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REVIEW OF THE STRUCTURAL MAINTENANCE FUNDING REQUIREMENTS FOR THE DEPARTMENT FOR INFRASTRUCTURE (ROADS)

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EXECUTIVE SUMMARY

The public road network in Northern Ireland is, for a small country, vast and hugely diverse. Moreover, it is widely accepted that Northern Ireland is more dependent on road-based travel than the rest of the UK. The lack of a substantial rail network means, for example, that almost all freight is transported by road in Northern Ireland compared to 76% in the rest of the UK. It follows, then, that the condition of the road network is of vital importance to the economic and social well-being of the country.

The management, maintenance and development of the road network is the responsibility of the Department for Infrastructure (DfI). The creation of DfI in May 2016 has enabled a more integrated response to a range of issues including regional development, active travel, road safety and flood risk management.

The Department's Strategic Objectives are:

- Shaping the region and promoting economic growth;
- Developing the infrastructure in a sustainable way; and
- Connecting people to opportunities and services.

DfI is a key contributor to a number of the Northern Ireland Executive's Programme for Government (PfG) outcomes, from unlocking the economic potential of the region, to tackling disadvantage, to protecting the

environment and in promoting the health and wellbeing of its citizens. The Department leads on Outcome 11: 'We connect people and opportunities through our infrastructure' and also makes a particular contribution to Outcome 2: 'We live and work sustainably, protecting the environment'. A well maintained road network, particularly where rail alternatives are scarce, is fundamental to the delivery of these Outcomes.

The requirement for a properly funded and maintained road network was confirmed in policy terms in 1998. The development of the Structural Maintenance Funding Plan (SMFP) as a rational way of determining the optimum level of spend for structural maintenance has been established over successive studies and endorsed by Northern Ireland Audit Office (NIAO) and the Northern Ireland Assembly's Regional Development Committee. Financial pressures have meant that, over recent years, the budgets required to maintain the road network have been less - sometimes significantly less - than it has been estimated is required.

Direct comparisons of spending across other parts of the UK need to be viewed in the context of how the different countries operate. Northern Ireland has a much larger local road network per head of population than the rest of the UK - around two and a half times more than for local roads in England - and a relatively modest rail network. Even so, examination of Public Expenditure information shows that, whilst overall public spending in Northern Ireland

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is higher than any of the other UK regions (Countries), the proportion spent on transport is lower.

In 2015/16 transport spend in Northern Ireland, as a proportion of overall expenditure, was around half that of Wales and considerably less than half of that in England and Scotland. Moreover, the amount that NI spent per capita on roads (local and national combined) in 2015/16 was half that spent in 2010/11. England and Scotland both spend two and a half times that spent per km in NI and Wales spends 40% more.

As a consequence of road maintenance budgets provided from successive Comprehensive Spending Review rounds falling short of that required to maintain the roads at the 'good practice' surfacing frequencies set out in the 1998 'Road to Everywhere' Policy Review, DfI Roads adopted a sub-optimal budget strategy in order to preserve the fabric of the network. The strategy targets resources to:-

- Maintaining the Trunk Road Network (TRN)
- Maximising surface dressing
- Patching for safety reasons only
- Minimum footway expenditure compatible with providing a safe environment for pedestrians.

DfI's Corporate Plan places high importance on the need to adequately maintain the road network through a properly resourced

programme of structural maintenance. The purpose of the programme is to maintain the integrity of the network - one of the NI Governments most valuable assets. Such maintenance includes strengthening, surface dressing, patching and drainage works.

The funding plan recognises that road and footway surfaces do not last for ever and have limited life spans, the values of which are generally accepted by pavement engineers. At or around the end of those life spans, periodic maintenance is required in the form of resurfacing or surface dressing. However, when the budget allocated falls short of the Structural Maintenance Funding Plan (SMFP) requirements the level of treatment will not be sufficient to adhere to the planned timescales

The 'Road to Everywhere' Policy Review identified a budget required to deliver the SMFP which it recognised as being a conservative estimate based on the longest possible life span of the resurfacing, and in practice the materials may not last that long. Notwithstanding that assertion funding allocated to the SMFP has consistently been below those levels and has resulted in the Roads Service (at the time) introducing the sub-optimal maintenance strategy set out above that focussed on maintaining the high end of the network and keeping the rest of the network safe, so far as is reasonably possible. In introducing that strategy, it was always recognised that this should only ever be a short-term solution; however, 20 years later, that strategy persists with increased

resources required for short-term solutions such as reactive patching.

Maintaining our road networks in an appropriate condition supports society and the economy. A study undertaken by Transport Scotland concluded that there is an overall dis-benefit to society of reducing road maintenance expenditure; for every £1 reduction in road maintenance, there is a cost of £1.50 to the wider economy This is in addition to the higher maintenance costs that would also be incurred and the lost economic activity (CBI reported that every £1 spent on construction generates a wider economic return of £2.84).

The way in which maintenance funds have been allocated over the course of successive financial years demonstrates a volatile, even bizarre, approach with very often inadequate budgets set at the start of the year and then added to in-year. This makes the planning and implementation of an effective road maintenance strategy very difficult to deliver. Certainty of funding is the key to being able to provide the supply chain with the confidence to properly plan maintenance programmes and thereby lock them into keenly priced tenders. Similarly, budget certainty allows managers to plan and deploy their own workforce more effectively.

It seems to me that the administration is using roads maintenance as a 'balancing item' - adding to or taking from the budget line as other pressures appear or reduce. This is most likely based on the ability of DfI

Roads, in common with roads maintenance authorities generally, to spend money quickly when the need arises; however, whilst this might help other parts of the administration that are, for whatever reason, unable to manage their budgets effectively, it is grossly unfair on DfI Roads. This is true for the reasons that I have set out above but it is particularly true when the extra money becomes available towards the end of the year as this is the worst possible time of year to be carrying out any resurfacing or surface dressing works.

Greater certainty of budgets would yield efficiencies. Fluctuating budgets in-year make it extremely difficult to properly plan and implement programmes of work and DfI Roads needs to be allocated realistic budgets for the whole of the year sufficiently far in advance for it to develop and implement those programmes with confidence. If the Executive were to move to longer term committed budgets as is the case with Highways England, it is expected that much greater efficiencies could be achieved. Based on evidence from elsewhere efficiency savings of around 20% could be expected with a 5 year committed budget.

DfI Roads has a statutory duty to maintain roads in a safe and serviceable condition. In order to seek to comply with that duty DfI Roads has developed guidance and standards related to the inspection and repair of defects; however, these standards have had to be changed on 12 separate occasions since 2015 to deal with funding cuts and in-year changes.

EXECUTIVE SUMMARY

It was clear from discussions with DfI Roads Managers charged with maintaining the network that they have great concerns about the steady deterioration of, particularly, the lower class road network. Their view is that, generally, the trunk and A Class network is in a reasonable condition but that the B, C and U class roads are in a steady state of decline; their view is reinforced by the fact that this is where the vast majority of complaints come from.

As stated previously, restrictions on spending have resulted in sub-optimal maintenance strategies aimed primarily at keeping the network safe and whilst this is the right thing to do from a public liability perspective, it often results in money being spent poorly - repairing potholes, for example, where the surrounding surface is also in a very poor condition but there is insufficient money to take out a larger area and cut back to sound material before undertaking the repair. The result is that the pothole repair only lasts one or two years at most and, in some cases only a matter of months. The reduction in inspection and repair regimes brought about by the forced change in the guidance and standards means that damage that would cost relatively little to repair, were it carried out earlier, is often having to wait until that damage is so bad that there is no alternative but to fix it.

The lack of certainty of longer term budgets makes it very difficult for managers to properly plan and sustain the necessary plant and staffing resources to fully deliver

the maintenance activity required. The Northern Ireland Civil Service Voluntary Exit Scheme has had a significant impact and, without funding certainty over, say, a five year horizon, managers are unable to employ sufficient operatives to deliver anything other than minimum levels of maintenance. Where in-house resources are unable to meet these requirements the work is outsourced to private sector contractors in order to meet the agreed service levels.

Whilst the view about the condition of the network expressed by Roads Managers is consistent with the outcome of the condition surveys undertaken each year when considering trunk and A class roads (that they are generally in reasonable condition and even seeing a slight improvement), it is at odds with the survey outcomes for the B, C and U class network. Here, the survey data indicates that B and C Class roads have seen a gradual improvement in their estimated residual life (e.g. fewer roads being considered for maintenance) over the past 5-6 years and unclassified roads appear to be maintaining a broadly constant condition. The most likely reasons for this could be that short-term surface treatments (patching and surface dressing) are masking the long-term deterioration and the recent mild winters have not challenged vulnerable sections of road. Patching and surface dressing will improve the surface characteristics of the road and will also extend its life but they will not add strength to the road pavement so the deterioration of the road, which will most often happen within the lower layers, might not be evident to the machine

based or visual surveys. There is also an issue around the amount of the network that is surveyed each year, particularly the Course Visual Inspection (CVI) surveys undertaken on the unclassified network where just 10% is surveyed each year. Under the current system the 10% of new survey data is combined with the available data from previous years to provide an updated assessment of the overall condition. This is bound to have the impact of diluting the true changes in condition and a better approach might be to give greater credence to the more recent data through weighting the results.

Nearly half of the trunk road network and a quarter of the non-trunk A Class network is also at or below the 'investigatory level' for skidding resistance and requires further investigation. The investigatory level is the level of condition at which consideration is given to the need for further maintenance. At this level, all available evidence (e.g. accident rates) would be taken into account to determine future possible remedial actions. It is worth noting that the 'investigatory level' relates to skidding resistance of the surface and is a safety indicator not an indicator of structural condition.

The deterioration of the lower class network can be seen, vividly, in the number of customer complaints, potholes and vehicle damage claims. Over the past year, 90% of customer complaints/enquiries were concerning the B, C and U class network. Similarly, the number of vehicle damage

claims in 2017/18 is the highest on record and is nearly three times the average of the previous four years with the vast majority of incidents occurring at the end of the year. Unsurprisingly this tracks, very closely, the incidence of potholes occurring. Whilst there is no doubt the last winter was worse than any we have seen in recent years it was not at the level that meteorologists would class as unprecedented; the incidence of potholes and vehicle damage claims experienced are, on the other hand, unprecedented and reflect, not just the weather but also the condition of the roads. The proportion of the backlog that is attributable to B, C and U class roads (80%) is also a strong indicator of its poor condition.

Potholes are damaging to an organisation; as well as the cost to repair, they disrupt travel and other operations and they are reputationally very damaging when they become greater than stakeholders perceive to be reasonable.

Whilst the impact of potholes on motorised vehicles is predominantly one of vehicle damage, which, in itself, can be costly, the potential consequences for cyclists are much more severe with the threat of personal injury and even loss of life. The policy of choosing not to repair all potholes on routes that are likely to be used by cyclists is, at the least, contrary to the Executive's wider PfG objectives of encouraging active travel.

The funding gap (actual compared with required) has resulted in the increased backlog because when roads authorities fail

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to meet adequate funding requirements, they are not making a saving; they are merely deferring a cost against future commitments. It is also true that as the network moves progressively below the optimum funding level, the cost to reinstate it to that level increases. So, between 2009 and 2017 the SMFP was underfunded by around £311m (2017/18 prices); however, the maintenance backlog increased by £400m from £796m to £1.2bn (2017/18 prices).

There is very strong evidence that the closer that roads are maintained to their optimum condition, the less it costs annually to maintain them; late intervention can cost four times as much as applying treatments at the optimum time. There is therefore an overwhelming business case for timely, targeted intervention; the key outcome being that the customer would experience a better maintained road network at less cost to the roads authority. This is demonstrated in the Sixtowns Road Case Study in Chapter 3 and is, in fact, the way in which private sector organisations approach road maintenance in Public Private Partnership (PPP) Contracts. The ratio of spend to save benefit will vary depending on the condition of the network and the level of resource allocated but will be higher the poorer the starting condition. The West Midlands Road Condition Study suggested that an increase in funding, largely in the form of an accelerated maintenance programme, would generate returns of £6.50 for every £1 of public investment. A number of local authorities have used Prudential Borrowing to fund accelerated maintenance

programmes, but I understand this is not available to Government Departments in Northern Ireland.

