MANCHESTER CITY COUNCIL

Highways Lifecycle Planning & Whole life cost approach

Highways, Growth & Neighbourhoods
January 2019

Table of Contents

Highways Lifecycle Planning & Whole life cost approach

Record of Amendments

Issue No:	2.0 / 2019
Status:	Approved
Date:	January 2019
Author:	Tony King
Reviewed by:	Kevin Gillham
Owner:	Manchester City Council
Approved by:	Steve Robinson
Target Review Date:	January 2022

Amendments List

Version	Amendment	By	Date

1. Introduction

1.1 Manchester City Council recognises the importance of its highway infrastructure and how an effectively maintained and managed network contributes to the achievement of its corporate goals.

1.2 The Council's Highways Asset Management Policy & Strategy (HAMS) sets out our approach for the management of all highway assets including lighting, drainage, bridges and structures, cycling infrastructure and signage.

1.3 The HAMS stresses the importance of having up to date and reliable information about the number and type of assets and their condition so that the asset location, condition and where they are in their lifecycle is known.

1.4 Lifecycle planning is an important aspect of asset management and involves drawing up long-term plans for managing an asset grouping with the aim of providing the required levels of service at the lowest whole life cost.

1.5 Lifecycle plans capture all information relating to the asset inventory, its condition and performance. They also identify both the short-term routine maintenance needs and long-term capital costs and enable annual spend profiles per asset to be produced. They also enable long-term predictions about the deterioration of various assets and their maintenance needs to be forecast.

1.6 Lifecycle plans also provide secondary benefits in enabling the 'institutional knowledge' i.e. the knowledge and judgement of key personnel, to be captured and documented, thereby enabling it to be shared and further developed. They also enable the Council to gather information on the costs for each treatment option and the effect that this expenditure has on performance improvement year on year. Once these are known benchmarking can then take place with other authorities / treatments etc.

1.7 Lifecycle Planning recognises that there are key stages in the life of each asset type and that investment options need to be considered at each of these stages to ensure that each part of the asset achieves its full expected life, at minimum cost. Each asset goes through the following stages during its lifecycle:

Creation or Acquisition	Assets are created or acquired in response to either new development, to increase capacity or to improve performance.
Routine Maintenance	Carrying out minor works on a cyclical basis to maintain the asset in a serviceable condition.
Renewal or Replacement	Carrying out to return the asset to its "as new" capacity and condition.
Upgrading	Improve the asset above its original standard.
Disposal	Involves decommissioning, demolishing or selling old, obsolete or surplus assets.

1.8 This document describes the outline approach to highways lifecycle planning to ensure that the asset is effectively and efficiently maintained in accordance with the objectives set the HAMS.

2. Highway Network

2.1 The HAMS is based on managing our assets on a holistic basis and recognises that as we cannot do everything all at once, we need to prioritise between our assets based on the relative importance that each asset group contributes towards our goal of delivering an effective transport system and achieve our broader economic, social and environmental goals.

2.2 Carriageways (roads) are by far the largest of the Council's assets and account for an estimated 65% of the total highways asset value. Maintaining their condition and preserving their value is vital to the success of the Council's maintenance strategy and they are given budget priority above other elements of the highway asset.

2.3 In Manchester, there is approximately 1,400 km of carriageway maintained by the City Council. These are subdivided by class of road into the following:

'A' Roads & motorways	159 km
'B' Roads	40 km
'C' Roads	102 km
Residential unclassified roads	1,066 km

2.4 At a Greater Manchester level a Key Route Network (KRN) has been developed which includes all major routes in Manchester and covers about 10% of our road network (143 km). This enables the prioritisation of funding on network management and maintenance of those routes which have the most significant impact, particularly on our growth priorities.

2.5 We have also developed a 'Community Network' (CN) to help us prioritise those roads which provide access to community services like schools, hospitals, medical centres etc. so that we best meet our strategic objectives relating to growth and liveability. The CN comprises a total road length of approximately 456 km, about 33% of our network.

2.6 All of our roads are also classified in terms of network hierarchy, in accordance with the recommendations in the 'Well-Managed Highway Infrastructure' code of practice. This is used to partly define our highway inspection regime as well as prioritising funding decisions.

