

Appendix A – Carriageway Lifecycle Plan

Introduction

1. The background to lifecycle plans and the format of each are described in Chapter 6.1. This appendix provides the lifecycle plan for carriageways.
2. For management purposes, carriageways have been defined in categories 2 to 4b as shown in the table below. This is based on the national code of practice “Well Maintained Highways”. These categories reflect the type and use of different carriageways and so will form the basis for sound asset management. National funding and financial reporting is however based on the national classifications (A, B, C and unclassified).

Cat.	Hierarchy	Type of Road	Detailed Description
1	Motorways	Motorway	N/A
2	Strategic Routes	Trunk and Primary A Roads.	Routes between primary destinations.
3a	Main Distributor	Non primary A roads and important or heavily trafficked B roads.	Routes between strategic routes and linking urban centres to the strategic network. Annual average daily traffic: Urban >30,000 (1500 HGV) Rural >12,000 (1000 HGV)
3b	Secondary Distributor	B roads and heavily trafficked C roads.	In rural areas link larger villages to strategic/ main distributor network. In urban areas usually have a 30 mph speed limit and high levels of pedestrian usage. Annual average daily traffic: Urban >20,000 (300 HGV) Rural > 7,000 (150 HGV)
4a	Locally Important Roads	Routes linking into the main/ secondary distributor network, normally C class, with greater local significance in rural areas; plus heavily trafficked unclassified roads.	In rural areas provide inter-village links and connect to distributor network. In urban areas residential or industrial interconnecting roads. Annual average daily traffic: Urban >15,000 (150 HGV) Rural >5000 (100 HGV)
4b	All other metalled Roads	All other C roads and majority of unclassified network.	In rural areas serve smaller villages and provide access to limited number of properties and land. In urban areas predominately residential.

Levels of Service

3. The desirable levels of service for this asset category are set out in the table below (see Chapter 2 of main document). These levels of service would fully meet all aspirations whilst minimising whole-life

costs. This lifecycle plan, in later sections, shows how different levels of available funding will influence the extent to which these desirable levels of service can be achieved.

Attribute	Desired Standard	Performance measure
Availability	All roads available for use at all times bar periods of scheduled or emergency road works	<ul style="list-style-type: none"> • Highway reports • Performance Indicators
Network Integrity	<p>Safety - Road surface of appropriate skid resistance and profile to minimise risk of loss of control accidents.</p> <p>Serviceability - Good standard surface without unevenness or potholes affecting vehicle ride quality</p>	<ul style="list-style-type: none"> • Road casualty statistics • Performance Indicators • CVI surveys • MORI surveys
Condition	At a level consistent with achieving minimum whole life cost, that is NI 130/1 between 3 and 8%, NI 130/2 and 224b between 10 and 15%.	<ul style="list-style-type: none"> • National and local indicators • User surveys

- It will be noted that the levels of service above take a restricted look at, particularly, safety and serviceability. Wider attributes, including alignment, safety of junctions and other aspects currently dealt with under the Council's improvements programme, will be considered for inclusion in future editions of the TAMP, but funding will limit what can be justified.
- Failure to respond adequately to these levels of service will produce risk to the authority. The table below, which details the main risks, underlines the importance of responding properly to each.

Risk type	Description example
Physical	Accidents caused by asset defects
Business	Legal proceedings for failure in duty of care
Financial	Reduction in net book value of the asset because of poor maintenance practice; increased compensation payments following legal action;
Corporate image	Poor condition roads reflect on the overall image of the County Council
Environmental	More premium aggregate, natural resources and energy per kilometre of treated network will be used in reconstruction and shorter life materials as opposed to longer life materials, resurfacing and overlay.
Network	More disruption to pedestrians and others because of emergency unplanned maintenance following poor maintenance practice

Asset base and characteristics

6. The extent of carriageways in four categories is shown in the table below:

	A Road	B Road	C Road	UC Road
	km	km	Km	Km
Urban	113	88.3	425.2	1668.1
Rural	350.5	155.1	886	624.9