DfI Roads is in the process of implementing a fully functioning Pavement Management System. This is to be encouraged as it will provide a more robust and transparent approach to programme and scheme prioritisation as well as supporting the determination of the Asset Value and road maintenance backlog. DfI has taken delivery of the system and is being supported in its implementation by the system provider. The system chosen is similar to that used by others in the UK, in particular Scotland and Wales and it would be sensible for DfI Roads to engage with colleagues in Transport Scotland and/or Transport for Wales to better understand how best to deliver this vital resource. Better engagement with other UK highway authorities more generally would also yield significant benefits. DfI Roads is represented at senior levels on the UK Roads Liaison Group (UKRLG) and on the Boards that sit below RLG and is also a member of ADEPT (The Association of Directors of Environment, Economy, Planning and Transport). I understand that resource pressures have impacted on participation at this level in recent years but greater engagement in the UKRLG and ADEPT Working Groups would benefit DfI Roads through discussing similar issues facing other highway authorities and understanding best practice processes.

DfI's Asset Management Plan 2017 to 2022 sets out the strategic objectives and

challenges facing the Department and identifies important areas on which the Strategic Investment Board's (SIB) Asset Management Unit has worked closely with the Department to develop an Action Plan based on the known condition of its assets. However, the information contained in the Plan is at a high level and lacks the detail necessary to provide the basis of robust asset management of the roads asset. If DfI Roads were to develop its own Highways Asset Management Plan, in line with best practice across other parts of the UK, it would provide a much more robust framework in which to manage its asset effectively.

My final comment here, though, must be about funding. My overall assessment is that the funding requirements, as set out in the Structural Maintenance Funding Plan, provide a sound rationale. It has been developed over many years and has been endorsed by NIAO and the Northern Ireland Assembly's Regional Development Committee. It is based on the premise that road pavements have defined lifespans and require to be periodically maintained. The lifespans and treatment periods are recognised as best practice by pavement engineers across the world; consequently, the basis of the SMFP is well founded. In the absence of meaningful conditional modelling, which will only become available once the PMS is fully functional, I can offer no better way of determining maintenance need. The figure set for the SMFP in 1998 was £80m and, as described in Chapter 4, Table 7, is now estimated at c. £143m in

today's terms. I would therefore suggest that the figure of £143m is a realistic estimate of the annual requirement for structural maintenance funding.



CHAPTER 1

LANDSCAPE (INTRODUCTION)

1.1 Northern Ireland's Road Network

1.1.1 The public road network in Northern Ireland is, for a small country, vast and hugely diverse. Moreover, it is widely accepted that Northern Ireland is more dependent on road-based travel than the rest of the UK. The lack of a substantial rail network means, for example, that almost all freight is transported by road in Northern Ireland compared to 76% in the rest of the UK. It follows, then, that the condition of the road network is of vital importance to the economic and social well-being of the country.

1.1.2 Financial pressures have meant that, over recent years, the budgets required to maintain the road network have been less - sometimes significantly less - than it has been estimated is required. This Review will consider and comment upon how those budget requirements have been derived, how they compare with what has been allocated, how allocated funds have been deployed and how the road network is currently performing. It will also seek to assess how those charged with maintaining the network do so and provide a view on the likely funding requirements going forward, as well as the likely consequences of not providing that funding.

1.2 Responsibility for Roads Maintenance

1.2.1 The management, maintenance and development of the road network is the responsibility of the Department for Infrastructure (DfI). The creation of DfI in May 2016 has enabled a more integrated response to a range of issues including regional development, active travel, road safety and flood risk management.

1.2.2 The Department's Strategic Objectives are:

- Shaping the region and promoting economic growth;
- Developing the infrastructure in a sustainable way; and
- Connecting people to opportunities and services.

1.2.3 DfI is a key contributor to a number of the Northern Ireland Executive's Programme for Government (PfG) outcomes, from unlocking the economic potential of the region, to tackling disadvantage, to protecting the environment and in promoting health and wellbeing of its citizens. The Department leads on Outcome 11: 'We connect people and opportunities through our infrastructure' and also makes a particular contribution to Outcome 2: 'We live and work sustainably, protecting the

LANDSCAPE (INTRODUCTION)

environment'. A well maintained road network, particularly where rail alternatives are scarce and there is a large dispersed rural population, is fundamental to the delivery of these Outcomes.

1.2.4 Within the Department, DfI Roads maintains, develops and manages the road network to facilitate the safe

and convenient movement of people and goods. The region's public road network has 26,000 kilometres of road, 10,000 kilometres of footway, 5,800 bridges, 283,000 street lights and 34 Park and Ride/Share car parks. It is valued at £26bn. Details of the lengths of road for which DfI roads is responsible by road type is set out below.

TABLE 1 ROAD LENGTHS

Road Classification	Road length (carriageway-kms)	% of road network
Motorway	27 (268)	0.1
A Class Trunk	1333	5.2
A Class non-trunk	1215	4.7
B Class	2904	11.2
C Class	4734	18.3
Unclassified	15646	60.5
Total	25895 (26100)	100%

Note: Since 2008 the maintenance of the majority of the motorway network has been undertaken by Design, Build, Finance and Operate (DBFO) forms of contract and hence the principal figure here is that for which DfI Roads budget is concerned. The figure in brackets is the total motorway carriageway length.

CONCLUSION 1

NI is more dependent on road travel than the rest of the UK. A well maintained road network is fundamental to the economic and social wellbeing of the country and the delivery of PfG Outcomes.

1.3 Previous studies

1.3.1 Concern about the level of funding provided for road maintenance and how to make a convincing case for more funding has existed for many years. In this, Northern Ireland is far from unique; indeed, it is unlikely that there is a roads authority anywhere in the world that would say that it is completely happy with the condition

of its network and the level of funding provided. Roads maintenance is the Cinderella in most organisations and, whilst as I will explain later, there is an overwhelming business case for managing the network at the optimum level, most if not all roads authorities have a maintenance backlog. The table below shows the principal studies that have been undertaken over recent years.

TABLE 2 PREVIOUS STUDIES

Year	Review/Report	Outcome
1984, 1989, 1994	Various studies by Professor Snaith	Level of investment for structural maintenance should be set at £75m (1994 report) which is equivalent to £117m at 2017/18 prices.
1998	The Road to Everywhere policy review	Developed Structural Maintenance Funding Plan. Level of investment to fund Plan should be £80m per annum, which is equivalent to £114m at 2017/18 prices.
2000	NIAO review 'Structural Maintenance of Roads'	Endorsed SMFP and need for £80m per annum; established backlog at £100m, which is equivalent to £114m and £140m respectively at 2017/18 prices.
2009	'Review of Structural Maintenance Requirements for the Roads Service' by Professor Snaith	Funding for SMFP should be set at £108m per annum; backlog is £700m which is equivalent to £123m and £796m respectively at 2017/18 prices.
2018	Assessment of budgetary needs by DfI Roads - using Snaith methodology with updated prices.	Funding for SMFP now stands at £143m per annum and estimated backlog at £1.2bn

Note: the backlog in 2000 was calculated using a slightly different methodology to that used in 2009 and 2018 and is therefore not directly comparable.

LANDSCAPE (INTRODUCTION)

1.4 Studies undertaken since 1984

1.4.1 In a bid to determine the optimum structural maintenance budget, Roads Service commissioned Professor M.S. Snaith of the University of Birmingham and a leading authority in the field of structural maintenance strategy and road condition assessment, to carry out a series of reviews in 1986, 1989 and 1994. The 1994 review recognised that simply measuring network condition was not a good basis for establishing a funding strategy because by the time deterioration was detected it was often too late to contribute to medium and long term financial planning. Accordingly, Snaith's review proposed a more rational way of determining the optimum level of investment for structural maintenance of the Northern Ireland road network which he put at £75m per annum and which is equivalent to £117m at 2017/18 prices.

1.4.2 In December 1998 Roads Service published an internal Policy Evaluation of Structural Maintenance of Roads and Footways entitled 'The Road to Everywhere' which confirmed the requirement, in policy terms, for a properly funded and maintained road network. The Policy Evaluation also developed and updated Snaith's methodology to produce a Structural Maintenance Funding Plan (SMFP) for the Northern Ireland road network.

The Plan recognised that road and footway surfaces do not last for ever and have limited life spans, the values of which are generally widely accepted by road pavement engineers. At the end of these lifespans periodic maintenance is required in the form of resurfacing or surface dressing.

1.4.3 By applying these good practice frequencies to the known area of roads and footways and applying the unit costs for remedial treatments current at that time, the SMFP was developed. At the time the Plan indicated that £80m per annum, which is equivalent to £114m at 2017/18 prices, was needed to maintain the network and, importantly, deemed this to be a conservative estimate, this is a point that I will return to later.

1.4.4 In June 2000 the Northern Ireland Audit Office published its review entitled 'Structural Maintenance of Roads' which endorsed the methodology that was used to develop the SMFP and the need for an annual budget of £80m but noted that this amount did nothing to address the maintenance backlog; nor, indeed, had the backlog been calculated. Accordingly, it asked DFI Roads to calculate the backlog, which it put at £100m based on the (MARCH) surveying methods that were in place at that time.

1.4.5 Nine years later, Professor Snaith was asked to return to Northern Ireland to reassess the funding of road maintenance which he did in his report 'A Review of the Structural Maintenance Funding requirements for the Roads Service' published in September 2009. This review 'probed the efficiency of the Roads Service as they have dealt with the conflicting demands of a satisfactory level of serviceability and a declining budget for overall Structural Maintenance using techniques which are now well established and indeed Northern Ireland Audit Office approved' and recommended that the overall Structural Maintenance budget be increased to £108m at 2009 prices. This, Professor Snaith concluded, would halt the year on year increase in the length of roads in the country deemed 'not fit for purpose' which he described as the backlog. He also suggested that it would be helpful for the economy at large if extra monies were available to reduce the backlog, which he put at £700m, over a number of years.

1.4.6 As indicated above, the methodology developed by Professor Snaith to determine the backlog, centred on using road condition information to calculate the cost of remediating those sections of road that were deemed 'not fit for purpose'. Between 2000 and 2009, when the above assessments of the backlog were

carried out, Roads Service changed the way in which it measured road condition to those described in Chapter 2. Consequently, the figures of £100m (2000) and £700m (2009) have been calculated in different ways and whilst each is the best assessment of the backlog pertaining at that time, they are not directly comparable. I do not, however, view this issue to be material to the later conclusions that I draw relating to backlog.

1.4.7 This year, DfI Roads has assessed that the figure of £108m, required in 2009 (which is equivalent to £123m at 2017/18 prices) equates to c. £143m at 2018 prices; this is explained in Table 8, Chapter 4. The current backlog (based on the methodology of 2009) stands at c£1.2bn.

CONCLUSION 2

The requirement for a properly funded and maintained road network was confirmed in policy terms in 1998. The development of the Structural Maintenance Funding Plan as a rational way of determining the optimum level of spend for structural maintenance has been established over successive studies and endorsed by NIAO and the Northern Ireland Assembly's Regional Development Committee. The Structural Maintenance Funding Plan requirement, at 2018 prices, is c. £143m.



CHAPTER 2

CONDITION OF THE NI ROAD NETWORK

2.1 Road Design

- 2.1.1 New roads are, generally, designed to last for 20 or 40 years. The maintenance of those roads can take a number of forms. When the road has completely failed it will require reconstruction which will again provide a design life of 20 or 40 years, depending on the depth of reconstruction materials used and expected number/ weight of commercial vehicles.
- 2.1.2 Over the life of the road pavement, surveys will provide information on its condition in terms of its surface characteristics and its residual life. If the surface has lost its skidding resistance or has become cracked but is otherwise basically sound, it might be appropriate to apply a surface dressing. If the surface has more serious defects such as longitudinal deformations or rutting but the layers below the surface courses are sound (as measured by the residual life) then resurfacing might be the most cost-effective treatment. Both surface dressing and resurfacing will extend the life of the pavement and the point at which reconstruction will be required although neither will fully restore the life of the pavement to its original 20 or 40 year life. Indeed, surface dressing will reseal the pavement and so extend its life by preventing water ingress as well as improving ride quality and skidding

resistance but does not add to the strength, and therefore the residual life at all; resurfacing, depending on the depth of inlay, can add strength but thinner inlays, particularly when they are laid on less than fully sound base material will only result in marginal, if any, improvement in strength. Patching is a form of resurfacing carried out, as its name suggests, over a limited area to deal with specific problems.

- 2.1.3 When a road pavement reaches the end of its design life it will continue to have a level of serviceability. However, the way in which it behaves will become increasingly unpredictable and will result in a progressively increased need for unplanned maintenance (patching, pothole repair, etc) which is inefficient and disruptive to road users. The table overleaf shows the different types of treatment, how long they are likely to last and how much they cost. The basic principle is that the cheapest treatment that is appropriate to address the road condition should be applied.

