would be expected to identify any serious defects or obvious malfunction of the equipment.

In addition, Inspections are made in response to calls and Firmstep reports by others.

Service and Condition Inspection Regime

Annual Periodic inspection by qualified maintenance contractor, recorded onto the Imtrac system.

Ad hoc inspection by qualified maintenance engineer whilst responding to faults recorded onto the Imtrac system.

Ad hoc inspection by PCC Traffic Signal engineers / technician any issues found recorded onto the Imtrac system.

System for recording Inspections

The Imtrac system is used to record the results of condition surveys.

8.2 Creation of new assets

New Traffic Signal and Information System Assets by Developers

All equipment installed by developers is adopted subject to compliance with Plymouth City Council Specifications. The condition of the asset is inspected and its operation reviewed before adoption.

New Traffic Signal and Information System Assets by Highway Authority

Any new assets are designed and constructed to current design standards and usually arise from new assets provided by Plymouth City Council led transport schemes or new assets provided by Plymouth City Council led safety schemes.

8.3 Key asset performance Targets

Performance Management Targets

KPIs (Key performance Indicators) are included within the maintenance contract principally for the purpose of monitoring contract performance. But these are also used to monitor to performance of the asset.

- KPI 1- Priority 1 fault attendance, 2 hour.
- KPI 2- Priority 1 fault fixes.
- KPI 3- Priority 2 fault fixes, 24 hour.
- KPI 4- Priority 5 fixes.
- KPI 5- Periodic Inspections.
- KPI 6- Bulk Lamp Changes.
- KPI 7- Premature Lamp Failure.
- KPI 8- Spares Availability.
- KPI 9- Loop Repairs (not currently monitored).
- KPI 10- Traffic Signal Availability.

Corporate Targets

Congestion reduction is a key corporate target and is in line with the goal of Keeping Plymouth Moving.

8.4 Public perception of asset.

Public Perception

Traffic signals, electronic signage and enforcement cameras are generally accepted as an appropriate safety or aid to movement for both vehicular traffic and pedestrians.

Public Expectation

Well maintained and correctly functioning Traffic signal and Intelligent Transport System assets are generally invisible to our customers, where this is not the case Plymouth City Council are seen to have failed.

- To provide a safe highway network
- Created unnecessary delay due to poor co-ordination of traffic signals.
- Unreliable journey times
- Delays to public transport
- Poor condition of street furniture.

8.5 Environmental and Heritage Considerations

Environmental

Traffic signals and other equipment may be located in areas of particular sensitivity and whilst care is taken in the positioning of equipment, the scope to alter layouts is limited.

- Our older sites have higher energy consumption.

- Current specification for new and refurbished site lowers energy usage.
- Current specification increases design life of sites by the identification of key components that are known weaknesses and investment in alternative technologies.

Heritage

Traffic signals and other equipment may be located in areas such as conservation areas or historic areas, but the scope of mitigating the impact is often limited by technical and design requirements.

8.6 Risk Assessment

Key risks

The malfunction of equipment could result in inefficient operation or potential safety problems. The deterioration in poles or fixings could cause realignment of signal heads. There is a potential risk of injury due to electrical faults.

- Electrical equipment on the highway, Risk of electric shock due to deterioration.
- Electrical equipment on the highway, Risk of electric shock due to damage.
- Failure, all lamps out, leading to increased risk of accidents. If it is deemed these failures are due to poor maintenance, spares availability / unobtainable there is risk to the authority of being held liable.
- Lamp Failure, increased risk of accidents
- Detector faults, reducing junction or pedestrian crossing efficiency causing congestion and dissatisfaction.
- Risk of obsolete equipment failing resulting in extended downtime or unplanned replacement

Risk Management

A programmed and targeted inspection regime can reduce the risks associated with the structural failure of poles or deterioration of electrical wiring and equipment.

Faults such as signals not working are reported by highway inspectors, through Firmstep or by others.

Maintenance and replacement work must be carried out by competent contractors with a trained workforce following correct procedures.

8.7 Disposal or downgrading of Asset

The removal of Traffic Signals requires the original reasons for their installations to have changed. For example if a site was designed to solve a safety issue, a new road bypassing the junction may be used as evidence in a business case for the road to be redesigned and the removal of the Traffic Signals. When this occurs the design of new road scheme should capture this and the costs should within that scheme.

8.8 Asset Value

Replacement Value

An approximate replacement value of £20m has been calculated for this asset group.

8.9 Asset Condition

	EXCELLENT	GOOD	AVERAGE	POOR
Condition of traffic signals – the percentage of traffic signal sites greater than 20 years old.	<2%	2% - 4%	>4% - 8%	>8%

Based on this classification the asset condition currently is Average.

Traffic Signal systems have a design life of 15 years.