The typical carriageway widths for each class and category

Road Class	Typical Width (m)
A	8.0
B	7.4
C	7.1
Unclassified	5.8

And split by hierarchy:

Category	2	3a	3b	4a	4b
Length km	244	185	239	1,071	2,546

Asset Condition and Assessment

7. To assess the extent to which the desirable levels of service are met requires measurements covering the three dimensions of Availability, Network Integrity, and Condition. .
8. The condition of A, B and C roads is assessed annually by SCANNER surveys. A proportion of the unclassified network is assessed annually by (Coarse Visual Inspection) CVI survey. CVI surveys are also done on proportions of A, B and C roads to check trends. Annual deflectograph surveys, which have been carried out on proportions of A and B roads, have been suspended for financial reasons since 2011/12. Griptester surveys are also carried out on a proportion of A and B roads and on a site specific basis on C roads. The table below details the annual survey programme.

	A Roads	B & C Roads	Unclassified
SCANNER	100% (in one direction) surveyed annually	100% (in one direction) surveyed annually	Not surveyed
GRIPTESTER	33% of network surveyed annually	25% of B roads and site specific surveys on C roads	Not surveyed
CVI	20% surveyed annually	50% surveyed annually(may reduce to 20% in future)	25% surveyed annually

9. The Council has set its own standards for the frequency of its highway safety inspections. These take into account national guidelines, issued in the latest Code of Practice for Maintenance Management “Well Maintained Highways” (July 2005):

Feature	Reference	Category	Frequency of Inspection
<u>Carriageways</u>	2	Strategic Routes	1 month
	3(a)	Main Distributors	1 month
	3(b)	Secondary Distributors	1 month
	4(a)	Locally Important Roads	3 months
	4(b)	All other metalled Roads	1 year

10. There are national Indicators sets (NI) for A, B, and C roads. NI 130/1 & 130/2 are a direct application of the Road Condition Index (RCI) from the current UKPMS default rule set. For unclassified roads the emphasis is on a range of condition indices relevant to rural and urban roads

- Principal roads (A roads) – 130/1; formerly NI 168 and BV223 before that.
- Non Principal Classified (B & C roads) – 130/2; formerly NI 169 and BV224a before that.
- Unclassified (un-numbered minor roads) – LTP formally BV224b

The overall condition of the roads in Leicestershire over the last few years is shown in Table 4 below which details the BVPI results:

Table 4 NI and BVPI RESULTS

All figures are %'s	2008/9	2009/10	2010/11
Deflectograph Survey. (BVPI 96)	10.4	8.5	8.5
NI 168 Condition of Principal road network based on SCANNER Survey.	2	2	2
NI 169 Condition of Non-Principal Classified road network by SCANNER	4	4	5
LTP2 43 (BVPI 97b) Condition of Unclassified road network based on CVI.	9	10	11

Asset Valuation

11. The initial gross replacement cost for the carriageway asset is £3,800 million. The depreciation is approximately £92.5 million, which means that the net value is approximately £3,700 million.

Future Changes in Demand

12. Major new development is planned in the County over the next twenty years. This expansion will bring substantial lengths of new carriageway in new housing and employment areas, and will also intensify the use of existing carriageways. The increase in the extent of the asset will, in the long term, produce a requirement for additional maintenance expenditure. The likely impact on maintenance expenditure, and on government funding for this, has not at this stage been quantified.

Treatment options and costs

13. Road class will be used, in preference to hierarchy, to reflect the way that the Department for Transport (DfT) allocate capital funding and the Environment and Transport Department allocate and monitor it.

These classes will be split into urban and rural categories, in line with the categories in UKPMS. The urban category includes all roads with speed limits up to and including 40 mph. The rural category includes all roads with a speed limit above 40 mph. The infrastructure code¹ requires assets to be broken down into finite and indefinite life components. The **finite** life component for carriageways is the surface layer, which can be up to 100 mm thick. The component thickness for classified roads will be 100 mm and will comprise the top two courses - surface and binder courses. The component thickness for unclassified roads will be 40 mm and will comprise only the top course.