CONDITION OF THE NI ROAD NETWORK

TABLE 3 GENERAL TYPES OF TREATMENT & COSTS

Treatment	Impact	Lifespan	Cost
Reconstruction (completely removing the existing road pavement and replacing it with new materials)	Fully restores life of pavement and improves ride quality	20-40 years	£80/m ²
Resurfacing (removing defective surface layers down to sound material and replacing them)	Partially restores life of pavement and improves ride quality	15-20 years	£5-£7/m ²
Area patching (removing defective surface layers over a relatively limited area and replacing them)	Partially restores life of pavement and improves ride quality	Around 5 years	£18/m ²
Surface dressing (applying a tar spray to the road surface and a layer of uncoated chippings that are then rolled into the tar)	Primarily seals and improves surface texture. Extends the life of the road surface.	Up to 10 years	£1.5-£2/m ²
Localised patching (cutting back potholes to sound material and filling them). It is accepted that shorter term patching is also an option.	Extends life of pavement locally	Up to 5 years	£46 -£98 per patch

2.2 Pavement treatments

- 2.2.1 The figures for lifespan are those typically achieved. The variability is related to how well the treatments are applied in terms of ensuring that the area of road pavement around and below the treated area is in good condition. The cost of patching will vary considerably depending on factors such as the amount of patching undertaken in a particular localised area and the figures given are only a very broad indication. Whether the work is carried out as part of a planned programme also has a significant bearing on cost. The Annual Local Authority Road Maintenance (ALARM) survey 2017 reported that the average cost of filling a pothole in England and Wales was £49 as part of a planned programme and £72 as a reactive repair. Reactive repairs are also significantly more disruptive to road users.
- 2.2.2 Roads are designed to accommodate vehicle loadings (described in terms of standard axles). The damage that vehicles do to road pavements is a function of the fourth power of the axle load; thus an HGV with four 11.5T axles will impart the same damage as over half a million cars with two 0.5T axles as can be seen below.

FIGURE 1 - DAMAGE CAUSED BY HGVS

Damage caused by HGVs

Loading on typical car axle
= 0.5T (on each of 2 axles)

Loading on typical HGV axle
= 11.5T (on each of 4 axles)

HGV loading per axle is $11.5/0.5$
= 23 times that of a car

HGV has twice as many axles

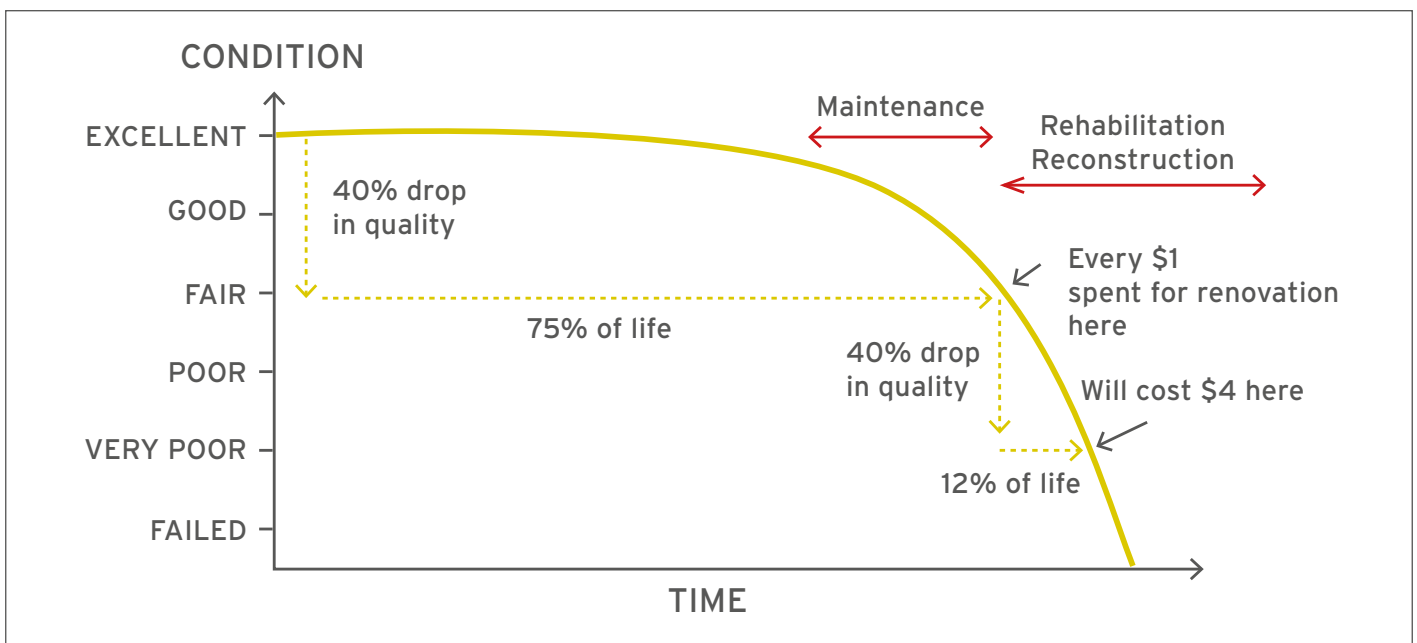
Thus, damage is 23 to the fourth power
times 2

HGV damage is 559,682 times that of
a car

- 2.2.3 Road pavements do not deteriorate at a uniform rate over their lifespan; indeed the rate of deterioration - and the amount of treatment required over the first half of their lives is usually minimal. This is followed by an increasingly rapid deterioration as shown in the figure overleaf.

CONDITION OF THE NI ROAD NETWORK

FIGURE 2 - DETERMINISTIC REPRESENTATION OF SERVICEABILITY DECLINE (SHAHIN AND WALTHER 1990) - TAKEN FROM SNAITH REVIEW 2009



2.2.4 The graph above shows that late intervention can cost four times as much as applying treatments at the optimum time.

2.2.5 Of course, this idealised version of events is subject to considerable variation in terms of precise timings. Roads are constructed upon wide range of soil types and whilst the surface on which the road is constructed (the subgrade) is required to meet certain minimum requirements, some will always perform better than others. Moreover, road construction is carried out under a range of climatic conditions with a huge number of variables which can

and do impact on the quality of the final product. Finally, the extent to which the road drainage is operating effectively has a huge impact on pavement life

2.2.6 Consequently, roads do not deteriorate at a uniform rate and, as a section of road moves towards the end of its design life some parts of that road length will continue to perform well whilst others will be in need of treatment - patching, for instance. The design of the best treatment for a section of road will take into account the residual life of the section generally and the condition locally to arrive at the best

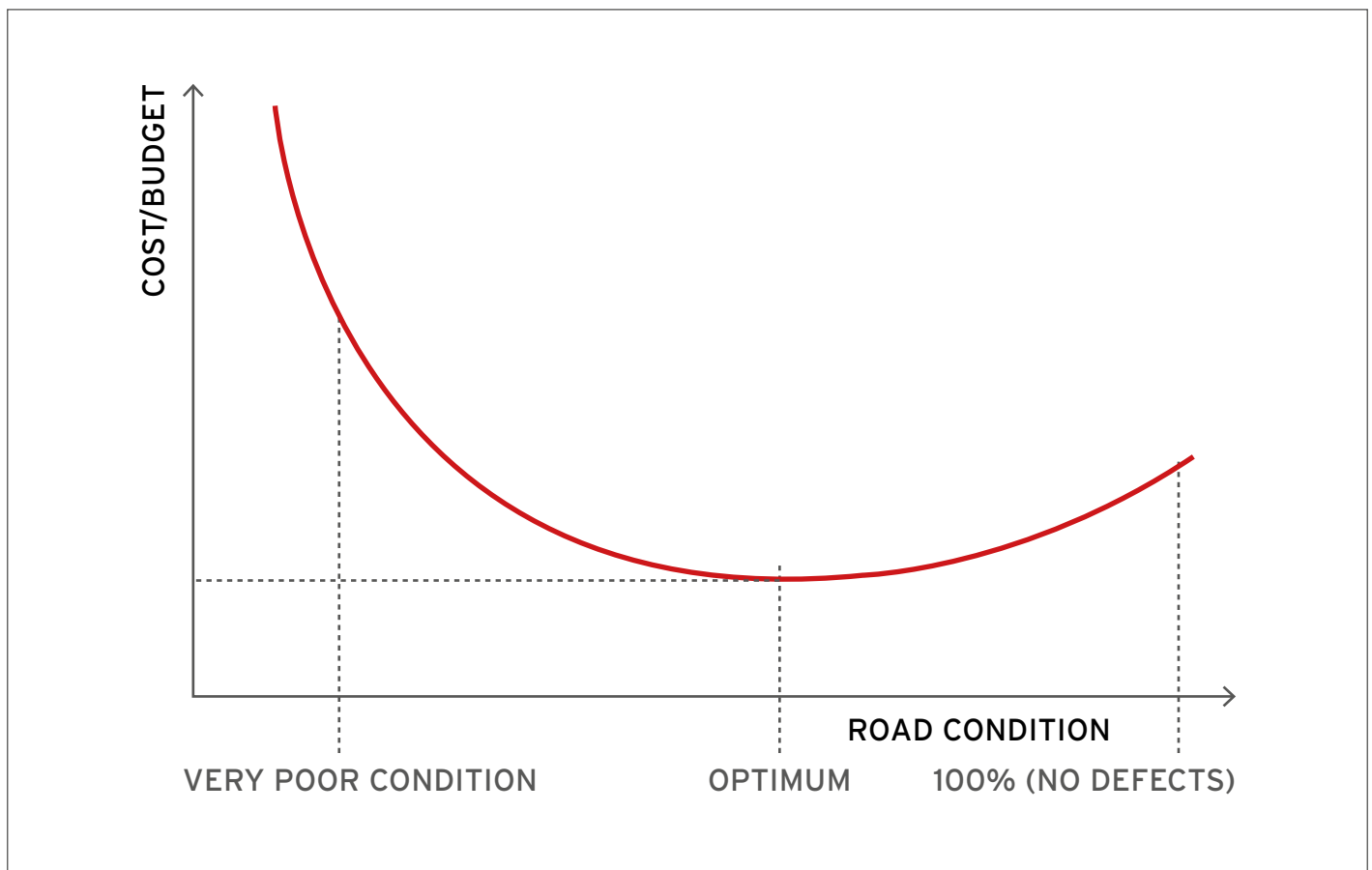
value treatment. These days, that design is usually undertaken within a Pavement Management System which contains all of the condition parameters known. If planned reactive maintenance is executed effectively it will significantly extend the life of the road pavement and delay or even avoid the need for more expensive treatments.

A particular issue with many of the minor and unclassified roads in Northern Ireland is that they have evolved from, basically, dirt tracks and have no proper road foundation or drainage. Bad weather and changes in traffic patterns (particularly increased heavy vehicle traffic) can cause these roads to deteriorate very quickly. Some of these roads will have been surfaced dressed many times over the years. Spraying a road with a thick coating of bituminous material and then rolling chippings into it is an effective treatment for these roads; however, it adds no strength to the pavement structure below the surface dressed layers and repeated treatments can produce a road surface that will have a tendency to become unstable, particularly in very hot weather. A process known as 'fatting up' occurs in which the bitumen rises to the surface of the road and becomes soft and fluid. That is what has happened to many roads in NI during the recent very hot weather. As well as the very visible immediate issue of 'melting roads' this process results in a deterioration of the skidding resistance, ride quality and durability of the road.

2.2.7 In summary then, there is very strong evidence that the closer that roads are maintained to their optimum condition, the less it costs annually to maintain them. Maintaining a road in a better than optimum condition is also inefficient as it will require too much of the pavement that is not in a poor condition to be replaced. There is therefore an overwhelming business case for timely, targeted intervention; the key outcome being that the customer would experience a better maintained road network at less cost to the roads authority. This is demonstrated in the graph overleaf and is, in fact the way in which private sector organisations approach road maintenance in PPP Contracts. The ratio of spend to save benefit will vary depending on the condition of the network and the level of resource allocated but will be higher the poorer the starting condition. The West Midlands Road Condition Study suggested that an increase in funding, largely in the form of an accelerated maintenance programme, would generate returns of £6.50 for every £1 of public investment. Similarly, the NIAO Case Study on Sixtowns Road detailed in Chapter 3 identifies that the patching treatments being undertaken were three and a half times more expensive than resurfacing over a 25 year horizon, A number of local authorities have used Prudential Borrowing to fund accelerated maintenance programmes, but I understand this is not available to Government Departments in Northern Ireland.

CONDITION OF THE NI ROAD NETWORK

FIGURE 3 - RELATIONSHIP BETWEEN THE OVERALL CONDITION OF THE NETWORK AND THE ANNUAL BUDGET REQUIRED TO MAINTAIN THAT CONDITION



CONCLUSION 3

Roads are designed to last for a defined period but internal and external factors will mean that they do not deteriorate in a uniform or homogeneous manner. Timely intervention is highly cost effective with late intervention costing as much as four times the optimum. There is a very strong business case for timely intervention; the key outcome being a better customer experience resulting from a better maintained network and at a lower cost to the authority to maintain.