3. Highway Codes of Practice and Guidance

3.1 The carriageway lifecycle plan recognises that the authority has the duty of maintenance for highways maintainable at public expense as contained in the Highways Act 1980 Section 41 and the recommendations contained within various codes of practice, procedures and standards which include:

- UKRLG 'Well-Managed Highway Infrastructure' code of practice
- HMEP UKRLG Highway Infrastructure Asset Management Guidance
- Manual for Streets
- Design Manual for Roads and Bridges (Volume 7)
- HMEP Pothole Review

4. Levels of Service

4.1 It is important that the Council actively seeks the views of its customers and residents in order that it can understand their needs and adapt its services accordingly.

4.2 Our long term vision for Manchester's future is set out in the 'Our Manchester' strategy. Tens of thousands of people were involved in the consultation which looked at how to make Manchester into the place people would want to live, work, play and do business in 2025.

4.3 As part of the 'Our Manchester' value for money budget campaign, a Highways focus communications week took place in June 2017, which included highways content shared across social media, press releases, e-bulletins and a twitter Q&A session with the Executive Member for Environment. Almost 815,000 interactions and engagements were recorded during the week.

4.4 In addition, in order to better understand resident's views we commissioned the National Highways and Transport (NHT) Public Satisfaction Survey in 2017. The survey is carried out by IPSOS/MORI and allows comparison on performance at a local, regional and national level. This survey will be carried out annually to enable us to compare results year on year and modify our service objectives accordingly to drive continuous improvement.

4.5 The objectives set out in the 'Our Manchester' strategy have informed the defined levels of service set out in our performance management framework. These are:

- A safe highway network;
- A serviceable & resilient highway network;
- Manage the network effectively & efficiently;
- Customer satisfaction;

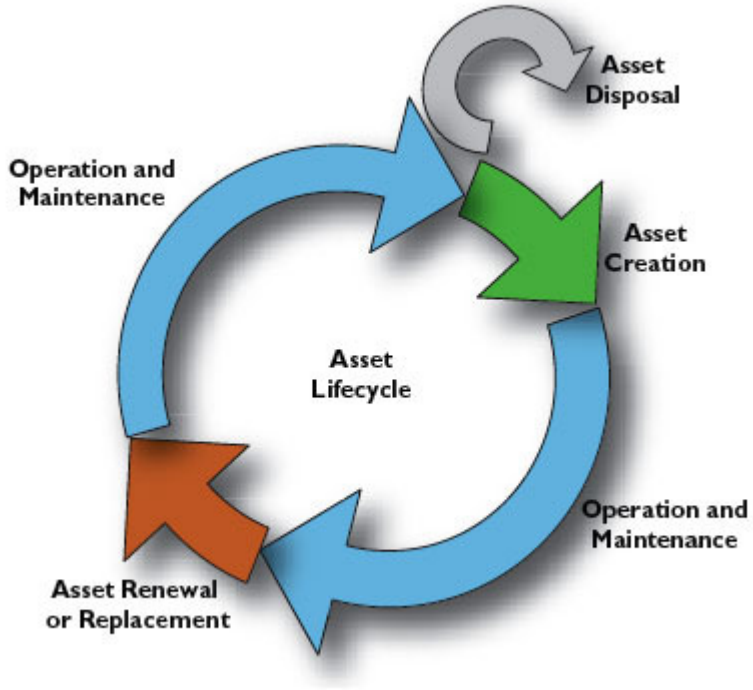
4.6 Lifecycle planning shows how different levels of funding will influence the extent to which these desirable levels of service can be achieved.

5. Lifecycle modelling

5.1 Asset Lifecycle

5.1.1 The following describes the stages in an assets life cycle that underpin our lifecycle modelling approach:

- **Asset Creation (Construction / Asset Acquisition)**
  New assets are typically acquired from either adoption or from taking over improvement works completed by contractors on behalf of the council. This is normally managed by the development control team using Section 38, 278 or 106 legal agreements.
  Newly constructed 'adoptable' streets are only adopted and added to Manchester's Asset Registers once they meet council specifications.



