# Appendix D – Street Lighting Lifecycle Plan

**Introduction**

1. The background to lifecycle plans, and the format of each, is described in Section 5. This appendix provides the lifecycle plan for street lighting columns.
2. Street lighting is divided into various categories for asset management purposes. The four main components of column, lantern, lamp and power supply have different needs but, broadly speaking, the needs of each lantern are similar as are the needs of each lamp type. The main consideration in terms of capital investment is column type. The following categories are used:

| ***Category*** | ***Description*** |
|---|---|
| Painted steel | Also includes columns which are galvanised and painted |
| Galvanised steel | Refers to galvanised but not over-painted columns. This is the type of column currently being installed. |
| Concrete | Amongst the oldest columns and vary in design and size |
| Other | This includes aluminium, cast iron, wooden poles and brackets mounted on buildings etc. |

**Levels of service**

3. The desirable levels of service for this asset category are set out in the table below. Judgements on the four attributes of safety, serviceability, availability and condition are made based on the national code of practice, "Well-lit highways", and on the criteria described in Section 2. Customer feedback is via the NHT annual customer satisfaction survey.

4. This level of service is one which fully meets all aspirations whilst minimising whole-life cost. The lifecycle plan, in later sections, shows how different levels of available funding will influence the extent to which this desirable level of service can be achieved.

| ***Attribute*** | ***Desired Standard*** | ***Performance measures*** |
|---|---|---|
| Safety (Network Integrity.) | Roads and footways lit to the standard. Switch off, dimming and part night lighting to be introduced (as far as risk assessments allow) taking into account crime, anti-social behaviour and traffic accidents. Equipment used shall have low levels of light pollution. | Public satisfaction as measured by NHT survey |

| | | |
|---|---|---|
| Serviceability | Installations physically and electrically safe. | |
| Availability | All lights working as planned. | Local PI |
| Condition | Consistent with achieving minimum whole-life cost, in terms of preventative maintenance and column replacement | Defined standards met |

5. Failure to respond adequately to any of these four dimensions of level 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 structural defects or failure to maintain adequate structure.<br>Electrical risk to the public.<br>Injury to an operative working in the highway due to incomplete records, particularly underground cable records, |
| Business and financial risk | Legal proceedings for failing in duty of care<br>Increase in compensation payouts due to a rising number of accidents and third party claims.<br>Fines imposed on the authority as a result of legal proceedings.<br>Reduction in the net book value of the asset. |
| Corporate image | Ineffective or defective lighting reflecting on the overall image of the County Council |
| Environmental | Greater energy use, and light spillage, from old equipment |

**Asset base and characteristics**

6. This asset grouping comprises all street lighting, including feeder pillars and all cabling that is owned by the County Council as highway authority. The tables below give brief details of the current lighting stock.

| **Column Type** | |
|---|---|
| Column material | Number |
| Mild steel painted | 29980 |
| Mild steel galvanized | 26251 |
| Mild steel paint & galv | 458 |
| Mild steel 1 – total | 56689 |
| Stainless steel | 102 |
| Concrete | 8150 |
| Aluminium | 23 |
| Cast Iron | 154 |
| Wood | 1519 |
| Other | 249 |
| **All** | 66886 |

| **Lamps** | | |
|---|---|---|
| Lamp Type | | |
| Low pressure sodium | Wattage | Number |
| | 35 | 25045 |
| | 90 | 1605 |
| High pressure sodium | 50 | 5478 |
| | 70 | 14320 |
| | 100 | 5218 |
| | 150 | 10026 |
| | 250 | 3146 |
| | 400 | 236 |
| Other | Various | 1504 |
| **Total** | | **66889** |

| **Control** | |
|---|---|
| | Number |
| Time switch – all night | 0 |
| Tim switch – part night | 0 |
| Photo cell – all night | 50864 |
| Photo cell – part night | 14994 |
| 24 hour operation | 218 |
| Dimmed equipment | 813 |
| **Total** | 66889 |