The **indefinite** life component for carriageways is the remaining construction, which will be referred to as the underlying layers; these will not normally be replaced and will not therefore be considered in this lifecycle plan, however

an estimate of the proportion of the underlying layers that might need to be replaced in any major resurfacing work on the more heavily trafficked roads will be considered. This will only be one or perhaps two longitudinal trenches. A typical trench will be 0.6 metres wide, which for a 6 metre wide carriageway, equates to 10%. The depth of trench backfill that will be replaced will be taken as 150 mm.

14. Road surfaces can be renewed, retextured, protected or repaired. Renewal involves replacing the top layer and will normally require replacement, or patching, of parts of the underlying layer. Retexturing increases the serviceable life of the surface course and restores a consistent level of grip. Protection treatments, such as surface dressing, restore the skid resistance and seal the surface of the road which prevents moisture getting into the surface and further oxidation of the binder. Repairs are treatments like patching, filling pot-holes, crack sealing and resetting ironwork.

15. A typical stretch of road might be maintained as follows, following the laying of a new surface:

- Inspect at required frequencies looking for potential potholes, problems around and concerning ironwork; reset ironwork and fill potholes;
- Empty gullies and catch pits; (sweep channels and hatched areas – this is not a highway function); weed spray to channels;
- Patch and seal areas to restore surface, especially in channels and around gullies;
- Consider surface dressing after 7 to 15 years, depending on road category and usage; more highly stressed areas, like junctions will be resurfaced when necessary, rather than dressed;

Consider more significant roads for resurfacing earlier in their lives; less significant and less heavily trafficked roads may be surface dressed twice or more times before resurfacing.

16. The current levels of capital funding have only been available to the whole of the County network since 2001. The significant improvement in the condition of every category up to 2008/9 was achieved using a mixture of resurfacing and revenue-funded surface dressing and patching. The programme was

generally determined on a worst-first basis, because of the initial poor condition and the available capital and revenue funding, rather than a justified asset management approach.

17. The types of treatment which are considered appropriate for each road class and category are as follows. The figure following the tick is the anticipated Total useful life (T_{UL}) in years:-

Road Class	Category	Resurface 100 mm T_{UL} years	Resurface 40 mm T_{UL} years	Overlay T_{UL} years	Surface Dress T_{UL} years and proportion of o/a length that it is appropriate to dress
A	Urban	✓ - 40	✓ - 20	✗	✓ - 7 – 30%
	Rural	✓ - 50	✓ - 25	✓ - 25	✓ - 7 – 75%
B	Urban	✓ - 45	✓ - 25	✗	✓ - 8 – 40%
	Rural	✓ - 55	✓ - 25	✓ - 25	✓ - 8 – 80%
C	Urban	✗	✓ - 30	✗	✓ - 9 – 45%
	Rural	✗	✓ - 35	✓ - 35	✓ - 9 – 85%
Unclassified	Urban	✗	✓ - 30	✗	✓ - 15 – 70%
	Rural	✗	✗	✓ - 40	✓ - 10 – 90%

The treatment costs for the various treatments, which include labour, plant, material, traffic management and professional fees, are shown in the table below. The second figure suggests a typical figure for the replacement of deteriorated binder course: -

Road Class	Category	Resurface 100 mm £/m ² - Binder course %	Resurface 40 mm £/m ² - Binder course %	Overlay £/m ²	Surface Dress £/m ² - incl. pre- patching
A	Urban	30 – 20%	15 – 10%	✗	£2.75
	Rural	25 – 10%	12 – 5%	10	£2.25
B	Urban	30 – 20%	15 – 8%	✗	£2.50
	Rural	25 – 10%	12 – 3%	9	£2.00
C	Urban	✗	13 – 5%	✗	£2.25
	Rural	✗	12 – 3%	8	£1.75
Unclassified	Urban	✗	10	✗	£2.00
	Rural	✗	✗	6	£1.50