- **Operation and Maintenance (incl. Routine Maintenance)**
  Routine maintenance treatments are undertaken to ensure the highway asset is maintained at a minimum service level. Safety inspectors are responsible for identifying and assessing any defects which reduce the safety of the road user.
  Manchester's inspection and repair regime is outlined in the GM Framework for Highway Safety Inspections and accompanying MCC Highway Inspection Policy. This is implemented using a risk based approach in line with the 'Well-Managed Highway Infrastructure' code of practice.

- **Asset Renewal**
  Planned maintenance treatments used on the network are a combination of preventative maintenance and resurfacing works. Surface treatments such as micro asphalt or surface dressing are applied at the optimum time to prolong the life of the carriageway and reduce the rate of deterioration. Resurfacing or reconstruction works are necessary once the asset has deteriorated to a poor state and is approaching the end of its lifecycle.

- **Asset Disposal**
  In the case of highways, roads themselves are rarely fully decommissioned, although individual asset components are constantly being withdrawn, and may or may not be replaced, depending on current demand.

5.1.2 The following describes the lifecycle modelling approach currently used by the Council. The objectives of lifecycle planning are stated by the UK Roads Liaison Group in the Highway Infrastructure Asset Management Guidance as:

- Identify long term investment for highway infrastructure assets and develop an appropriate maintenance strategy;

- Support decision making, the case for investing in maintenance activities and demonstrate the impact of different funding scenarios;

- Predict future performance of highway infrastructure assets for different levels of investment and different maintenance strategies;

5.1.3 To address these objectives we have established a lifecycle planning process aligned the recommendations of the guidance. It has implemented a rolling programme of lifecycle review and maintenance based on the principles of minimised whole life cost.

5.2 Deterioration & cost modelling

5.2.1 Our road (carriageway) and footway network has a condition survey carried out annually and divided into one of the following condition categories:

- Grade 5 (Red): Structurally impaired (no residual life)
- Grade 4 (Amber): Functionally impaired (approx. 1 to 3 years of residual life)
- Grade 3 (Green): Mid-life
- Grade 2 (Blue): Aesthetically impaired
- Grade 1 (Lilac): As new

5.2.2 The key to lifecycle investment and good highway asset management is knowing and understanding what treatments to apply at the right time that maximises the life of the asset at a minimum cost.

5.2.3 The majority of roads and bituminous footways that are in a mid-life condition can have their residual life extended by 7 to 10 years if preventative treatments (for example micro asphalt overlay) are applied before they deteriorate further. This is a cost effective intervention given that the costs of preventative treatments are more than three times lower than the costs of resurfacing.