| Column material | Age (years) | Number of columns by column mounting height | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 4m (Or Less) | 5m | 6m | 8m | 10m | 12m | Total Columns |
| Mild Steel | 0-20 | 50 | 9431 | 14682 | 7373 | 5077 | 2002 | 38615 |
| | 21-30 | 3 | 7101 | 36 | 2351 | 1534 | 127 | 11152 |
| | 31-40 | 3 | 4210 | 69 | 742 | 1099 | 46 | 6169 |
| | Over 40 | | 737 | 14 | 2 | | | 753 |
| | **Total** | **56** | **21479** | **14801** | **10468** | **7710** | **2175** | **56689** |
| Stainless steel | 0-20 | | | 92 | 1 | | | 93 |
| | 21-30 | | **4** | **5** | | | | **9** |
| | 31-40 | | | | | | | **0** |
| | Over 40 | | | | | | | **0** |
| | **Total** | **0** | **4** | **97** | **1** | **0** | **0** | **102** |
| Concrete | 0-20 | | 3 | 5 | | | | 8 |
| | 21-30 | | 7 | | 1 | | | 8 |
| | 31-40 | 3 | 5557 | 6 | 3 | 2 | | 5571 |
| | Over 40 | | 2561 | 2 | | | | 2563 |
| | **Total** | **3** | **8128** | **13** | **4** | **2** | **0** | **8150** |
| Aluminium (tubular and Fabricated) | 0-20 | | 1 | | | | 1 | 16 |
| | 21-30 | | 1 | | | | | 1 |
| | 31-40 | | 3 | 2 | | | | 5 |
| | Over 40 | | 1 | | | | | 1 |
| | **Total** | **0** | **6** | **2** | **0** | **0** | **1** | **23** |
| Cast Iron | 0-20 | 146 | | 1 | | | | 147 |
| | 21-30 | | 1 | | | | | 1 |
| | 31-40 | | 6 | | | | | 6 |
| | Over 40 | | | | | | | 0 |
| | **Total** | **146** | **7** | **1** | **0** | **0** | **0** | 154 |
| Wood Includes those mounted on electricity/ Telecom poles | 0-20 | | 154 | 54 | | | | 208 |
| | 21-30 | | 358 | | | | | 358 |
| | 31-40 | | 938 | 3 | | | | 941 |
| | Over 40 | | 12 | | | | | 12 |
| | **Total** | **0** | **1462** | **57** | **0** | **0** | **0** | **1519** |
| Composite Include fibre glass and GRP | 0-20 | | | | | | | 0 |
| | 21-30 | | | | | | | 0 |
| | 31-40 | | | | | | | 0 |
| | Over 40 | | | | | | | 0 |
| | **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other* | 0-20 | 214 | 2 | | 12 | | | 228 |
| | 21-30 | | 10 | 1 | | | | 11 |
| | 31-40 | | 10 | | | | | 10 |
| | Over 40 | | | | | | | 0 |
| | **Total** | **214** | **22** | **1** | **12** | **0** | **0** | **249** |
| | | | | | | | | |
| **All** | **Total** | **419** | **31108** | **14972** | **10485** | **7712** | **2176** | **66886** |

7. During 2012 a research project is being undertaken to evaluate the use of LED road lighting lanterns. Considerations will surround the ability of the lantern to meet the Roadway Lighting design codes given in BSEN13201, ease of installation, ease of maintenance, aesthetic considerations, initial cost and whole life cost including energy consumption charges.

**Asset condition and assessment**

8. To assess the extent to which the desirable levels of service are met requires measurements covering the four dimensions of safety, availability, condition and serviceability. There are as yet no measures for serviceability, and these will be considered further in the next edition of the TAMP.

9. Regular inspections and checks are undertaken as shown in the table below.

| | *Frequency* |
|---|---|
| Clean, inspect and change lamp | 4 - 6 years depending upon lamp type |
| Structural test | Initially at "Action Age" and then determined by the previous test |
| Electrical test | 6 years |
| Visual safety check | Every visit |
| Scouting to check light operational | Rural 4 weekly. Market towns and urban area around Leicester City – 2 weekly. |

10. All street lighting columns are regularly inspected. From 2006-2012 all known type 1805 and 1806 concrete columns were removed due to structural concerns. Other concrete columns, particularly types 10, X and NX, together with painted steel columns installed prior to 1990, are now showing signs of deterioration. During the 2011/12 financial year 251 lighting columns were identified as needing immediate replacement due to concerns surrounding their structural condition. Of these 137 were concrete lighting columns of the types already identified as being of concern. 114 were steel columns, up from 32 lighting columns per year during the 2004/5 financial year. This reflects the increasing age of the painted steel lighting column stock. Currently less than 3% of our painted steel stock are known to be over 40 years old. By 2017 approx 18% of our painted steel column stock (8% of our total stock) will be known to be more than 40 years old.

11. During the summer of 2011 two steel lighting columns, installed in 1984 and 1988, suffered catastrophic bracket failures. Investigations have shown these failures to be associated with a particular bracket type. Work is currently ongoing to ascertain the

quantity and locations of this type of steel column. Future funding will be targeted towards the types of steel and concrete columns mentioned above. On a more positive note, other types of concrete column continue to perform well and repairs, such as sleeving, can extend the life of the lighting column for some years.