Manufacturers are required to maintain and repair equipment for 15 years after production has ceased, although component supply can make this impossible.

15 years after production has finished, equipment is considered to be obsolete and therefore unmaintainable.

The age of Plymouth City Council traffic signal and ITS assets ranges from new to over 30 years.

8.10 Maintenance Strategy

Reactive maintenance

Reactive maintenance is carried by the specialist equipment maintenance contractor as required.

Faults are reported from a variety of sources.

- Remote monitoring through the PCSCOOT system
- Remote monitoring through the ImCity system.
- Faults identified by MOP / stakeholders and recorded through Firmstep.
- Faults identified through Periodic Inspection recorded through Imtrac
- Faults identified by the maintenance contractor recorded through Imtrac
- Faults identified by Plymouth City Council staff

Once a fault has been identified a priority level is applied by the PCC staff and a job is raised on the Imtrac system.

Routine Maintenance

Routine Maintenance is carried out by the specialist equipment maintenance contractor on a regular programme.

Planned maintenance

As part of the maintenance contract an annual periodic inspection is carried out and the results loaded onto Imtrac.

Example PI sheets New Traffic Signal and Information System Assets

Site Ref	Site Address		Date	26/09/2017
J38121	NOTTE ST LOCKYER ST		Engineer	Chris Sherlock

Note: For condition use Good / Fair / Poor / Urgent

Controller		LV OUT Type		Controller Serial no	
Controller type	T400		Stratos		NA
Site spec present	Y	Site Plan correct	NA	Date revised	NA
EPROM no:	Y	Check-sum number	NA	MOVA licence no	NA
Log book present		EPROM no matches spec	Y	MOVA dataset version	NA

Controller earth fault loop impedance		0.36		Controller supply voltage	230V
Date of back up battery -	Controller	NONE		All cables labelled	Y
	OMU	NONE		All cables secure and tidy	Y
RCD Trip tests ok	Y	Fuses correct		Earth bonded	Y

Controller case & foundation condition	POOR	Terminal blocks / backplane condition	FAIR	Earth Connections and bonding condition	Good
Accessibility of controller	POOR	Door seal operational	N	Door bolts operational	N
Base seal intact	Y	Site number on case	N	Anti-Graffiti coating	N
Dimming operational	Y	Dimming voltage	160V		

TOD/BSA/BSR correct?	Y	Fault log clear	Y	Correct operation of configured modes	Y
Manual panel facilities/ lamps fully operational	Y	OMU / OTU reports lamp faults to instation	not checked		

Record of any temporary data (RAM DATA CHANGES)

All lamps working correctly?	Y	All AGDs working correctly?	NA	Inside of controller cleaned	Y
All loops working correctly?	Y	All oncrossings working correctly?	NA	Manual panel operates correctly, cleaned / lubricated	Y
Hinges / locks lubricated:	Y	All kerbsides working correctly?	NA	Lenses cleaned	TIS
Log book completed: (supply new if required)	Y	Evidence of infestation	N	Above ground detection cleaned	TIS

Asset Management Equipment	Number	Condition	Equipment	Number	Condition
RAG:	10	See notes	RAGA		
RAG+GA	1	fair/good	RAGA+GA		
RAG+RS	2	poor	RAGA+RS		
Box signs			Backing boards	All	3 good rest poor
			Reflective tape / border intact	All	3 good rest poor
Farside RM/GM	4	poor	Puffin Nearside Units		
Farside Cycle RM/GM			Toucan nearside units		
Farside Equestrian RM/GM			Equestrian nearside units		
PBU / wait unit	3	poor	Demand only units		
Audible Units			Indicator only units		
Tactiles			High level repeater units		
Standard Poles	9	see notes	Mast Arms		
Short poles			High Poles		
Swan-Neck poles			Brackets	All	3 good rest poor
Pole caps	9	see notes	Fixings on Lamp Columns		
4 Channel det packs	5	OK	Microwave vehicle detectors		
2 Channel det packs			Infra-Red Vehicle detectors		
Oncrossing detectors			Radar Detection		
Kerbside detectors			Other detection		

Site Ref	Site Address
J38121	NOTTE ST LOCKYER ST

Test Equipment Used	Serial Number	Calibration date	Job number
RCD TESTER KT-56	7003326	22/06/2017	5623
MEGGER KT-45	7016882	22/06/2017	5624

Earthings

TNCS		TN-S		TNC	X	TT	

Operation of RCD Protecting 13A Sockets

Phase	1/2n	1n	5½n
0 deg	No Trip	27ms	19ms
180 deg	No Trip	29ms	22ms

Main Overcurrent Protection Device and Rating	63A
Main Isolator / Circuit Breaker Device and Rating	30A
Main Equipotential Bonding Conductor Size	6mm

Earth Loop Impedance at the Pole top (Ohms)

