KENT HIGHWAY SERVICES

PLANNED CARRIAGEWAY MAINTENANCE

INFORMATION NOTE

September 2010

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Forward

Last winter's weather was the worst seen across the country for almost three decades and has forced all local authorities to review how they look after one of their most valuable assets, their roads. Kent Highway Services has reacted in a number of ways to the weather damage, from the successful 'find and fix' programme and innovative 'jet-patching' of minor country lanes to the improved information and reporting of faults via the website.

Kent County Council has a legal obligation under the Highways Act to maintain roads. Whilst this day-to-day repair activity is critical for the 'here and now', it is important that we plan for the future, invest in our roads and undertake preventative treatments to avoid costly reactive repairs.

In difficult financial times it is important that the public, Members and our staff have a clear understanding of how we are managing this type of preventative work. They also need to understand the options that we have available to us via the competitive market and why we use certain types of treatment, as opposed to others. It is critical we demonstrate that we are driving value for money in how the work is procured and that the appropriate treatment is delivered to local residents and road users.

The preventative maintenance work we undertake is a result of a series of technical surveys, inspections and engagement with the community. It also follows the standards set out in a number of policy documents and codes of practice. The 'Planned Carriageway Maintenance Guide' is a short and concise document that outlines what causes roads to deteriorate, how sections of roads are assessed and selected for repair and the range of treatments that are available. An important aspect of planned maintenance is the timely undertaking of preventative maintenance which has the benefits of being more costs effective and less disruptive. We often use the every day analogy that if you have a house fitted with wooden windows you would maintain them through regular painting rather than replacing them. In the context of highway maintenance we have available to us techniques that achieve this effect.

Kent Highway Services is keen to work with Members, District, Town and Parish Councils and the local community to ensure the right level of service is provided. By developing documents like the 'Planned Carriageway Maintenance Guide', we aim to provide better information about what we do, confidence in why we do it and better engage with the communities we serve, to work together to deliver a better service.

Nick Chard
Cabinet Member for Environment, Highways and Waste
September 2010

1.0 Introduction

As the Highway Authority, the Kent County Council (KCC) is responsible for the maintenance of Kent's roads and pavements, except for the motorways and trunk roads. KCC has a duty under the Highways Act 1980 to maintain the network in a safe condition. To achieve this, we carry out three types of maintenance activities, Cyclic, Reactive and Programmed. A brief description of Cyclic and Reactive is given below, but the main focus of this document is on Programmed Maintenance activities.

Cyclic Maintenance
This involves work that is done on a regular basis to maintain and protect the use of our roads. This includes things like drain and gully emptying, cleaning signs and bollards, repainting road-marking, replacing cats eyes, grass cutting and replacing lamps in street lights.

Reactive Maintenance
These are activities that need to be dealt with quickly, as a priority, in order to keep the road safe. These include things like potholes, local flooding, falling trees, trimming occasional overhanging branches and vegetation and repairing or removing damaged street furniture.

Planned Maintenance
The national guidance document 'Well-maintained Highways – Code of Practice for Highways Maintenance Management' describes programmed maintenance as:

"Programmed Maintenance is undertaken primarily in the interests of providing for a sustainable outcome, seeking to minimise cost over time, to add community value to the network or the environment. It can also be for safety purposes e.g. improving skidding resistance or contributing to serviceability, for example improving ride quality."

A key theme within highway maintenance over the recent years has been the need for a greater understanding of the assets we own and how to maintain them. The Local Transport Plan (LTP) 2006 requires us to provide details of our Transport Asset Management Plan (TAMP). The plan applies to all types of transport infrastructures covered within the LTP and in practice consists of individual asset plans for all the various schemes we build. The Highways Asset Management Plan (HAMP) is the document that refers to the highway element of the transportation network. An Asset Management Plan must therefore consider both the physical condition of the asset as well as how the asset is used.

The highway network is the most valuable asset that KCC manage, in terms of its actual monitory value, and the role the network plays in day to day activities of communities and the county. It's therefore important that the network is managed in a way that ensures easy, safe and reliable movement along it. To achieve these, the Asset Management Plan

must consider the current make-up and condition of the network, what level of service it is required to provide, future changes both in terms of its make-up, condition and level of service, and how the network will be managed to achieve the desired results.

The purpose of this document is to provide an overview of how we implement this by undertaking the following measures in respect of our highway network

- Defining the network
- Understanding the existing and predicting the condition of the network
- Ensuring the most efficient maintenance regime is applied to the network

2.0 The Network

Kent's roads and pavements are known as the highway network. They are divided into two groups - the National Road Classification System, such as A, B, C and unclassified roads (U), and Kent's Road Maintenance Hierarchy.