2.3 How condition is assessed

- 2.3.1 The DfI assesses the condition of its road network in broadly similar ways to that used by other national and local roads authorities in the UK. A combination of machine based surveys and visual inspections are used to assess the strength, surface condition, skidding resistance and ride quality; routine safety inspections are also undertaken in order to identify those defects that are likely to create a danger to the public and which must therefore be dealt with as a matter of priority.
- 2.3.2 Deflectograph surveys are carried out by a vehicle that measures the deflections of the roads surface under defined loading and uses this information to calculate the residual life of the road pavement and the need for structural repairs. The vehicle operates at low speeds and,

consequently, deflectograph surveys are relatively expensive. Currently, deflectograph surveys are carried out over one third of the motorway, trunk and non-trunk A class road network each year.

- 2.3.3 SCANNER (Surface Condition Assessment for the National Network of Roads), or High Speed Road Monitor, consists of a number of laser sensors mounted on a purpose built vehicle. It travels at close to traffic speed and measures the condition of the road in terms of the extent of surface cracking, ride quality, wheel-track rutting and alignment. The outputs from the SCANNER are combined to produce a Road Condition Index (RCI) which is the industry standard measure for road condition currently in use. RCI figures are derived from machine surveys carried out on the Motorway and trunk road network as well as A,B, and C Class roads and is used to identify the need for structural repairs. Excluding roads under PPP Contracts SCANNER surveys are currently carried out on half of the motorway and trunk road network each year whilst B and C Class roads are surveyed at a rate of 25% each year.
- 2.3.4 SCRIM (Sideways Coefficient Routine Investigation Machine) measures the skidding resistance of road surfaces. Currently, SCRIM surveys are carried

CONDITION OF THE NI ROAD NETWORK

out over the entire motorway and trunk road network and one third of the non-trunk A class road network each year. Sites where results fall below the investigatory level are prioritised for further investigation to determine whether maintenance treatment is required.

2.3.5 Coarse Visual Inspections (CVI) are currently undertaken by trained inspectors on the unclassified road network to determine its condition in line with United Kingdom Pavement Management System (UKPMS) rules and parameters. Whilst CVI is no longer required for the calculation of National Indicators in GB, Northern Ireland has continued with the methodology previously used to calculate the unclassified road Best Value Performance Indicator (BVPI) from the information in the CVI surveys, as the basis for reporting on the condition of its unclassified network. From 2002 until 2015 most of the unclassified network has been subject to CVI surveys at an annual coverage of around 25%. More recently, this survey coverage has been reduced to 10% because of funding constraints and the impact of the NICS Voluntary Exit Scheme. Whilst there clearly needs to be sensible balance between the amount of time and money spent on surveys and the resources available to carry out treatments, surveying just 10% each year will not provide an accurate picture of the current state of the

unclassified road network. So, even though we know that there have been significant problems with the condition over this last winter, and the 10% survey will almost certainly reflect that situation, this will only make a small 'up to date' contribution to the aggregated condition figure. Any marked deterioration, or indeed improvement, in the unclassified road network will be highly damped by the condition information that is not changed from previous years. There will, therefore be a considerable lag in the profile of the overall condition data which will not reflect, accurately, the current state of the network. This will be explored further in Chapter 5. I understand that DfI Roads is investigating replacing the subjective CVI surveys with more objective forms of survey and also increasing the level of coverage. I would support this move.

CONCLUSION 4

Road condition surveys on all but the unclassified road network are carried out in a broadly similar manner to that in the rest of the UK. The techniques used for the Coarse Visual Inspection (CVI) surveys carried out on the unclassified road network are the same as those used in the rest of the UK where they are still used. The decision to undertake these surveys on just a 10% sample of the unclassified network means that changes in the true condition year on year are masked by the volume of data that remains unchanged.

2.4 Condition of roads in Northern Ireland

TABLE 4 PERCENTAGE OF THE ROAD NETWORK WITH MORE THAN 5 YEARS RESIDUAL LIFE

Deflectograph - Percentage of the road network with more than 5 years residual life			
	Motorways	Trunk A roads	Non-trunk A roads
Northern Ireland	*	77%	67%
Scotland	79%		N/A
Wales	93%	90%	N/A

*Majority of the motorway network in NI is managed and maintained by DBFO Companies

2.4.1 The percentage of the trunk road network (excluding motorways) with greater than 5 years residual life, as measured by deflectograph, was 77% in 2016/17; the percentage of non-trunk A class roads in the same year was 67%. As can be seen from the graphs overleaf, the residual life of both trunk and non-trunk A roads has shown a marginal improvement over recent years and is in line with the target condition of 70%. The condition is similar to that in Scotland but worse than Wales. Highways England no longer carries out deflectograph surveys at a network level, relying on SCANNER surveys for an assessment of network condition,

although I understand that it is investigating the use of traffic speed deflectograph technology.

CONDITION OF THE NI ROAD NETWORK

FIGURE 4 - PERCENTAGE OF TRN (EXCLUDING MOTORWAYS) GREATER THAN 5 YEARS RESIDUAL LIFE

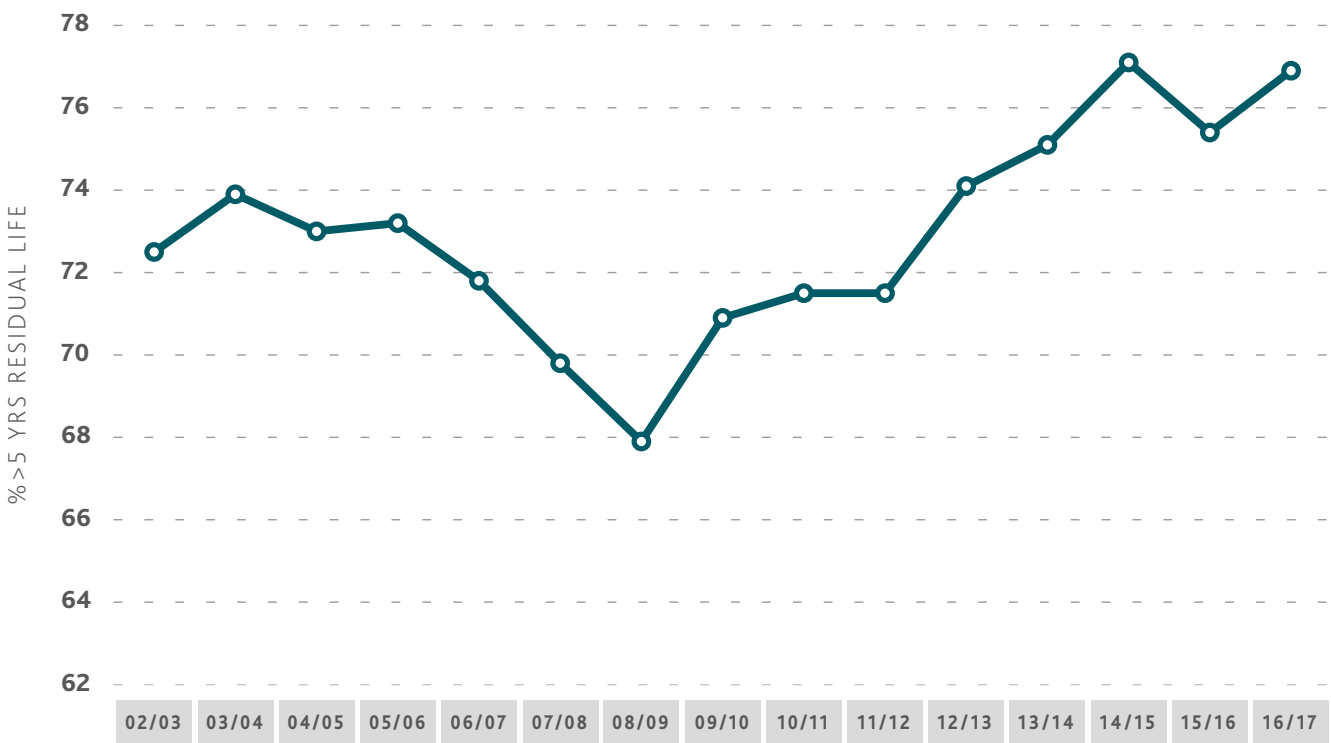
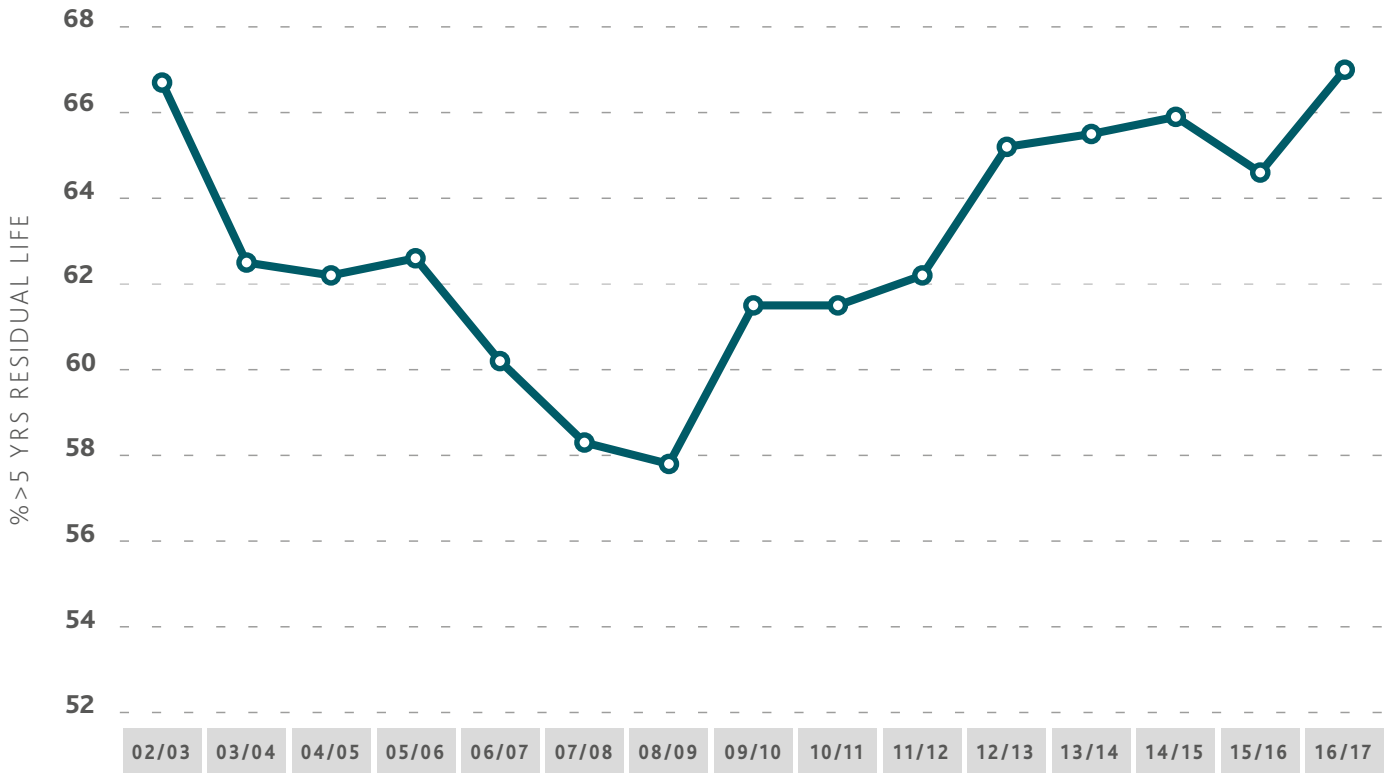


FIGURE 5 - PERCENTAGE OF NON-TRUNK A CLASS GREATER THAN 5 YEARS RESIDUAL LIFE



CONDITION OF THE NI ROAD NETWORK

2.4.2 The graphs below show the Road Condition Index for A, B and C class roads as measured by Scanner. The red lines indicate the proportion of the network where the RCI is greater than 100 (plan maintenance soon), the amber line indicates the proportion of the network with an RCI between 40 and 100 (investigate soon) and the purple line indicates

the proportion of the network with an RCI of over 40 and is, in effect, a combined red and amber score.

2.4.3 All B & C figures are for a rolling 4 year period. Survey coverage for first 3 sets of data was on a sample basis only. Full coverage was only achieved from 2012 - 2015 period onwards.