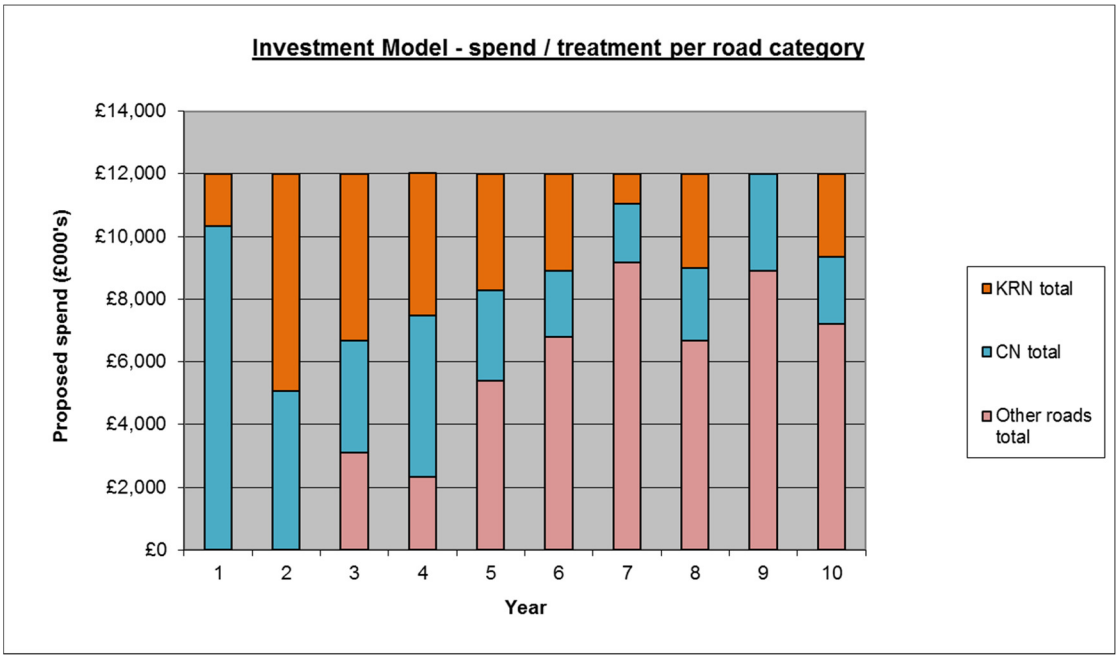
5.3 Carriageways

5.3.1 Our survey contractor, Gaist Solutions, in collaboration with York University and Blackpool Council, have developed an innovative cost and deterioration model for bituminous roads which builds on the available HMEP lifecycle toolkit but also adds the ability to produce optimised scenarios. These optimised scenarios select the most cost effective treatments and applies them at the right time in the lifecycle of the road.

5.3.2 We have used this advanced modelling approach to determine the required long term investment needed to effectively maintain our road network and this was successfully used to secure our current £100m Highway Investment Programme (2017-2021).

5.3.3 By inputting our local costs for different maintenance treatments into the model along with when these would need to be carried out, we can determine the optimum annual spend on each treatment and where these should be targeted in terms of class of road.

5.3.4 The following chart shows the optimum spend on different treatments split against KRN, CN and local roads over a 10 year investment period, based on a £12m annual budget.



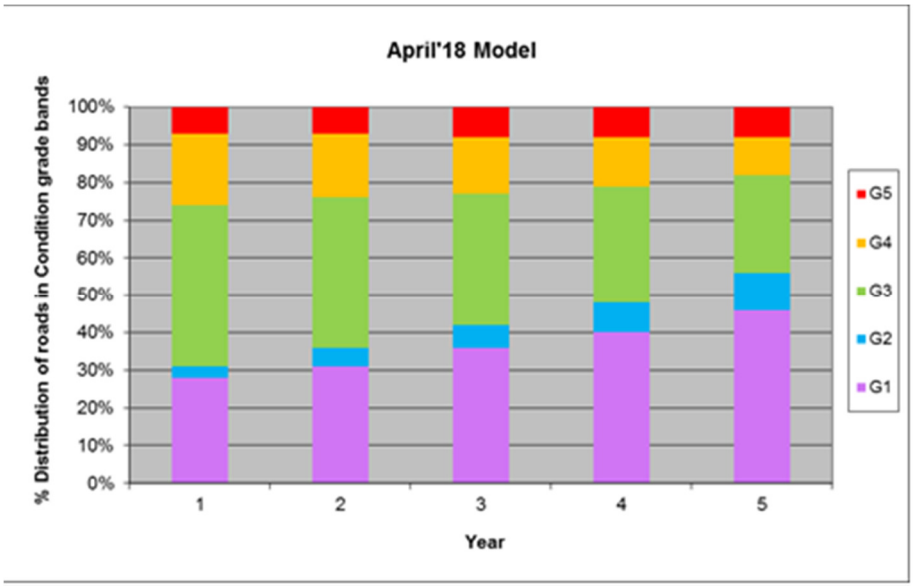
5.3.5 The results from the model are used to justify investment decisions and enable a reduction in whole life costs. The Highways Investment Programme advocates around £6m per year should be spent on preventative treatments and £6m per year on resurfacing / reconstruction works. We have developed a 2 to 3 year resurfacing / reconstruction programme for all classification of highway to enable programming of the works at the optimum time. It is not practicable to develop a preventative treatment programme for more than one year, because these roads may subsequently deteriorate beyond the point where these treatments would be effective.