Kent's Road Maintenance Hierarchy is based on the recommendations contained within the 'Code of Practice for Well-maintained Highways (Code of Practice). The Code of Practice states that a well considered network hierarchy is one that reflects how roads are actually used and that this should be the foundation of a consistent and affordable maintenance strategy.

We have adopted this recommendation and have grouped or road network into four hierarchal types:

- Major Strategic (MS) – routes, or parts of routes, linking major urban centres where these are not linked by trunk roads
- Other Strategic (OS) – routes or part of routes, between other urban centres or centres of industry/commerce.
- Locally Important (LI) – routes, or part of routes, of local importance in distribution of goods or people.
- Minor Roads (MR) – all other routes, including estate roads and rural lanes.

The inspection/survey and maintenance regime for each road reflects its position within the hierarchy. However, we are required to report to the Government on items such as the condition of the roads based on the nation road classification system. The classification and maintenance hierarchy of the network in Kent is shown in the table.

District	Maintenance Hierarchy					Classification				
	MS	OD	LI	MR	Total	A	B	C	U	Total
Ashford	35	110	141	786	1072	128	50	332	562	1072
Canterbury	70	71	110	539	790	112	23	120	535	790
Dartford	27	54	47	170	298	45	36	34	183	298
Dover	7	73	92	587	759	74	17	205	463	759
Gravesend	24	27	81	229	361	44	9	59	249	361
Maidstone	51	71	163	709	994	108	50	212	624	994
Sevenoaks	10	91	98	588	787	64	76	236	411	787
Shepway	24	53	102	586	765	73	40	179	473	765
Swale	37	39	84	622	782	52	30	173	527	782
Thanet	31	64	78	335	508	71	38	52	347	508
Tonbridge.& Malling	80	56	91	433	660	112	20	139	389	660
Tunbridge Wells	13	67	151	416	647	75	62	144	366	647
Total	**409**	**776**	**1238**	**6000**	**8423**	**958**	**451**	**1885**	**5129**	**8423**

3.0 Condition of the Network

3.1 Inspection/Survey Regime

Details relating to the condition of the highway network are obtained from the following sources:

- Safety inspections
- Reports from Kent Highway Services' (KHS) staff, Parish/District Councils, KCC Members and the public
- Condition surveys

i) Safety Inspections
As the name suggests, the purpose of safety inspections is to identify defects that present a hazard to the people who use the roads. They also provide important details for defending insurance claims. Problems that are reported as part of these inspections are limited in nature and include things such as potholes, defective manholes or gullies, worn and faded road making and are generally used for planning reactive and routine maintenance.

Safety inspections are carried out using the guideline in the Kent's Operational Reference Book (ORB) and the frequency of inspections relate to the network hierarchy, as identified below:

- High speed dual carriageways: weekly
- Major strategic and other strategic routes: monthly
- Local important and minor roads: twice a year

ii) Reports from KHS staff, Parish/District Councils, KCC Members and the public
These will usually result in a site inspection by a highway inspector or works gangs who will determine if routine or more major works are required.

iii) Condition Surveys

The surveys provide detailed information about the condition of the road and this is used to develop the annual maintenance programme. These surveys conform to national standards and are processed by accredited systems. The surveys establish key characteristics of the network including the quality of the journey, tyre groves in the road, the depth of the road's layers and skid resistance. The main types of condition surveys and the roads they cover are identified below:

a) SCANNER (Surface Condition Assessment for the National Network of Roads)

This involves using a specialised survey vehicle that is able to establish the quality of the carriageway condition, such as surface texture, cracking, and edge deterioration, whilst travelling at normal driving speeds. The data collected from this exercise is used, along with other surveys to understand the specific maintenance needs of the classified network within Kent.

The SCANNER survey is undertaken on the classified road network as follows:

- 'A' and 'B' Roads – 100% of the network in one direction annually. The direction of the survey is alternated each year meaning both directions are covered within a two year period.
- 'C' Road Network - 50% of the 'C' road network in one direction annually. The direction of the survey is alternated every two years meaning both directions are covered every four years.