FIGURE 6 - CONDITION OF TRN & A CLASS ROADS

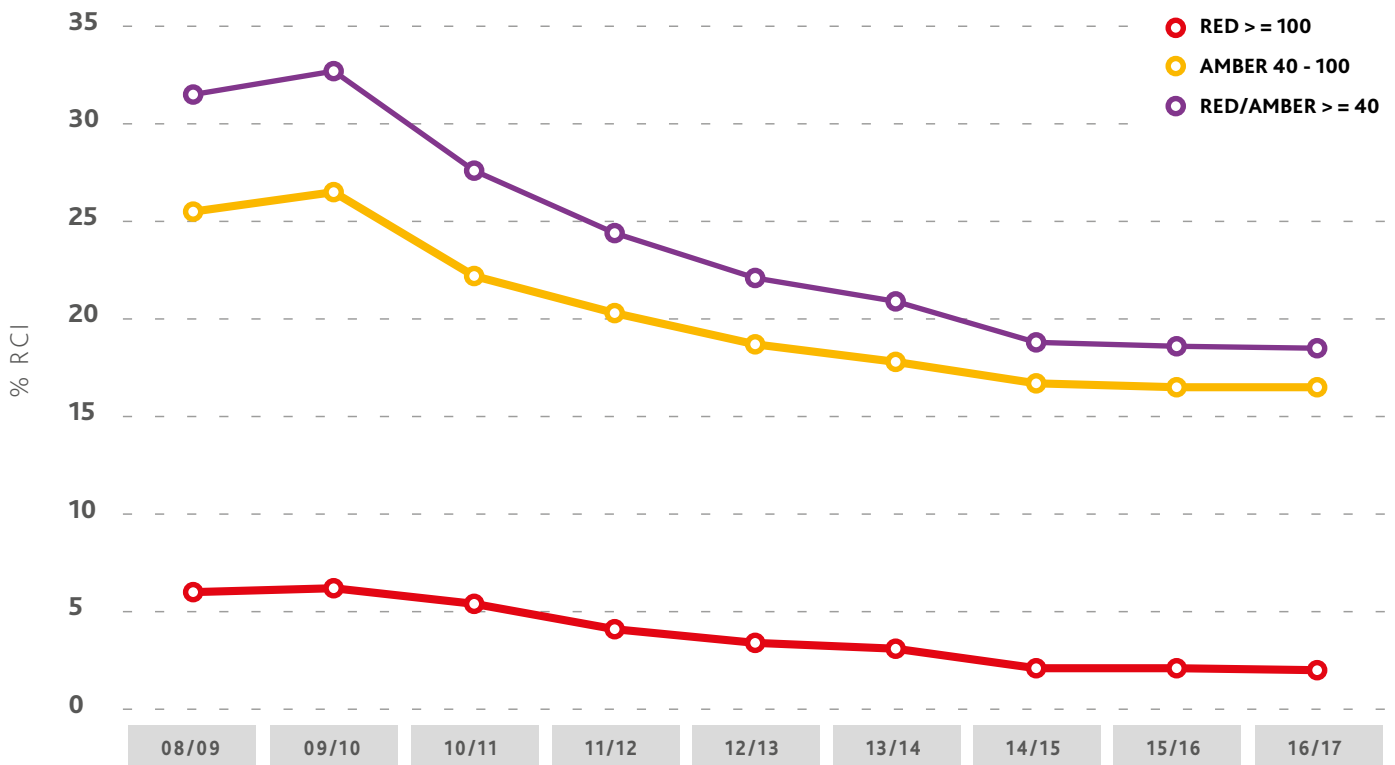


FIGURE 7 - CONDITION OF B CLASS ROADS

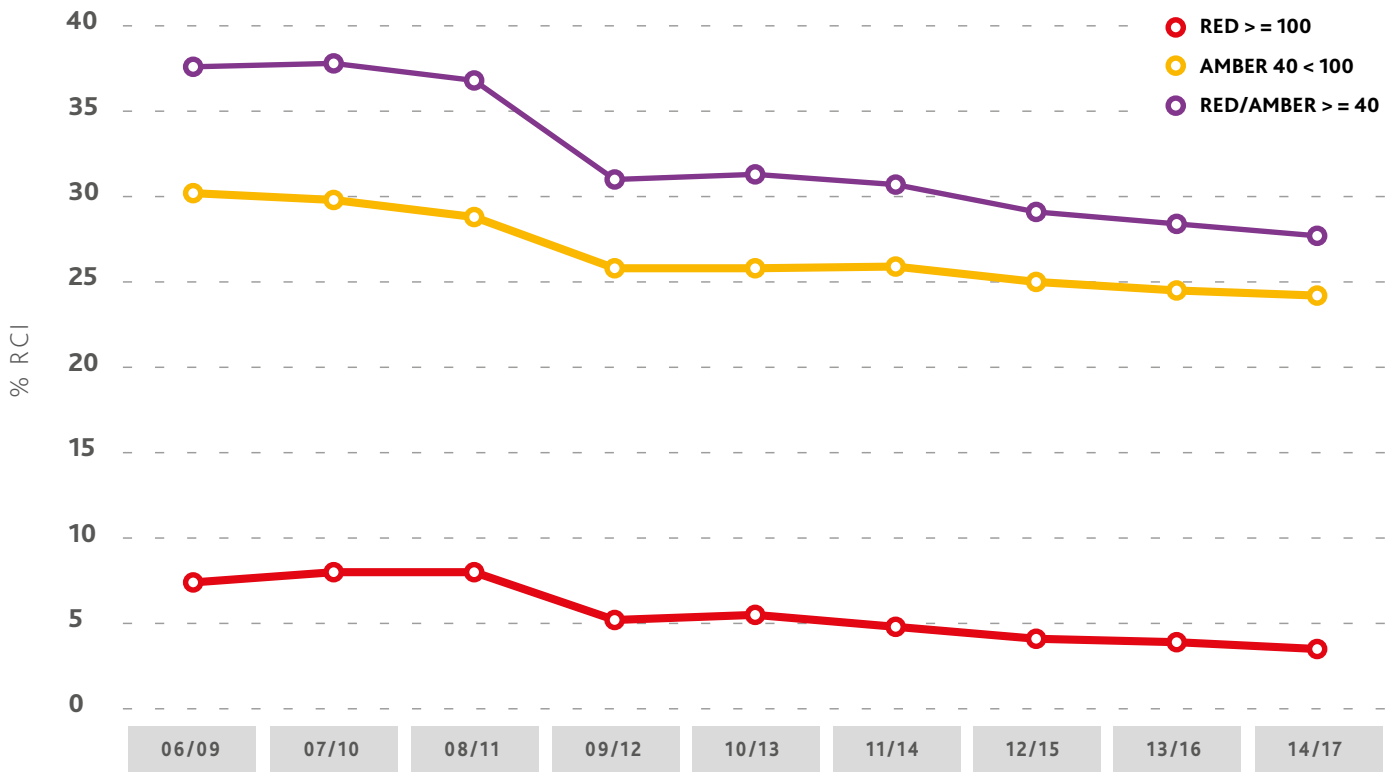
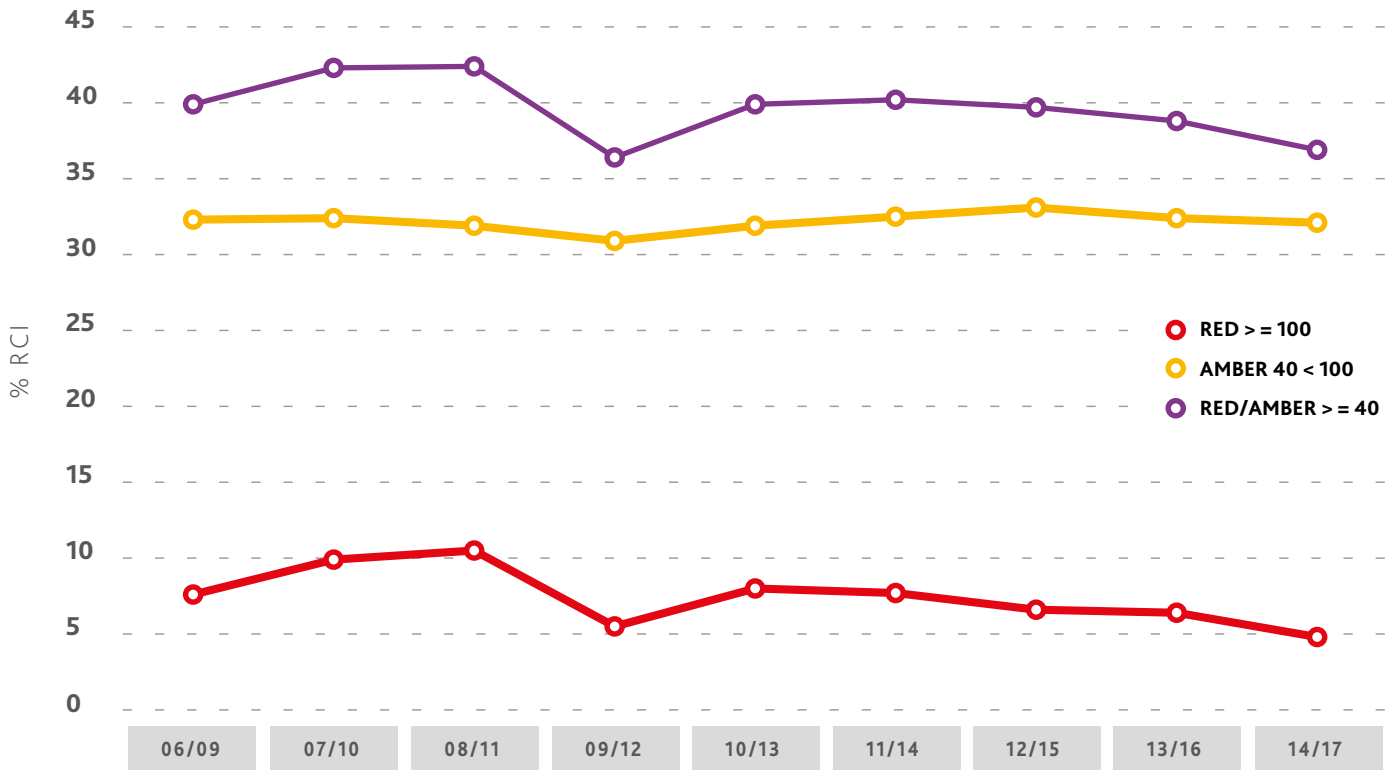


FIGURE 8 - CONDITION OF C CLASS ROADS



CONDITION OF THE NI ROAD NETWORK

2.4.4 As with deflectograph, the results show a marginally improving trend over recent years with 2% of the trunk and non-trunk A class roads, 4% of B class and 5% of C class

roads in poor condition and in need of planned maintenance. This is roughly in line with the situation in England and Scotland as can be seen from the table below.