5.3.6 Carriageway lifecycle planning is refreshed annually, following the receipt of the condition survey results. Evidence arising from lifecycle modelling activity is used to demonstrate how funding and/or performance requirements are achieved by implementation of our maintenance strategies with the objective of minimising expenditure, while providing the required performance over a specified period of time.

5.3.7 Performance data around network condition shows that the overall percentage (by area) of our roads rated as condition Grade 4 or 5 (poor) has risen from 19% in 2016 to 25% in 2017. The survey was carried out before the majority of the year 1 programme was carried out, so is a good indicator of condition prior to investment. Figures for next year should start to show an improvement in overall condition as shown in the updated condition modelling graph shown below.

5.3.8 Our performance target outlined in the Performance Management Strategy is 20%, which the lifecycle modelling shows we should achieve by the end of year 5 of the current investment programme.

5.3.9 A Scanner survey carried out on Manchester's KRN network in 2017 reflected an overall improvement in condition of the strategic roads, with a Road Condition Index (RCI) of 5%, compared to 8% in 2015. This is largely down to the work completed last year in resurfacing several of our major routes, funded by a successful Department for Transport (DfT) challenge fund bid.



5.4 Footways

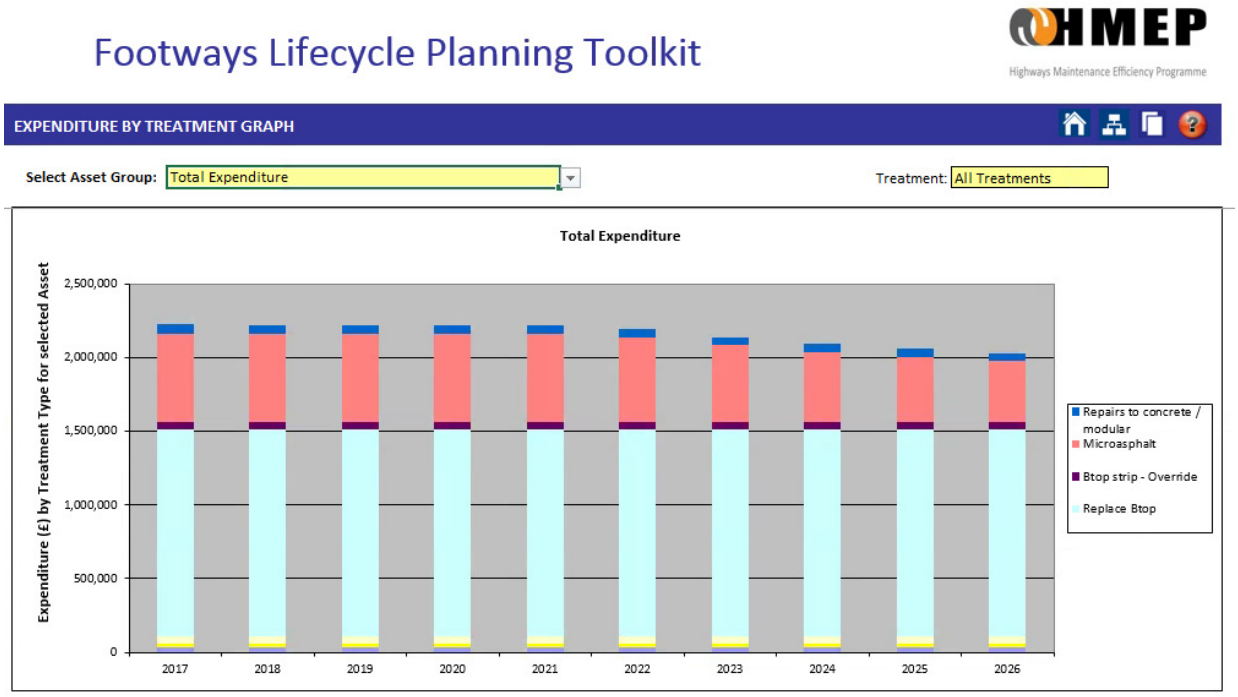
5.4.1 There are about 2,500 km of footways in Manchester that we are responsible for maintaining. In accordance with the 'Well-Managed Highway Infrastructure' code of practice, these are subdivided into hierarchy levels that are used as the starting point for defining our inspection and repair frequencies using a risk based approach, as well as prioritising our footway planned maintenance budgets.