The suggested proportion of each appropriate treatment to be used in a typical year

Road Class	Category	Resurface 100 mm % of o/a length	Resurface 40 mm % of o/a length	Overlay % of o/a length	Surface Dress % of o/a length
A	Urban	2.5	5	✖	4
	Rural	2	4	4	11
B	Urban	2.25	4	✖	5
	Rural	1.75	4	4	10
C	Urban	✖	3.4	✖	5
	Rural	✖	2.8	2.8	10
Unclassified	Urban	✖	3.4	✖	5
	Rural	✖	✖	2.5	9

The annual costs of each treatment

Road Class	Category	Resurface 100 mm £,000s	Resurface 40 mm £,000s	Overlay £,000s	Surface Dress £,000s
A	Urban	745.8	745.8	✖	109.4
	Rural	1542.2	1480.5	1233.8	763.4
B	Urban	417.2	370.9	0	77.3
	Rural	475	521	390.8	217.1
C	Urban	✖	1428.3	0	363.5
	Rural	✖	2262.5	1508.3	1178.4
Unclassified	Urban	✖	3119.3	0	917.4
	Rural	✖	✖	468.7	421.8
Total		3,180	9,928	3,602	4,048

The costs per square metre for each year of service for each treatment by class and category – i.e. divide unit rate by anticipated life

Road Class	Category	Resurface 100 mm £/m ² /yr	Resurface 40 mm £/m ² /yr	Overlay £/m ² /yr	Surface Dress £/m ² /yr
A	Urban	0.75	0.75	✗	0.39
	Rural	0.5	0.48	0.4	0.32
B	Urban	0.67	0.6	✗	0.31
	Rural	0.45	0.48	0.36	0.25
C	Urban	✗	0.43	✗	0.25
	Rural	✗	0.34	0.23	0.19
Unclassified	Urban	✗	0.33	✗	0.13
	Rural	✗	✗	0.15	0.15

It is interesting to note that for urban 'A' roads, the rates of resurfacing 100 mm and resurfacing 40 mm is similar and for rural unclassified roads overlaying is comparable with surface dressing.

The most cost-effective treatments appear to be:-

Road Class	Category	Resurface 100 mm	Resurface 40 mm	Overlay	Surface Dress
A	Urban		✓(1)		✓
	Rural			✓	✓
B	Urban		✓		✓
	Rural			✓	✓
C	Urban		✓		✓
	Rural			✓	✓
Unclassified	Urban		✓		✓
	Rural			✓	✓

(1)– This treatment has been selected in preference to 100 mm resurfacing because it allows up to twice the length to be treated for the same cost. These results must be treated with caution until the assumptions have been inspected, debated and reviewed against actual schemes. The assumptions are just that, they are not gospel.

This requires the following annual funding:

Road Class	Category	Resurface 100 mm £,000s	Resurface 40 mm £,000s	Overlay £,000s	Surface Dress £,000s
A	Urban		745.8	✕	109.4
	Rural		0	1233.8	763.4
B	Urban		370.9	0	77.3
	Rural		0	390.8	217.1
C	Urban	✕	1428.3	0	363.5
	Rural	✕	0	1508.3	1178.4
Unclassified	Urban	✕	3119.3	0	917.4
	Rural	✕	✕	468.7	421.8
Total			5,664	3,602	4,048

The actual level of funding, which is shown below, is less than the >£13 million total shown above, decisions have to be taken on which treatments to prioritise. Surface dressing is the top priority because it seals the surface and restores consistent grip to a greater area of road than any other treatment. Any residual funding will be split between the classified and unclassified networks in proportion to the assessed ukpms need; the reportable condition and the proportion of non-reportable condition.