TABLE 5 REGIONAL CONDITION AS MEASURED BY SCANNER

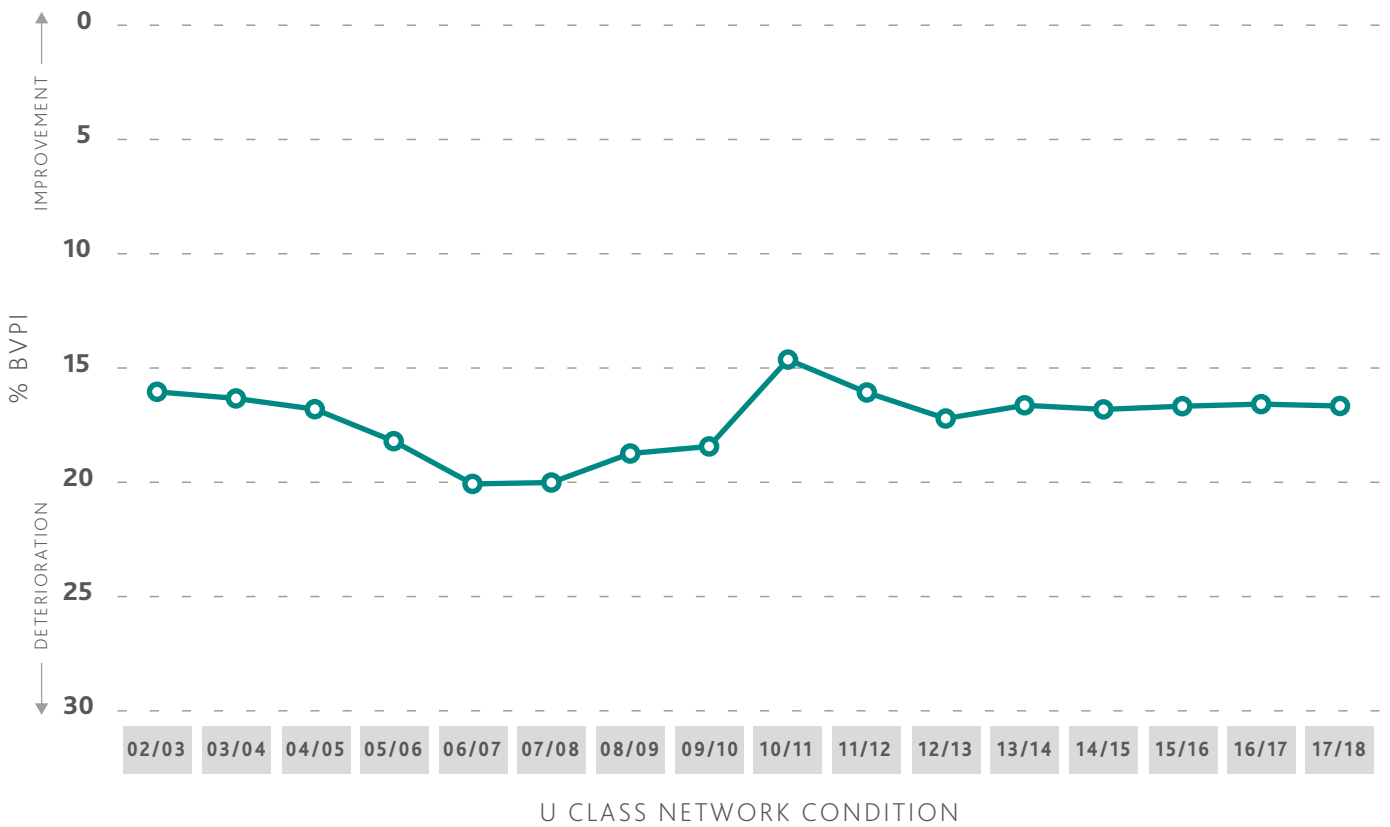
	Condition as measured by SCANNER - Road Condition Index (% in poor condition)					Condition as measured by CVI or Other visual survey
	Motorway	A Class trunk	A Class nontrunk	B Class	C class	Unclassified
Northern Ireland		2%		4%	5%	16%
Scotland	2%		4%	6%	6%	31%
England	2%	4%	3%	6%		17%
Wales	N/A	N/A	11.2%			N/A

Note - the condition data for the unclassified network in other jurisdictions might have been collected via different methods and so should be compared with caution. For Northern Ireland the data information is collected using CVI surveys to produce the BVPI

2.4.5 The graph opposite shows how the BVPI condition rating for unclassified roads has changed over successive years. It indicates that the condition rating has remained broadly level over recent years, however, this is hardly surprising given the reduction in survey coverage over recent years so changes in condition - be they

improvements or deteriorations are masked. As discussed previously, the assessment of condition from visual surveys will also be masked by the extensive surface dressing and patching which will give a better impression of the road surface that is not matched by its underlying condition.

FIGURE 9 - CONDITION OF UNCLASSIFIED ROADS



Note: Figures are for a rolling 4 year period. Full coverage of network from 02/03 to 15/16. Annual survey coverage from 2016/17 has reduced to around 10% per annum meaning the 2017/18 figure is based on 70% survey coverage pro rated for the whole U class network.

below the SCRIM investigatory level and 34% of the non-trunk A class network is at or below that level. The trunk road figure is considerably worse than other parts of the UK whilst non-trunk roads are broadly similar to the non-trunk Motorways and A roads in England

2.4.6 The current (2017) skidding resistance values as measured by SCRIM are shown overleaf; 48% of Northern Ireland’s trunk road network is at or

CONDITION OF THE NI ROAD NETWORK

TABLE 6 REGIONAL SKIDDING RESISTANCE % AT OR BELOW INVESTIGATORY LEVEL

	SCRIM Levels (% at or below investigatory level)		
	Trunks Roads		Non-trunk Motorway and A Class roads
	M/way	A class	
Northern Ireland	3.2%	47.8%	34%
Scotland	28%		N/A
England	5%	19%	27%
Wales	0.1%	9.5%	N/A

Rural Road Initiative

In 2016 the then Infrastructure Minister, Chris Hazzard, announced that he had earmarked the £10m of additional funding announced by the Finance Minister for resurfacing work on 1,000 rural roads across the north.

Commenting at the time, The Minister said:

“I am delighted to announce today that rural communities across the region will benefit from a £10 million road improvement package to stop deterioration and repair severe defects on their local road network.

“The improvements will target around 1,000 rural roads, repairing many short lengths of road (20-50m) in particularly poor condition, together with a number of longer resurfacing schemes of around 1 km.

“In this difficult financial period, it is of course necessary to prioritise resources, but for too long rural communities have dropped down the priority list. Today will go some way to addressing that imbalance and giving rural communities across the region roads that are fit for purpose and that will stand the test of time and weather.”

CONCLUSION 5

Based on the outputs from the machine surveys A, B and C Class roads have seen a gradual improvement in their estimated residual life (e.g. fewer roads being considered for maintenance) over the past 5-6 years. Unclassified roads have not seen this same improvement and appear to be maintaining a broadly constant condition. Possible reasons for this could be connected to the strength of resurfacing and/or the recent mild winters as well as recent interventions such as the rural roads initiative; limited survey coverage will continue to mask out condition on these particular roads.

Nearly half of the trunk road network and a third of the non-trunk network is at or below the 'investigatory level' for skidding resistance and requires further investigation. The investigatory level is the level of skidding resistance at which consideration is given to the need for further maintenance. At this level, evidence (e.g. accident rates) would be taken into account to determine possible future actions. It is worth noting that the 'investigatory level' relates to skidding resistance of the road surface and is a safety indicator, not an indicator of structural condition.



CHAPTER 3

HOW THE NETWORK IS MANAGED

3.1 Statutory responsibilities

3.1.1 The Roads (NI) Order 1993 places a duty on the Department to 'maintain all roads' and states that in any action against the Department it shall be a reasonable defence to prove 'that the Department had taken such care as in all the circumstances was reasonably required to secure that part of the road to which the action relates was not dangerous for traffic'

3.1.2 It then defines the matters that the court should have particular regard to as;

- The character of the road and the traffic which was reasonably expected to use it
- The standard of maintenance appropriate for a road of that character and used by such traffic
- The state of repair in which a reasonable person would have expected to find the road
- Whether the Department knew, or could reasonably have been expected to know, that the condition of the road to which the action relates was likely to cause danger to road users
- Where the Department could not reasonably have been expected to repair that part of the road before the cause of action arose, what warning notices of its condition had been displayed

3.1.3 In order to seek to comply with the above requirements, DfI Roads, in common with other roads authorities in the UK has developed and introduced guidelines and standards relating to the inspection and repair of defects. These are contained in Roads Service Policy and Procedure Guides (RSPPG) and Director of Engineering Memoranda (DEM),

3.1.4 RSPPG_E019, issued in October 2012, set out 'the policies and standards to be used to ensure that the limited resources available for road maintenance are used most effectively'. The standards were developed from the two UK codes of practice in use as well as taking into account well established practices used in Northern Ireland.

3.1.5 In December 2015, DEM 158/15 introduced revised inspection frequencies brought about as a result of the impact of the Voluntary Exit Scheme (VES) on staffing levels'. It extended the inspection frequencies for all but the highest trafficked roads and footways and for certain car parks.

3.1.6 In relation to maintenance standards and service levels a DEM has been issued each year since 2015. DEM 160/16 and DEM 160/17, introduced in April 2016 and 2017 respectively, set out the policy in relation to the delivery of the limited road

HOW THE NETWORK IS MANAGED

maintenance service, intended as an interim measure, brought about by the significant financial pressures. The DEM set out, primarily, the prioritisation and repair of defects and the delivery of routine maintenance functions.

- 3.1.7 More recently DEM 160/18 has revised the policy further in relation to the limited maintenance service. These changes in maintenance standards - 12 in all since 2015 - have been necessary in order to align the standard that is able to be delivered with the budget that is available. This is in line with the process recommended in the UK Guidance 'Well Maintained Highways'.

CONCLUSION 6

DfI Roads has a statutory duty to maintain roads in a safe and serviceable condition. In order to seek to comply with that duty DfI Roads has developed guidance and standards related to the inspection and repair of defects; however, these standards have had to be changed on 12 separate occasions since 2015 to deal with funding cuts and in-year changes.

3.2 Management structure

- 3.2.1 DfI Roads is managed by a senior management team, headed by the Deputy Secretary, Roads and Rivers, who reports to the Permanent Secretary. Its headquarters is in Belfast with four divisions, each headed by a Divisional Roads Manager based in Belfast, Coleraine, Craigavon and Omagh. Each division is divided into a number of sections, which generally correspond to district council areas. A share of the annual structural maintenance budget is apportioned to each of the divisions. Thereafter, the Divisional Roads Manager is responsible for allocating funds across the division.
- 3.2.2 Allocations are made to four Divisions on the basis of need using a range of weighted indicators tailored to each maintenance activity (i.e. resurfacing, patching, etc.). Divisions use these indicators when apportioning across Council areas to ensure, as far as possible, an equitable distribution of funds across the NI road network.
- 3.2.3 During the course of this review I met with the Divisional Roads Manager (DRM) and the Network Maintenance Manager (NMM) of Southern Division representing the client side of the organisation and the Head of Roads Operation and Maintenance (O&M) representing the in-house provider. One very clear message that emerged

from all of my discussions is that the Voluntary Exit Scheme has had a negative impact in terms of reducing the capacity, capability and skill set of the organisation.

potholes, for example, where the surrounding surface is also in a very poor condition but there is insufficient money to take out a larger area and cut back to sound material before undertaking the repair. The result is that the pothole repair only lasts one or two years at most and, in some cases only a matter of months.

3.2.4 It was also clear from discussions with the client representatives that they have great concerns about the steady deterioration of, particularly, the lower class road network. Their view is that, generally, the trunk and A Class network is in a reasonable condition but that the B, C and U class roads are in a steady state of decline; their view is reinforced by the fact that this is where the vast majority of complaints come from.

An examination of the level of customer complaints/enquiries between July 2017 and June 2018 demonstrates that the vast majority relate to potholes and that over half relate to the unclassified network; if we include B and C class roads the figure goes up to around 90%. The level of complaints/enquiries is roughly balanced across the four Divisions.

3.2.5 The restrictions on spending have resulted in sub-optimal maintenance strategies aimed primarily at keeping the network safe and whilst this is the right thing to do from a public liability perspective, it often results in money being spent poorly - repairing

HOW THE NETWORK IS MANAGED

FIGURE 10 - ROAD MAINTENANCE STANDARDS FOR SAFETY

DfI Roads categorises defects according to their severity as follows;

Category 0 - significant hazard to road uses such as oil spillage, tree blocking road, etc.

Category 1 - potholes greater than 100mm deep, etc.