Pole No	Ohms	Pole No	Ohms	Pole No	Ohms	Pole No	Ohms	Pole No	Ohms
1		10		19		28		37	
2		11		20		29		38	
3		12		21		30		39	
4		13		22		31		40	
5		14		23		32		41	
6		15		24		33		42	
7		16		25		34		43	
8		17		26		35		44	
9		18		27		36		45	
Earth Loop Impedance at source (Ohms)		0.36							

Condition of Terminal blocks	POOR	Condition of Earth Connections and Bonding	POOR	Condition of mechanical support cables	N/A
Wait Lamp voltage correct	50V			Cables Labelled?	NA

Polarity Check: Pass P, Fail

Departures from 17th Edition and any other comments

Are any urgent works required at this site?	Y
Does a County engineer need to inspect the site within 6 months	Y

Name (Block Letters)	Date of visit	Signature
Chris Sherlock	26/09/2017	Sherlock

Plymouth City Council has provided funds allowing for the replacement of equipment identified as being at high risk of failure of identified as being in a dangerous condition.

It is calculated that there is a £4.51million backlog of equipment renewal based upon the age of the equipment.

The backlog is increasing at the following rate. A programme of renewal expenditure needs to exceed these values to prevent the backlog increasing.

YEAR	2017/18	2018/19	2019/20	2020/21	2021/22
Expenditure	£40K	£150K	£150K	£100K	£300K

Developer contributions have allowed the asset to be improved for example by including pedestrian facilities, inclusion of adaptive control strategies.

Plymouth City Council schemes designed to reduce congestion, improve connectivity, provide bus priority and inform the public have improved the asset.

9. Street Furniture Lifecycle Plan

Function

To protect and provide guidance for all highway users.

Legal obligations

Highways Act 1980 and related legislation places a duty of care for all highway users.