5.4.2 The footway hierarchies are shown in the table below and these have been agreed across the 10 Greater Manchester authorities and documented in the 'Greater Manchester Highway Safety Inspection Framework' which was approved by the GM Highways Board in April 2018.

Footway Hierarchy:

Inspection Frequency	Category	Designation	Criteria description
Monthly	1	**Primary Footway**	Busy urban shopping and business area footways and major pedestrian routes – Usually part of priority (1 & 2) footway gritting network;
3 monthly	2	**Secondary Footway**	Medium usage footways feeding into primary routes, local shopping centres;
6 monthly	3	**Link Footway**	Footways linking local access footways through urban areas.
12 monthly	4	**Local Access Footway**	Usually unclassified road footways with low usage, estate footways and cul-de-sacs;
12 monthly	5	**Public rights of way**	Field footpaths and bridleways

5.4.3 We have used the Footway Lifecycle Planning Toolkit (First published by HMEP in November 2012) in a similar way to the carriageway model to analyse different budget and treatment scenarios over a 10 year period to determine the optimum budget required for footways over the course of the 5 year investment period, as well as an indicative treatment split (see graph below).



5.4.4 As a result, we have allocated around £2m per year for footway maintenance schemes as part of the investment programme. As for carriageways, we have developed a 2 to 3 year footway reconstruction programme, prioritising the worst condition heavily used footways on strategic routes and the worst condition footways on the community network, in line with our HAMS.

5.4.5 Footway lifecycle modelling is refreshed annually, following the receipt of the condition survey results. This will be used to modify investment budgets moving forward as required, dependant on service needs.

5.4.6 Performance data around footway condition shows that the overall percentage (by area) of our footways rated as condition Grade 4 or 5 (poor) has risen from 11% in 2016 to 16% in 2017.

5.4.7 As the highways investment programme progresses we will look to increase the footway programme to work towards our target performance figure of <10% condition Grade 4 or 5 (poor) outlined in the Performance Management Strategy.

5.5 Bridges & Structures

5.5.1 In order to carry out lifecycle planning for structures a robust inspection regime is required. The Inspection regime records the condition of bridges at element level for all components of a bridge e.g. main beams; bearings; piers; parapets etc. Currently each element is scored on severity and extent of any defect recorded in accordance with national standards.

5.5.2 Current inspection records for the Council's structures stock are not complete, so in 2017, Jacobs were appointed to undertake a Principal Bridge Inspection (PBI) risk ranking of MCC owned highway structures in accordance with Highways Agency Interim Advice Note 171/12 - Risk Based Principal Inspection Intervals (IAN 171/12).

5.5.3 A schedule of inspections has been defined to return MCC's inspection records to a compliant state within six years, and subsequently identify a prioritised list of required bridge maintenance work using a lifecycle planning approach.

5.5.4 When considering whole life costs, account needs to be taken of the direct and indirect costs associated with the asset group, including works, design and supervision, inspection and assessment. With highway bridges, which have a long life but are very expensive to replace at the end of that life, it is essential to plan preventative maintenance works in a timely manner, since delays will increase the whole-life cost of the structure.

5.5.5 Current work programmes are determined using the data in our bridge management system, and priority is given to the following:-

- structures with low BCICRIT values, i.e. those with structural defects which have a direct impact on their load-carrying capacity;
- structures with safety-related defects;
- structures with defects which, if not remedied, are likely to lead to more serious problems, for example failed waterproofing systems which will permit salt laden water ingress into decks, leading to corrosion of steel reinforcement and potential alkali silica reaction;

5.5.6 The available funding is allocated to each of the above work-types on an annual basis to suit the importance or criticality of the works identified. This strategy is intended to deliver the identified levels of service.

5.5.7 Precedence is given to highway bridges on the Key Route Network (KRN) and MCC Resilient Network, which carry the highest volumes of traffic and are key in ensuring network connectibility.