However, Kent has taken the decision to operate a slightly enhanced regime based on its maintenance hierarchy described in Section 2. Therefore, all unclassified roads that fall within the category of Locally Important or above are also covered by the survey.

b) Kent DVI (Driven Visual Inspection)

This is undertaken by a slow moving vehicle, which allows a large part of the unclassified network to be assessed each year. The survey is carried out by specially trained inspectors to ensure consistency. The data produced from these inspections is processed within the same system as the SCANNER data. It is used to assist in determining the specific maintenance needs of the unclassified network within Kent. Changes to the frequency of this survey have recently been considered and it is proposed that in future, the survey will be undertaken on 25% of the unclassified network each year, meaning all unclassified roads will be covered in a four year cycle.

c) SCRIM (Sideway-force Coefficient Routine Investigation Machine)

The SCRIM survey is used to identify the resistance of surface to skidding and is undertaken using a specialised vehicle travelling at normal driving speed.

All Major Strategic and Other Strategic network, as well as 'A' and 'B' class roads not within these categories, are surveyed annually.

The data from the survey is processed and assessed to identify sections of the network that require further investigation by an engineer.

3.2 Modes of Deterioration

Roads deteriorate over time and how this deterioration develops is largely dependant on the construction of the road and the type and volume of traffic using it. The highway network in the UK has evolved over a long period of time. Whilst the strategic network may consist of roads that have been designed to an appropriate standard, the local road network is more variable, ranging from a sound construction to 19th century roads.

There are three basic forms of road construction:

- Flexible – consisting of bituminous bound macadam, usually referred to as 'Tarmac', as surface and sub-surface structure.
- Rigid – consisting of concrete as surface and structural layers.
- Semi Flexible – a hybrid consisting of bituminous bound macadam surfacing layer and concrete structural layer.
- Modular – this type of construction is typically based on similar foundations to flexible but the surface consists of either small stone, concrete or clay paviors. Examples of this would be, roads surfaced using granite sets or block paving.

Each of these types of roads will deteriorate in a different way and therefore different methods of maintenance are required to address the defects as they develop.

The principal reasons for deterioration of roads are environmental effects, wear and tear or a combination of both. When a combination of both occurs, the rate of deterioration of the road increases quickly.

Environmental Factors:

- Rain – when rain penetrates cracks in the carriageway surface, can turn to ice and expand during cold weather conditions, breaking up the surface material.
- Air - causes oxidisation of bitumen in flexible road surfacing, causing the material to become brittle and prone to cracking.
- Sunlight - UV radiation breaks down the bitumen used in flexible road construction.
- Heat – the thermal expansion and contraction of material due to temperature variations will crack the road surface.

Wear and Tear

This occurs either due to the volume and weight of traffic passing over the road or the activities of utility companies. A modern road is constructed to distribute the weight of vehicles passing over it to the underlying soil, at a level that the soil can support. If the load being transferred to the underlying soil becomes too high, the road structure will fail over time. The weight of vehicles is generally associated with high numbers of HGVs passing over the road. By contrast, light vehicles, such as cars, impose very little or no weight on the road and therefore have very little impact.

Work undertaken by utility companies also negatively affects the structure of the road because they create a break in the road structure and surface materials, and could weaken the road. If these works are poorly repaired then this affect builds up in time and the life expectancy of the road is greatly reduced

An example of these factors combining is when the road develops cracking due to heavy vehicles or poor road repairs thus allowing water to penetrate to the underlying soil. This in turn weakens the soil and so reduces its ability to withstand everyday use. This then leads to more extensive and serious cracking and ultimately results in the failure of the road.

As roads age and wear the incidents of defects increase. Outlined below is a list of typical defects with an overview of their causes and details on the most likely form of treatment.

Pothole

Potholes are the defect most familiar to road users. Whilst in isolation they are most likely to result from a localised failure in the surface material, in certain cases it may be a sign of a more major failure, especially when combined with cracking. Potholes can present a safety hazard and are normally managed as routine maintenance activity and made safe by small scale repairs If left to deteriorate, potholes can grow quickly, both in area and depth, dependant on volume and weight of traffic and weather conditions.

Regular appearance of potholes can be a symptom that the surface material is approaching the end of its life and should be considered for replacement or the presence of other problems under the road surface.

Aggregate Loss (Bituminous Roads)

The public generally refer to the materials used in flexible road construction as ‘tarmac’(short for Tarmacadam). Tarmac has not been used for a number of decades due to the lack of availability of tar and, more importantly, the health issues associated with it, so it has now been replaced by bitumen. Tarmac is essentially a mixture of stone and gravel of different sizes (called aggregate), compacted into layers to make the Macadam. This Macadam is held together by a binding material, originally tar, but now bitumen as stated above (hence the term ‘Tar-mac’). This form of road construction was developed by John Loudon McAdam in the 1820’s and over the subsequent years there have been many innovations in materials but the principle remains the same.