Management strategy for minimising whole-life costs

18. Whole life costs include not only the direct costs of works, design, supervision and surveys, but also the indirect costs caused by sub-optimal maintenance regimes, including inconvenience to users, environmental impacts and third party claims. The main factors which will affect the whole life cost of an individual carriageway are:

- Type and quality of construction
- Degree and type of damage and degradation
- Type and volume of traffic
- Speed and quality of response to damage and degradation
- Timing of intervention and quality of medium and long term treatments

19. At present the links between these have not been fully quantified. This is an important area for research and progress nationally will be used to inform future editions of the TAMP. This will be a significant exercise, involving renewals, preventative work and reactive maintenance.

20. Historically, the Council's strategy for maintaining carriageways has been:

- to specify a high standard of initial construction
- to undertake timely reactive maintenance in order to keep carriageways in a safe condition and prevent short term deterioration,

- to have a programme of preventative maintenance to arrest deterioration of the surface and lower layers and to extend the life of the carriageway at minimum cost
- to resurface carriageways (using recycling techniques where economical) when reactive and preventative work is uneconomic
- to renew carriageways which are uneconomic to treat by other means.

21. This strategy is based on good practice but there has been no rigorous financial evaluation of the approach or testing of alternatives, for example the timing of the various interventions. The strategy is accepted as best practice for this version of the TAMP but further investigation of alternatives will be undertaken for the next version.

Options and targets within the management strategy

22. The analysis which follows analyses levels of capital spending against predicted outcomes for carriageway condition. Similar analysis in future editions of the TAMP will need to analyse in more detail the impact of revenue spending on condition, and also assess whether other aspects of conditions of service need similar consideration. It should be noted that the causal link between capital spend and resulting condition is complicated and not necessarily fully explained by the headline figures; this is another area for further investigation in future editions of the TAMP.

LTP proposals

23. The second Local Transport Plan reviewed the correlation between the achievement of condition targets and proposed overall spending, within the indicative government allocations. This capital spending on resurfacing and reconstruction was to be supported by continued revenue spending on reactive maintenance at a level predicted to be approximately £5m a year in real terms through the five year period. The table below shows the LTP3 predicted spending and targets (targets for principal roads and non-principal classified are based upon SCANNER surveys and unclassified roads are for CVI surveys)

£000s	2010/11 Baseline	2011/12	2012/13	2013/14	2014/15
Classified road network spend £,000s	5,661	4,753	4,404	5,119	5,135
Classified road network condition	4%	5%	6%	7%	
Principal road network spend £,000s	2,215	1,790	1,300	2,000	2,010
Principal road network condition	2%	3-4%	4-5%	4-6%	
Non-principal classified road network spend £,000s	3,446	2,783	3,104	3,119	3,125
Non-principal classified road network condition	5%	5-7%	6-8%	7-10%	
Unclassified road network spend £'000s	1,295	1,046	1,700	1,170	1,180
Unclassified road network condition	11%	13%	15%	16%	

Lifecycle action plan

24. Most of the actions to deliver this lifecycle plan are contained within the wider summary of development contained in Section 9. A separate action plan is therefore not included here, though it will be in future editions of the TAMP.

Risks

25. The risks involved in implementing the lifecycle action plan have been assessed against the council's standard grid of likelihood versus impact and are detailed in the table below, with an outline of the mitigation to be planned. The 'red' risks from each lifecycle plan are listed in section 7 of the main TAMP document.

Impact of effects	Severe	A				
	Significant	B			1,2,3	
	Moderate	C				
	Minor	D				
			4	3	2	1
			Very Un-Likely	Not Very Likely	Quite Likely	Very Likely
Likelihood of causes						

Risk	Level	Mitigation (for red risks)	Responsible
1. Insufficient staff resources for analytical work, particularly given structural change in the department	2B	Ensure prioritised within group local action plan	DMT
2. Reduced capital funding	2B	Review allocation between asset categories to minimise overall deterioration	DMT
3. Reduced revenue funding	2B	Ditto	ditto

Add Glossary to explain any acronyms and highways expressions – SCANNER, deflectograph, Griptester and CVI;

Notes – 1 – Code of Practice on transport infrastructure assets - 2010.