5.5.8 Currently, maintenance works are identified in an annual programme, with major schemes planned up to two years ahead. However, to assist with scheme delivery and overall financial planning, a two-year work programme is being developed, which will be subject to amendment in the event that a more critical scheme arises.

5.5.9 In many instances the existing age of bridge elements is unknown. The Structures Asset Management Planning Toolkit (UK Bridges Board 2015) (SAMPt) which provides technical and engineering detail for structures life cycle planning, deals with this issue by using

complex deterioration profiles to predict the life span of each element. This is also influenced by the environment of the individual element with mild, moderate or severe environments being used in the model.

5.5.10 Greater Manchester authorities now use Pontis bridge management system, which stores the condition data of each structure at element level and is capable of reporting in accordance with the four proposed maintenance strategies outlined below.

5.5.11 These maintenance strategies are based on those described in the Structures Asset Management Planning Toolkit (UK Bridges Board 2015) (SAMPt) – Part A: Methodology, and linked to our carriageway hierarchy. This provides a risk based strategy which considers maintenance on structures at different defined intervention levels for the different category of carriageway that the structure supports.

5.5.12 Pontis has been amended to incorporate a risk ranking tool which follows the format set out in IAN 171/12 and uses the scoring defined in the IAN 171/12 Risk Assessment Questionnaire (IAN 171/12 RAQ). Inspection data collected by Jacobs' operatives and MCC archive data obtained from Pontis has been used to populate the risk ranking tool.

5.5.13 The Proposed Maintenance Strategies are:

1. Planned Targeted Strategy:
   Interventions aimed towards delivering a required target condition for the structure. All elements are considered for treatment when they reach a condition of 3C. This should be linked to Resilient Route Network Assets and Ancient Monuments.

2. Planned Preventative Strategy:
   To be used for regular and frequent minor intervention that slow down the rate of deterioration. All critical elements are considered for treatment when they reach a condition of 3C. This should be linked to all gritting routes and all listed structure.

3. Planned Do Minimum Strategy:
   To be used for infrequent, but major interventions. The Structures Asset Management Planning Toolkit suggests intervention at an element condition score of 4D. This should be linked to all roads that are not on the gritting route network

4. Unplanned Reactive Strategy:
   All elements are considered for treatment when they reach condition 5B (ie failure). The Structures Asset Management Planning Toolkit states that this would be very unlikely in practice, however under the present financial constraints this maintenance strategy may be used where it is known the existing bridge is to be replaced in the medium term. E.g. there is a proposed development at the site. This strategy will provide the most cost effective solution to manage the deterioration in the medium term

5.5.14 Adopting these strategies will allow the targeting of resources to ensure the preventative maintenance is prioritized to support the KRN and CN, so reflecting the investment strategy for carriageways.

5.5.15 Value Management and Value Engineering:

5.5.15.1 The above processes will lead to a list of potential schemes and work costs to be considered for preventative maintenance. Using Value Management principles a prioritised three year works programme can then be developed and regularly updated by the Value Management Process. Value Management will consider combining different work items on one structure; combining similar work types on several structures and combining schemes based on route or area.

5.5.15.2 Applying Value Management principles will also allow consideration to be given to prioritising across asset groups as well as within them wherever possible - this approach is likely to save traffic management costs, minimise traffic disruption, reduce congestion and travel times. It should also bring about environmental benefits; the integration of bridges and structures schemes with other asset maintenance programmes will ensure best value of the investment is achieved. E.g. co-ordinating maintenance on structures to coincide with resurfacing and drainage maintenance projects.

5.5.15.3 Value engineering options for the prioritised schemes will then be proposed for final budget approval. Options for maintenance; renewal or upgrading of each component within the scheme will be considered to ensure the investment will deliver the best value for money within the whole lifecycle of the asset.

5.5.16 Implementing the four maintenance strategies at structure level together with the powerful scenario analysis SQL tool within the Pontis system will provide Manchester with comprehensive Life Cycle Planning capability for the structures assets. Delivery of this approach will support the implementation of the recommendations in the 'Well Managed Highways Infrastructure' Code of Practice.