As referred to previously bitumen over a period of time is attacked by the elements, including oxygen within the air, and sunlight. This attack has the effect of making the material less flexible and therefore brittle. When this occurs the ability of the bitumen to act as a binding agent is reduced and ultimately it will fail. This can be seen either as loose aggregate on the road surface or small holes, which, if left untreated, will ultimately result in potholes. Once this process starts, the action of vehicles passing over the surface accelerates the deterioration. If localised, then routine patching may be the appropriate course of action but if the road is significantly affected then either surface dressing or micro asphalt should be considered.

Aggregate Loss (Concrete Roads)

Concrete roads will also suffer from a loss of material at its surface and within its structure, although typically over a much longer timescale than bitumen. Material loss (or aggregate loss) in concrete roads occurs through the process of wear, water seeping into the road and break down of the bond between the materials within the concretes structure. Whilst in some cases shallow potholes occur, more frequently the result is a rough surface which provides uncomfortable and noisy ride quality. The repair of concrete roads poses a greater challenge than bituminous ones and whilst it is possible to undertake localised repairs, the area repaired has to remain traffic free for a period of time. If the affected area is large it is usual to consider some form of resurfacing which overlays the existing concrete surface.

Cracking (Bituminous Roads)

Unless it is severe, most people that use the roads will not notice cracking but it can present a significant threat to the structural quality of the road. Cracks in the road structure allow water to seep into the road causing a weakening of the underlying soil and accelerating the aging of bituminous materials.

Cracking can occur due to a number of reasons including the normal aging of the surface material, excessive strain on the road by the volume / weight of traffic, failure of the road foundation or changes in the underlying ground conditions. It is important for engineers to understand the actual cause of the cracking before deciding on the appropriate course of action. If cracking is due to aging and caught early, it is possible to stop further deterioration by improving the road surface (using surface dressing or micro asphalt). If the cracking is confined to the surface layer and there is no underlying structural failure, then resurfacing (replacing the road's top layer) may be selected. However, if cracking has been caused by a more fundamental structural problem then it may be necessary to replace the full depth of the structural layers of the road in a process known as reconstruction.

Cracking (Concrete Roads)

Cracking in concrete roads usually results from either excessive use of the road by heavy vehicles or changes that have occurred in the underlying soil. Whilst ground conditions may change through environmental and geotechnical reasons, they can also be affected by water seepage through the construction joints that are a feature of concrete roads. When the underlying soil becomes wet it loses its strength and therefore is less able to support the road. It is not unusual for gaps, or pockets, to form under concrete roads, which are, often caused by ground water washing the underlying soil away. The road will then span these pockets, and when subjected to routine traffic use, cracks will form and further wear and tear will occur. A typical feature of these is rocking slabs which, cause noise and vibration. The remedial course of action could range from the localised replacement of the affected area to more significant reconstruction of the road.

Rutting

When subjected to continuous high levels of traffic bituminous roads develop rutting in wheel track areas. The use of the road by traffic displaces the surfacing, and sometimes the materials within the road structure, by creating an uneven running surface that can, if severe, present a hazard. Although some materials used in more recent years are less prone to rutting, it still does occur on roads that carry high numbers of HGVs.

If localised, rutting can be treated through routine maintenance but if extensive, then resurfacing should be considered either by replacing or overlaying the existing surface as needed.

Deformation

Deformation can occur for several reasons including changes within the underlying soil, excessive road traffic and general wear and tear to the structure of the road caused by public utility companies or us doing works over time. Deformation generally results in a poor quality of journey and sometimes in increased noise levels, if severe, it can cause a hazard.

If localised, deformation can be treated through routine repairs, but if extensive, resurfacing should be considered either by replacing or overlaying the existing surface..

Edge Deterioration

Edge deterioration can be caused by several factors and generally occurs on un-kerbed rural lanes. It can take a number of forms such as deformation, potholes, cracking or a combination of all.

The most common causes are mainly due to the roads original construction not being suited for today's traffic levels. The edge of the road is driven on by vehicles and therefore weakens the underlying soil. This combined with poor drainage, results in the road edge deteriorating.

If localised, edge deterioration can be routinely dealt with through patching, but if more significant lengths are involved an assessment would need to be made to determine whether reconstruction of the edge known as haunching (with the option of surface dressing the whole road during the next surface dressing programme) is required.

Low Skid Resistance

The ability of a road surface to resist vehicles skidding reduces over a period of time due to the wearing and polishing effect of the many thousands of vehicles that pass over it. In the case of bituminous roads, it may also be caused by heat damage leading to higher levels of bitumen on the surface. Either through

polishing or loss of surface texture, the road surface can reach the point where it could present a hazard to highway users, although unlike other defects identified above it is unlikely that drivers would be aware of this.