Category 2 - potholes >50 - 100mm deep

Category 3 - potholes >20 - 50 mm deep

Category 4 - other defects

It also categorises response times as R0, R1, R2, R3 and R4

R0 - Repair or make safe as soon as practical

R1 - Repair or make safe before the end of the calendar day

R2 - Repair or make safe within 5 working days

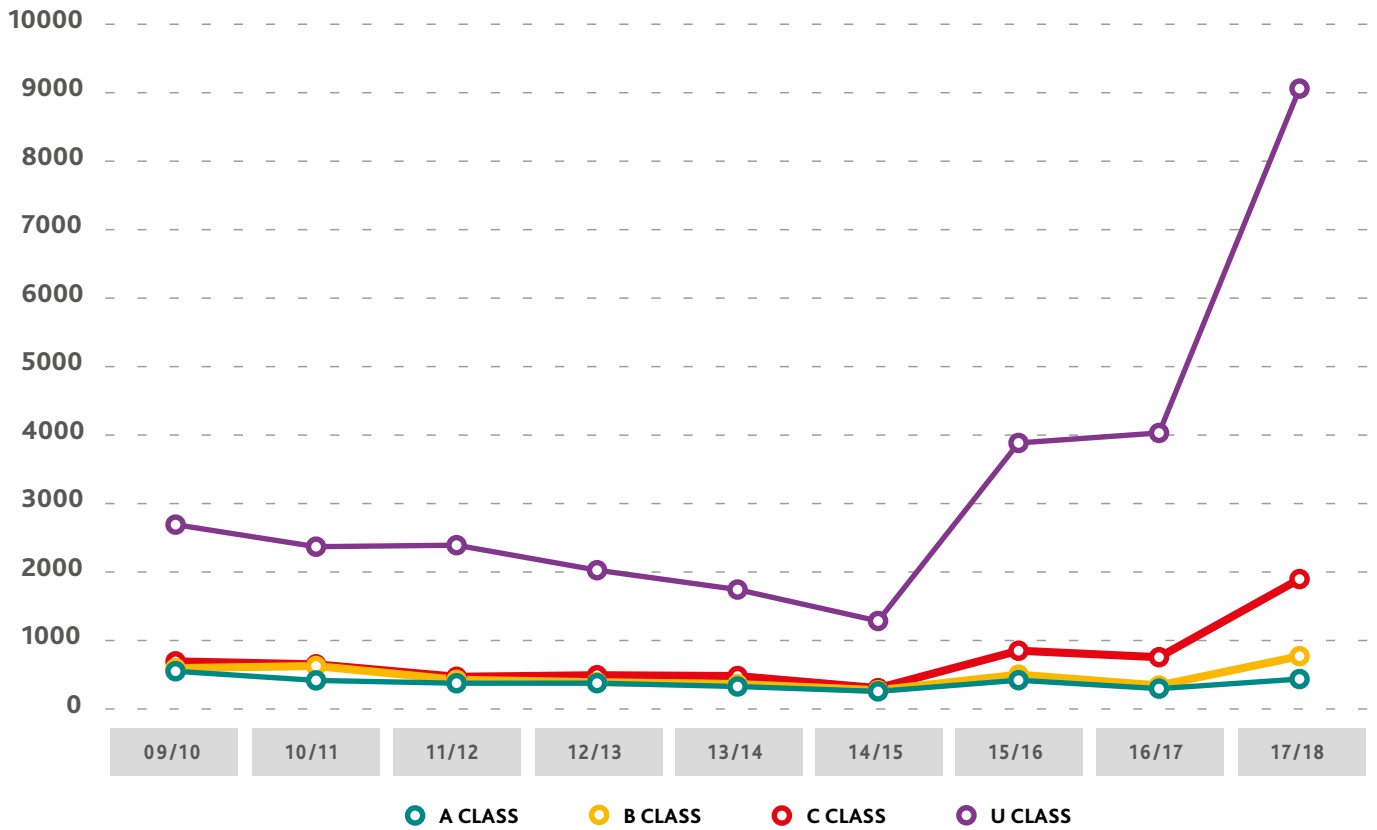
R3 - Repair within 4 weeks

R4 - Repair during next available programme

DEM 160/17 - instructed that other than on highly trafficked roads, no Category 3 defects should be repaired and that, in the case of low trafficked rural roads, neither should Category 2 defects be repaired. This meant that over large parts of the road network, defects of between 20 and 50 mm deep were not being treated and on low trafficked rural roads defects of between 50 and 100mm deep were not being treated. Further, it instructed that only those defects that are to be instructed for repair are to be recorded.

DEM 160/18 modified this instruction to require Category 2 defects on low trafficked rural roads to be instructed for repair and to advise that 'it is permissible to record but not mark out on site' those R3 defects that are not to be instructed for repair.

FIGURE 11 - NUMBER OF CATEGORY 1 DEFECTS SINCE LIMITED SERVICE



The diagram above illustrates the impact in terms of number of category 1 type defects across the various networks since the introduction of the limited service since 2015.

HOW THE NETWORK IS MANAGED

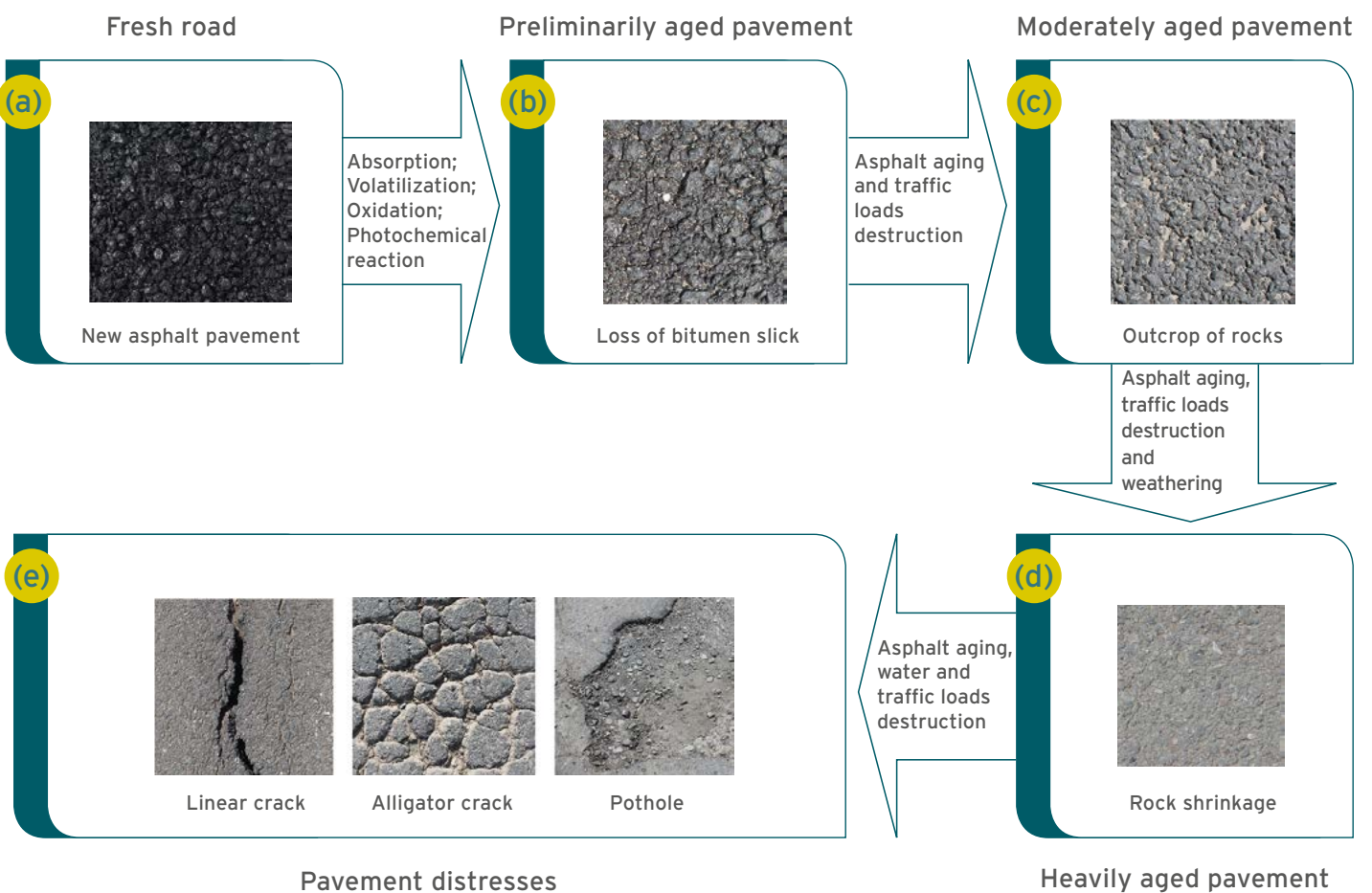
3.2.6 The reduction in inspection and repair regimes means that there is no scope for preventative patching and that damage that would cost relatively little to repair, were it carried out earlier, is often having to wait until that damage is so bad that there is no alternative but to fix it. This is illustrated in the pictures below. This shows how a road pavement that is in relatively good condition and which would cost relatively

little to repair will, if left untreated, progressively deteriorate to the point where it has failed completely and requires major reconstruction. Along the way, it is highly likely that the travelling public will have suffered a reduction in service standard and even vehicle damage. The deterioration mechanism is explained in diagrammatic form below the photographs.

**A stitch in time -
how road surfaces
will deteriorate if
untreated**



FIGURE 12 - PAVEMENT DISTRESS - TAKEN FROM YIFAN PAN ET AL, JOURNAL OF APPLIED REMOTE SENSING (6 JANUARY 2017)



The aging processes of asphalt pavement over time. (a) Fresh road pavement, (b) preliminarily aged pavement, (c) moderately aged pavement, (d) heavily aged pavement, and (e) pavement distresses (e.g. linear crack, alligator crack, pothole, etc.)

HOW THE NETWORK IS MANAGED

3.2.7 From discussions with the Head of O&M, the Department's internal contractor provider, it is clear that the lack of certainty of longer term budgets makes it impossible for him to properly plan and sustain the necessary plant and staffing resources to fully deliver the maintenance activity required by the Divisional Roads Managers. The Voluntary Exit Scheme has had a significant impact on the O&M team and, without funding certainty over, say, a five year horizon, he is unable to employ operatives to deliver anything other than minimum levels of maintenance. Where O&M is unable to meet the Divisional Roads Manager's requirements the work is outsourced to private sector contractors to meet the agreed service levels of the DEM.

3.2.8 With the money that has been allocated for the repair of potholes following the last winter, all of those consulted consider it highly unlikely that they will be able to arrest the current state of decline. What this means is that it is highly likely that the overall condition of the network, particularly the lower class network, will be worse at the start of the coming winter than it was at the start of the last; however, with the staffing and equipment currently available to O&M, it would not be able to deliver all the work required even if the money were forthcoming.

In its 2000 Study, NIAO included a number of case studies. Case study A concerned a stretch of the Sixtowns Road between Omagh and Draperstown. It considered three options for the 400 metre stretch of road:

Option 1 - Continue as at present, patching potholes and other damaged areas as they occur

Option 2 - Patch and overlay now on a reinforcing fabric to existing 5m width

Option 3 - Widen now to 6 metres, patch and overlay on a reinforcing fabric

The estimated costs at that time of the different options over a 25 year period were:

Option 1 - £171,000 Initial spend £8,400

Option 2 - £49,000 Initial spend £45,600

Option 3 - £69,000 Initial spend £67,900

NIAO's conclusion was that the current practice of keeping the road serviceable through patching is approximately three and a half times more expensive than resurfacing and two and a half times more expensive than resurfacing and widening, which was NIAO's preferred option.

NIAO also noted that the analysis took no account of public liability claims which would almost certainly be much higher for Option 1 but that given current funding pressures, Roads Service was restricted to Option 1, which clearly did not offer the best value for money.

CONCLUSION 7

Managers responsible for the maintenance of the road network believe that, whilst the trunk and A Class network is in a reasonable condition, the B, C and U Class roads are in progressive decline. Their professional opinion is supported by the level of complaints that they receive in respect of the lower class roads.

Funding pressures, leading to sub-optimal maintenance strategies, are resulting in reduced value for money.

As of August 2018 there is insufficient money allocated to the repair of the network to bring it back, even, to the condition that it was in prior to last winter.



CHAPTER 4

FUNDING

4.1 Funding

- 4.1.1 All road maintenance falls into one of two categories - Capital and Revenue. Capital is used for infrastructure projects and improvements or changes to existing infrastructure. This can include major maintenance work that adds value to the network in terms of its Asset Valuation such as resurfacing and strengthening. Revenue is spent on day-to-day activities like routine maintenance, for example, grass cutting or gully emptying and reactive maintenance, such as filling potholes.
- 4.1.2 Structural maintenance in Northern Ireland is the collective term used to cover both capital and routine activities related to the renewal, repair and maintenance of the road pavement

4.2 Previous Reviews

- 4.2.1 DfI's Corporate Plan places high importance on the need to adequately maintain the road network through a properly resourced programme of structural maintenance. The purpose of the programme is to maintain the integrity of the network - one of the NI Governments most valuable assets. Such maintenance includes strengthening, surface dressing, patching and drainage works.

- 4.2.2 Chapter 1 of this Review describes the previous studies that have been undertaken which led, in 2009, to Professor Snaith recommending that the overall Structural Maintenance budget be increased to £108m per annum at 2009 prices (£123m at 2017/18 prices). He also assessed the maintenance backlog to have increased to £700m (£796m at 2017/18 prices). The table that supports Professor Snaith's funding recommendation, updated to current figures, is reproduced below. The table sets out the basis on which DfI has estimated that it now needs c. £140m to properly fund the SMFP; the road maintenance backlog now stands at £1.2bn.