***Structural Testing***

12. Street lighting columns are tested once they reach their "Action Age". This date is determined by the location of the column, its surface protection, wind exposure and any attachments fitted to the column. Generally the "action age" is around 20 years after installation. After this initial test subsequent tests are undertaken every 3, 2 or 1 year, depending upon the results of the previous test. Steel lighting columns are visually inspected with an endoscope and ultrasonic material thickness testing is carried out if the endoscope reveals a potential problem. Concrete columns are visually tested. The Council also has lighting brackets mounted on Electricity Board wooden poles, bridges and other buildings and structures not owned by the council. Structural testing only ascertains if the bracket (and ancillary equipment) fixing to these structures is sound. Maintenance of the structure itself is the responsibility of others.

13. Detailed analysis of the results has shown that different types of lighting columns have different structural problems. Testing of steel lighting columns has shown considerable variability of lighting column condition in any one location. The main cause of failure is internal corrosion and our practice is to replace only those steel columns which fail the test. Our analysis has shown that this amounts to approximately 0.37% of painted steel columns in 2010/11.

14. A visual safety check of the condition of each lighting column is carried out on every visit. Lighting columns thought to be structurally unsound are further assessed and may be subject to an emergency "make safe" or are replaced in the shortest possible time.

***Electrical Testing***

15. Electrical testing of each lighting column, feeder pillar and council-owned cable network is carried out every six years in accordance with the IEE regulations. Test results are checked and defects programmed to be rectified.

**Asset valuation**

16. Appendix E details the approach taken to asset valuation. The initial net value (depreciated cost) of the street lighting asset is £56million

**Future changes in demand**

17. In recent years capital funding has been targeted towards replacement of existing stock rather than provision of more lighting. From the start of LTP3 limited funds are being

directed to street lighting improvements that will assist residents to access the services they require. The Community Access Lighting budget is being targeted at improvements to lighting around bus stops, shops and community areas.

18. Major new development is planned in the county over the next twenty years. This expansion will bring substantial lengths of new highway in new housing and employment areas, with attendant street lighting. The increase in the asset base will produce a requirement for additional maintenance expenditure, and in the long term an increased need for replacement.

**Treatment options and costs**

19. The limited number of types of lighting installation, and ways in which they deteriorate, lead to a relatively short list of maintenance treatments. These are summarised in the table below. Short-term treatments are dictated by safety and serviceability requirements. Decisions on when to intervene with medium and long-term treatments are determined in accordance with the asset management strategy.

| **Work category** | **Interval** | **Unit cost (£)** |
|---|---|---|
| *Steel columns* | | |
| Replacement | 40 years | 800.00 |
| *Concrete columns* | | |
| Sleeving | As Required | 250.00 |
| Replacement | 40 years | 800.00 |
| *Lamps* | | |
| Reactive replacement | As required | 15.00 |
| Programmed replacement | 4 -6 years | 12.00 |
| *Lanterns* | | |
| Reactive Replacement | As required | 150.00 |
| Replacement | With column | inc in col cost |
| *Electrical components* | | |
| Reactive repairs | As required | 6 plus component cost |

***Column Painting***

20. Whilst new lighting columns are fully galvanised and have additional root protection, older steel columns had only aluminium or zinc spray coating which was then over-painted. The existing painted columns will continue to deteriorate and will initially become visually unsightly. Surface rust will then corrode the parent metal, weakening the structure. However, these lighting columns also corrode on the inside as the internal surfaces of the tube are not protected. Painting will not therefore significantly extend life expectancy of these ungalvanised steel columns.

***Column sleeving***

21. This can extend the life of some types of concrete column. Structural testing has shown that later styles of concrete columns have structural concerns along the length of the shaft. As a result, sleeving works are now being restricted to older type 7 columns that had a more substantial base and shaft construction. The majority of type 7 columns have now been sleeved and can be expected to last for a considerable time.

***Lamp replacement***

22. Different lamp types have a different mean life. Therefore the bulk lamp change is undertaken at 4 – 6 year intervals, depending upon the lamp survival curves for each lamp type. Longer periods between replacement lead to more expensive reactive replacements or increased outages. Shorter periods do not maximise lamp life. If the decision is taken to use LED lamps in future then these lamps will not require a bulk lamp change.

**Management strategy for minimising whole-life costs**

23. Whole life costs include not only the direct costs of works, design and supervision testing and inspections, 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 installation are:

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

24. At present, the links between these have not been fully quantified. This is an important area for research and development and progress nationally will be used to inform policy decisions. The evolution of the LED lamp for street lighting applications will soon become a viable alternative. These options will also be considered at the appropriate time.