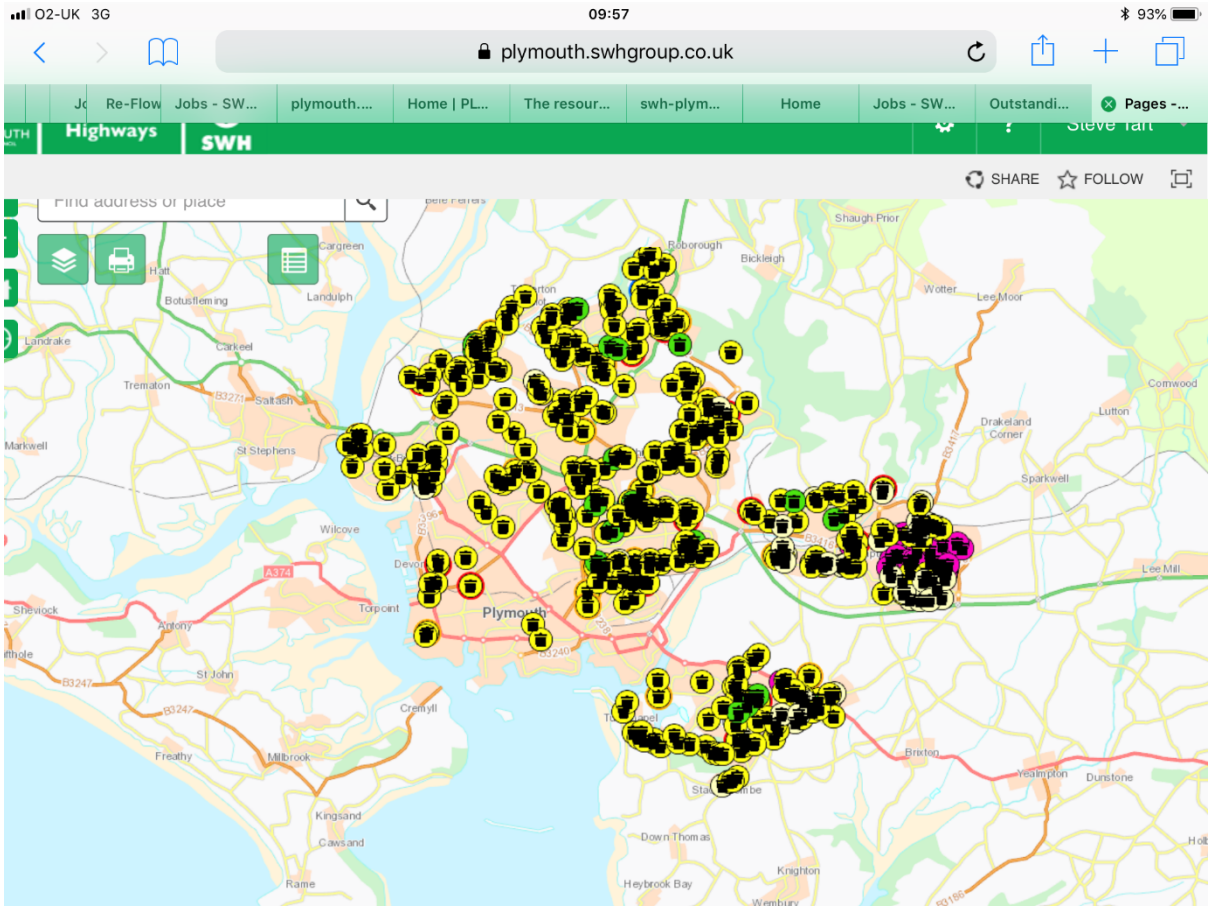
9.1 Inventory information summary

Scale and size of asset

DESCRIPTION	QUANTITY
Salt/Grit Bins	427
Vehicle Restraint System	Unknown
Non-illuminated Direction Bollards	Unknown
Bollards	Unknown
Planters	Unknown
Non-illuminated Sign Posts	Unknown
Signs	Unknown

Location and type of inventory

Location of salt/grit bins plotted on OS Map electric databox.



Location and type of some vehicle restraint systems recorded on HIMS.

No information is currently held on other street furniture types.

Coverage of inventory data

Excellent coverage for salt/grit bins.

Limited condition information for vehicle restraint systems.

No information is currently held on conditions of other street furniture types.

Reliability of inventory data

Reliable up to date information on salt/grit bins.

The information on vehicle restraint systems is limited and requires updating.

System for managing and updating data

There is no management process in place to capture and/or update the data.

There is an aspiration to capture all street furniture and for it to be recorded on HIMS.

9.2 Inspection and assessment regimes

Safety inspections

Street furniture is inspected alongside carriageway and footway safety inspections.

Safety inspection frequency

FEATURE	DESCRIPTION	CATEGORY	FREQUENCY
Carriageways	Strategic route	2	1 month
	Main distributor	3a	1 month
	Secondary distributor	3b	1 month
	Link road	4a	3 months
Footways	Prestige area	1a	1 month
	Primary walking route	1	1 month
	Secondary walking route	2	3 months
	Link footway	3	6 months
	Local access footway	4	1 year
Cycle routes	Part of carriageway	A	As for carriageways
	Remote from carriageway	B	As for footways
	Cycle trails	C	1 year

In addition, inspections are made in response to customer, staff and contractor reports.

Salt/grit bins are inspected annually and once mid-season.

Service and condition inspection regime

Service and condition surveys are not currently undertaken. Safety inspections are as described above.

System for recording inspections

Safety defects, in accordance with the Highways Safety Inspection Manual for each type of street furniture, are recorded on HIMS.

9.3 Creation of new assets

Street furniture installations are created from a number of activities such as Section 38 and 278 works, infrastructure improvements and following safety audits.

9.4 Key asset performance targets

There are no asset performance targets for this asset type.

9.5 Public perception of asset

Public perception

There are no measurable levels of public perception regarding street furniture.

Public expectation

The public expect defective street furniture to be repaired within reasonable timescales.

9.6 Environmental and heritage considerations

Environmental

Street furniture is often located in areas of particular sensitivity, such as near schools, hospitals or residential areas where restrictions on working times and maintenance processes may need to be applied.

Heritage

Street furniture within conservation areas will be given extra consideration to ensure they are aesthetically suitable.

9.7 Risk assessment

Key risks

Safety critical street furniture such as vehicle restraint systems and pedestrian guardrails provide safety for both motor vehicles and pedestrians. Deterioration of these assets may inhibit their usefulness in preventing serious injury.

Risk management

As programmed and targeted maintenance programme significantly reduces the risks associated with highways, and can improve road safety and reduce claims against Plymouth City Council. Within the limited funding it is important to target repairs and maintenance works at those areas most in need.

Maintenance work on street furniture will be carried out by competent contractors with a trained workforce following the correct procedures.

9.8 Disposal or downgrading of asset

Asset condition and performance

Street furniture may be disposed of following the change of highway use, e.g. stopping up of a street. Disposal may also come about from reactive repairs where the street furniture is assessed to be no longer required e.g. within a Lean Streets process.

9.9 Asset condition and performance

Replacement value

There is insufficient data to produce a replacement value for this asset group.

9.10 Asset condition

There is insufficient data to produce a replacement value for this asset group.

9.11 Maintenance strategy

Reaction maintenance regime

Street furniture is inspected alongside carriageway and footway safety inspections. Safety defects identified will be actioned within timescales set out in the Highways Safety Inspection Manual.

Version December 2018

APPENDIX A: ASSET DETEREIORATION AND INVESTMENT MODELS

APPENDIX B: DRAINAGE ASSET HISTORIC CONDITION AND REPLACEMENT VALUES