In most cases it is not possible to deal with this defect through routine maintenance and although repair methods exist to restore the texture of the existing surface material, the effect of such techniques in most cases will be short lived. If the problem is located near to a road feature, such as an approach to a roundabout or sharp bend, the decision may be made to apply a thin layer of high friction material to the existing surface. However, if the section of the road is of a significant length and not specifically related to a feature as described above it would be usual to treat the existing surface either by surface dressing, or resurfacing.

4.0 Planned Maintenance Regimes

4.1 Maintenance Methods

Planned Maintenance can be classed in two groups

- **Preventative**: Maintenance done to prevent the deterioration of the highway network and if not addressed more extensive, expensive and disruptive work would result. Surface dressing and Micro Asphalt are typical approaches to dealing with this problem.

- **Structural**: Maintenance done to restore either the surface, or where required, one or all of the structural layers of the road to the required standard. Resurfacing and reconstruction works fall into this category

A more detailed overview of the main types of work used within Kent is provided below.

Surface Dressing

Surface dressing is an effective and economic method of preventing the deterioration of road surface through aging, minor cracking and loss of texture. Used correctly, it can significantly extend the life of a road.

The process involves spraying the existing surface with a layer of bitumen to both seal the surface and to act as a bonding agent for a layer of chippings which are applied immediately afterwards. The bitumen is capable of sealing minor cracks and preventing future aging of the bitumen in the existing surface material. The layer or layers of chippings, as there can be more than one, restore the surface texture of the road. The process is relatively quick and disruption to traffic is limited.

Surface dressing will not change the existing shape of a road or deal with other serious defects. It is therefore necessary to undertake 'patching' of affected areas on the road surface to deal with these areas before undertaking surface dressing. The process may

not be suitable for all locations and therefore careful consideration should be applied to each potential site as to its suitability and design.

If managed poorly, surface dressing can prove unpopular with road users due to loose chippings and sometimes exposed bitumen but these problems are in most cases avoidable through good design, construction and maintenance.

As a guide, the typical average cost for Surface Dressing is £ 2.75/m² and a life expectancy of seven years

Micro Asphalt

Micro Asphalt, like surface dressing, is a preventative form of maintenance and works in a similar way by both sealing and restoring texture. However, the process differs in that the bitumen and aggregate are mixed prior to laying and to a degree the process can be used to regulate minor defects in the road surface.

As with surface dressing, if significant defects are present these must be attended to prior to laying Micro Asphalt. Micro Asphalt is considered by some to be a high quality form of surface dressing and is generally used in estate roads.

As a guide, the typical average cost for Micro Asphalt is £ 6.00/m² and a life expectancy of seven years.

Resurfacing

Resurfacing is the process of replacing the surface of the road usually to a depth of between 30 - 40mm. This may be done in one of two ways, either removing the existing surface material and laying new material in its place, known as 'inlay resurfacing', or laying new material on top of the existing surface material, known as 'overlay resurfacing'. The decision as to which method is used will depend on the site. Whilst the overlay method is less expensive, and adds some strength to the existing road structure, the nature and type of the road may mean the increase in surface level is not acceptable due to issues such as kerbing, drainage etc.

Resurfacing is more disruptive than Surface Dressing or Micro Asphalt because the process takes longer. However, it is often possible to open the site to traffic when actual work is not in progress.

Whilst adding some strength to the road structure, the surface course main purpose is to provide good and smooth ride qualities and good levels of grip. However, if the road has serious underlying structural problems, resurfacing will not resolve these and whilst it may seem that a short term replacement of the road has been provided, it will quickly fail.

As a guide, the typical average cost for resurfacing is £18.00/m² and a life expectancy of 15-20 years.

Reconstruction

Where the structural integrity of the road has significantly failed to the point where none of the above techniques are appropriate, reconstruction of the road would be required. The objective of road reconstruction is to restore the expected life of the road before major maintenance is required again. This may involve the removal and replacement of part or all of the structural layers of the road, either across the full width of the road or restricted to the side, when it is referred to as haunching.

Reconstruction is the most disruptive form of maintenance, as it is usually not possible to open the road to traffic when work is not in progress due to the depth of material that has been removed. It is also the longest and most expensive process. However, reconstruction allows us to recycle more of the waste products for use as aggregate in other resurfacing schemes.

As a guide, the typical average cost for reconstruction is £40.00/m² and a life expectancy of 25 years.