25. Historically the County Council's strategy for maintaining street lighting has been:-

- To look for a high standard of initial installation
- To carry out electrical and structural testing of units
- To undertake 'night patrols' for inoperative lighting
- To undertake reactive maintenance works expeditiously to prevent short term deterioration and keep in a safe condition.
- To maintain an up-to-date inventory of lighting stock to facilitate maintenance management and enable competitive purchase of energy.
- To bulk-change lamps to maintain light output at satisfactory levels.
- To replace life-expired columns within budget availability, with a particular emphasis on replacing life-expired concrete columns

26. This strategy is based on good practice. However, the sums allocated for column replacement historically have not been adequate, resulting in a backlog of lighting columns needing replacement. During the LTP2 period significant investment was introduced into this area and the backlog of lighting columns requiring replacement was reduced from 19.8% to 10.16%. The information that has come to light during the LTP2 period in relation to steel lighting column failures has dictated a revised methodology for the calculation of the backlog of lighting column replacement for LTP3. At the start of LTP3 the backlog was recalculated to 11.04% of lighting columns needing replacement using the new methodology. Investment in 2011/12 reduced this backlog to 8.4%. Further investment is required to remove those remaining lighting columns that are of structural concern and achieve our desired steady state replacement rate of 2.5%.

***LTP3 proposals to 2016/17***

27. The remaining Type 10, type X and Type NX concrete columns are in need of replacement. In addition, based upon previous experience with painted steel columns, 150 steel painted columns are predicted to need replacement in each of the following 5 years. Further significant investment is planned over the period 2012/13 to 2016/17 to aim reduce this backlog to a steady state backlog of 2.5%.

**The following table details the minimum lighting column replacement needs, and the proposed minimum number of lighting column replacements for the LTP3 period up to 2016/17.**

| Column Type | Total Number | No. life-expired at June 2012 | No. to be replaced before March 2017 | No. of life expired at end of March 2017 |
|---|---|---|---|---|
| Painted Steel | 29980 | 150 | 750 | 4859 |
| Galvanised Steel | 26709 | 0 | 0 | 0 |
| Concrete "x" | 392 | 392 | 392 | 0 |
| Concrete "nx" | 253 | 253 | 253 | 0 |
| Concrete 10 | 4823 | 4823 | 4823 | 0 |
| Concrete 7 | 2394 | 0 | 0 | uncertain |
| Other | 2335 | 0 | 0 | 0 |
| Total | 66889 | 5618 | 6218 | 4859 + |

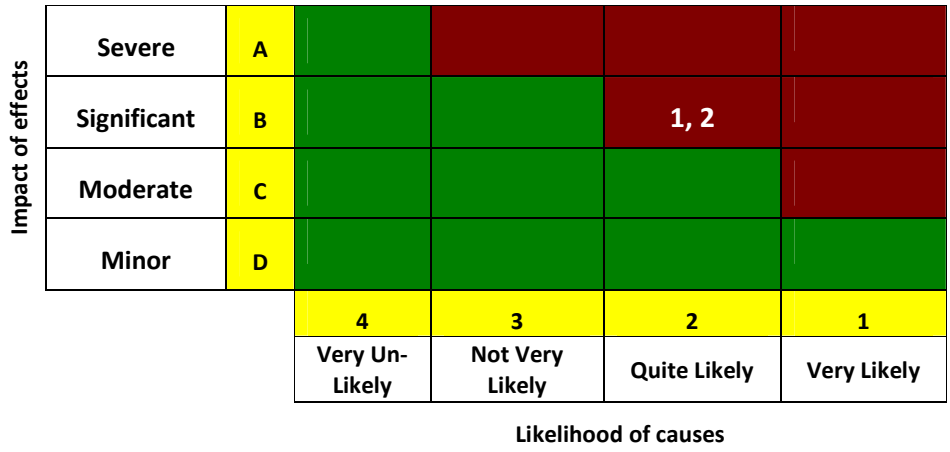
28. During the next 5 years continued monitoring of the painted steel lighting stock will be undertaken. Should an increased spend be required in this area this will be highlighted. After 2016/17 a new calculation methodology will be required to address the concerns that have developed over the next 5 years. On a pure age calculation approx 4850 additional painted steel lighting columns will be in excess of 40 years old and will probably require replacement.

***Alternative options***

29. Some authorities have sought to address the problem of replacing ageing lighting columns through PFI. Leicestershire reviewed the possibility of a PFI and a joint PFI with Derbyshire and Nottinghamshire. The affordability gap for both options was too large for these to be pursued.

**Risks**

30. 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 are listed in section 7 of the main TAMP document.




| ***Risk*** | ***Level*** | ***Mitigation*** | ***Responsible*** |
|---|---|---|---|
| 1. Insufficient staff resources for bulk column replacement scheme design work during 2012/13 | 2B | Use resources from URS if required | GM (Highway Management) |
| 2. Insufficient LHO resource to deliver agreed programme in 2012/13 | 3C | Use resources available via Tarmac. | GM (Highway Management) |

29th June 2012.