FUNDING

TABLE 7 STRUCTURAL MAINTENANCE FUNDING PLAN 2018/19 (UPDATED AUG 2018)

Network	Treatment	Good Practice Treatment Frequency (years)	Total Length (c'way km)	Annual Requirement (c'way km)	Treatment Cost - 2018 (£k/km)	Annual Cost (£k)
Motorways (inc. slips) Trunk Roads Addit A class B class C class U class	Resurfacing	1 in 20	23	1.15	253.68	292
		1 in 20	1,163	58.15	217.99	12,676
		1 in 20	1,215	60.75	171.11	10,395
		1 in 25	2,904	116.16	106.33	12,352
		1 in 25	4,734	189.36	106.33	20,135
		1 in 30	15,646	521.53	85.44	44,561
Bitmac carriageways	Surface Dress	1 in 10	20,319	1,950.6	9.35	18,243
(Treatment lengths for surface dressing have been adjusted to reflect supersession of resurfacing treatments over surface dressing)						
Total Carriageway Resurfacing and Surface Dressing Requirements						118,654
C'way Patching (current spend reduced by 50% to take account of good practice treatment freqs)						8,861
Concrete Roads (mainly in Belfast)						1,500
Structural Drainage						6,700
Footways						7,000
Total Structural Maintenance Requirement						142,715

4.2.3 The funding plan recognises that road and footway surfaces do not last for ever and have limited life spans, the values of which are generally accepted by pavement engineers. At or around the end of those life spans, periodic maintenance is required in the form of resurfacing or surface dressing. However, when the budget allocated falls short of the SMFP requirements the level of treatment will not be sufficient to adhere to

the planned timescales. The table opposite shows how resurfacing and surface dressing volumes currently being undertaken equate to treatment frequencies, should that volume be sustained over successive years. It can be seen that actual intervention frequencies are much longer than the good practice values.

TABLE 8 TREATMENT FREQUENCIES

RoadType	Treatment	Treatment Frequency (years)			
		Good Practice	2015-16	2016-17	2017-18
Motorway	Resurface	1 in 20	See note 1	See note 1	See note 1
Classified	Resurface	1 in 20-25	1 in 78	1 in 40	1 in 74
Unclassified	Resurface	1 in 30	1 in 198	1 in 55	1 in 123
Bitmac Roads	Surface Dress	1 in 10	1 in 18	1 in 16	1 in 21

Note 1: Majority of motorway network is now maintained by a DBFO company

TABLE 9 SHORTFALLS IN STRUCTURAL MAINTENANCE £M @ 2017/18 PRICES

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	Total
SMFP (£m)	123	125	128	136	137	139	142	143	141	1214
Spend	98	98	131	118	139	103	56	90	70	903
Shortfall	25	27	(3)	18	(2)	36	86	53	71	311

4.3 Funding levels

4.3.1 The table above shows the level of spending achieved compared to the SMFP budget (index linked). It shows a funding deficit of £311m, (at 2017/18 prices) between 2009/10 and 2017/18.

4.3.2 The Road to Everywhere (1998) identified a budget required to deliver the SMFP which it recognised as being a conservative estimate. Notwithstanding that assertion funding allocated to the SMFP has consistently been below those

FUNDING

levels and has resulted in DfI Roads introducing a sub-optimal maintenance strategy that focussed on maintaining the high end of the network and keeping the rest of the network safe, so far as is reasonably possible. In introducing that strategy, it was always recognised that this should only ever be a short-term solution; however, 20 years later, that strategy persists with increased resources required for short-term solutions such as patching.

4.3.3 The funding gap (actual compared with required) has resulted in the increased backlog because when roads authorities fail to meet adequate funding requirements, they are not making a saving; they are merely deferring a cost against future commitments. It is also true that as the network moves progressively below the optimum funding level, the cost to reinstate it to that level increases. So, between 2009 and 2017 the SMFP was underfunded by around £311m (at 2017/18 prices); however, the maintenance backlog increased by c. £400m from £796m to £1.2bn.

CONCLUSION 8

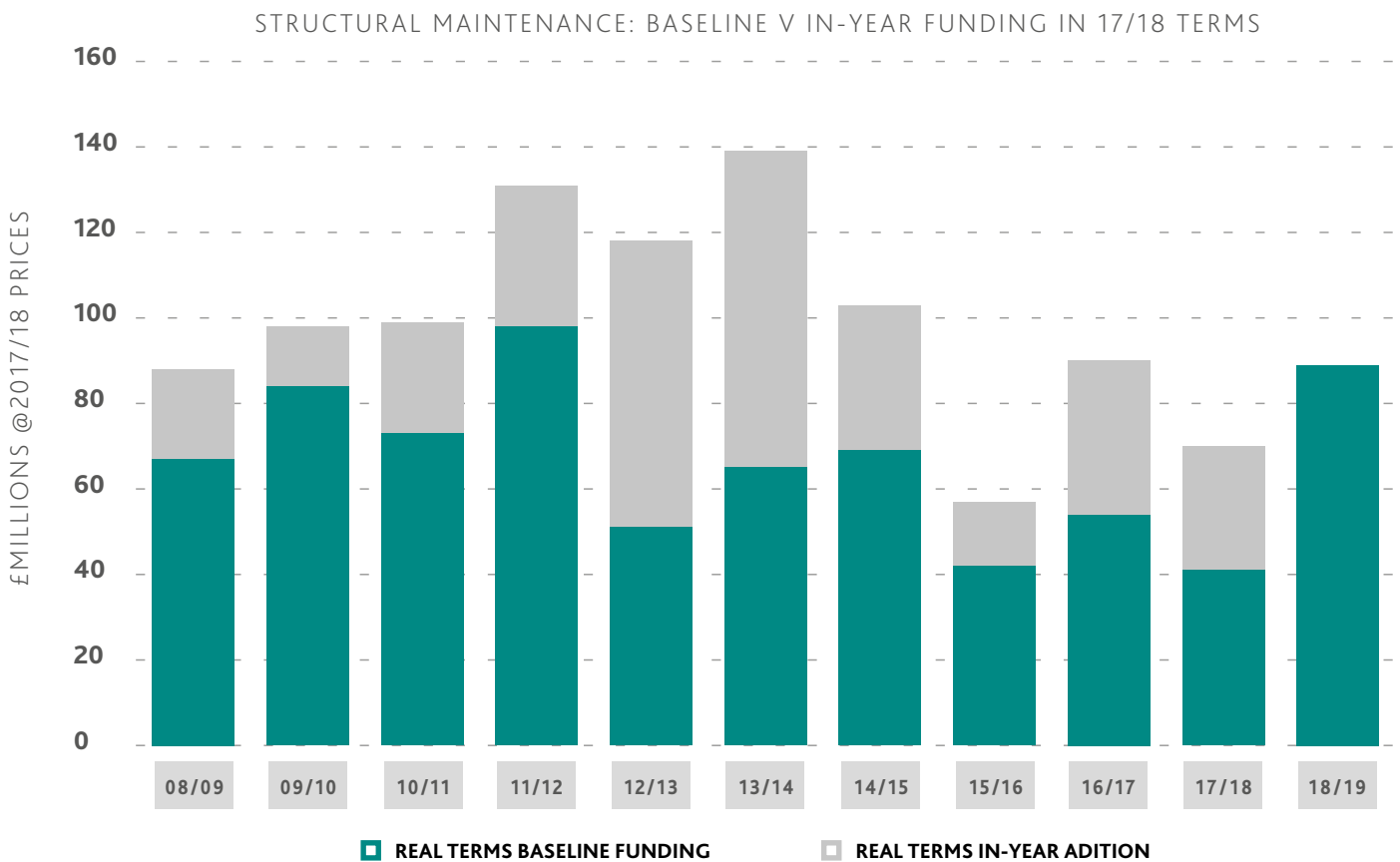
Funding for the SMFP has been significantly less than required. Between 2009 and 2017 there was a funding shortfall of £311m (based on 2017/18 prices). This has resulted in an increase in the maintenance backlog over the same period of c£400m from £796m to £1.2bn

4.4 Structural Maintenance Expenditure Patterns

4.4.1 The graph below shows how maintenance funds have been allocated over the course of the financial year. It describes a volatile, even bizarre, approach which makes the planning and delivery of an effective road maintenance strategy

close to impossible to deliver. Certainty of funding is the key to being able to provide the supply chain with the confidence to properly plan maintenance programmes and thereby lock them into keenly priced tenders. Similarly, budget certainty allows managers to plan and deploy their own workforce effectively.

FIGURE 13 - STRUCTURAL MAINTENANCE FUNDING



FUNDING

4.4.2 It seems to me that the administration is using roads maintenance as a 'balancing item' - adding to or taking from the budget line as other pressures appear or reduce. This is most likely based on the ability of DfI Roads, in common with roads maintenance authorities generally, to spend money quickly when the need arises; however, whilst this might help other parts of the administration that are, for whatever reason, unable to manage their budgets effectively, it is grossly unfair on DfI Roads. This is true for the reasons that I have set out above but it is particularly true when the extra money becomes available towards the end of the year as this is the worst possible time of year to be carrying out any resurfacing or surface dressing works. Extra funding, transferred in-year from underspend elsewhere will always be welcome but it cannot be a substitute for adequate budgeting; more, it should be seen as an extra that can be used to reduce the backlog.

In its report 'Action for Roads' published in July 2013, the Department for Transport concluded that certainty over the maintenance budget would allow the Highways Agency to plan work for maximum effect. Instead of fixing roads whenever funding becomes available, it could plan long-term asset maintenance based on a clear understanding of what the resources will be. This view was supported by evidence from the Netherlands where moving from a 1-2 year planning horizon to a 5-7 year vision resulted in savings of around 20% on maintenance spending. This was one of the key drivers in the development and implementation of the 5 year committed budgets to deliver the Road Investment Strategy in England

CONCLUSION 9

Greater certainty of budgets would yield efficiencies. Fluctuating budgets in-year make it extremely difficult to properly plan and implement programmes of work and DfI Roads needs to be allocated realistic budgets for the whole of the year sufficiently far in advance for it to develop and implement those programmes with confidence.

If the Executive were to move to longer term committed budgets as is the case with Highways England, it is expected that much greater efficiencies could be achieved. Based on evidence from elsewhere efficiency savings of around 20% could be expected with a 5 year committed budget.

4.4.3 One final observation, it is difficult to see how DFI Roads could be confident that it would be able to meet its minimum statutory duties with the level of budget allocated at the start of the year 2015/16 and not actually increased until November 2015; this must have been an issue for the Accounting Officer.

4.5 Comparison of funding levels in other countries

4.5.1 Direct comparisons of spending across other parts of the UK need to be viewed in the context of how the different countries operate. Northern Ireland has a much larger local road network per head of population than the rest of the UK - around two and a half times more than for local roads

in England - and a relatively modest rail network. Even so, examination of Public Expenditure information shows that, whilst overall public spending in Northern Ireland is higher than any of the other UK regions (Countries), the proportion spent on transport is lower.

4.5.2 The main authoritative source of public spending across different types of services and across different parts of the UK is the HM Treasury's Public Expenditure Statistical Analyses (PESA). The PESA data in the table below shows that in 2015/16 transport spend in Northern Ireland, as a proportion of overall expenditure, was around half that of Wales and considerably less than half of that in England and Scotland.

TABLE 10 PERCENTAGE OF TOTAL IDENTIFIABLE EXPENDITURE ATTRIBUTED TO TRANSPORT IN GB AND NI 2014/15 AND 2015/16 (SOURCE PESA 2016)

	2014/15	2015/16
England	3.4%	5.0%
Scotland	5.0%	4.8%
Wales	3.2%	4.0%
Northern Ireland	2.5%	2.1%

FUNDING

4.5.3 PESA data also shows that Northern Ireland spends less per capita on roads than Scotland or Wales and that this expenditure in 2015/16 was half

that spent in 2010/11 whereas others have broadly maintained spending. This is set out in the table below.

TABLE 11 PER CAPITA SPEND ON ROADS (NATIONAL AND LOCAL) IN THE UK 2010/11 TO 2014/15

	Outturn (£ per head)					
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Scotland	238	213	245	237	224	261
Wales	203	174	188	174	163	162
England	134	117	102	111	131	130
N Ireland	292	197	196	210	196	143

4.5.4 Wales spends 40% more on roads per km than Northern Ireland; England and Scotland both spend two and

a half times as much per km as Northern Ireland.

TABLE 12 SPEND PER KM OF ROAD IN 2015/16

	Road length (kms)	Total spend (2015/16)	Spend/km
Scotland	56250	£1399m	£24871
Wales	34642	£503m	£14520
England	303800	£7140m	£23500
N Ireland	25562	£264m	£10291

CONCLUSION 10

Whilst overall public spending in NI is higher than any other part of the UK, spend on transport is lower.

The amount that NI spent per capita on roads (local and national combined) in 2015/16 was half that spent in 2010/11.

England and Scotland both spend two and a half times that spent per km in NI; Wales spends 40% more.

4.6 How the money is allocated

4.6.1 As a consequence of road maintenance budgets provided from successive Comprehensive Spending Review rounds falling short of that required to maintain the roads at the 'good practice' surfacing frequencies set out in the 1998 Policy Review, Roads Service adopted a sub-optimal budget strategy in order to preserve the fabric of the network. The strategy targets resources to:-

- Maintaining the TRN
- Maximising surface dressing
- Patching for safety reasons only
- Minimum footway expenditure compatible with providing a safe environment for pedestrians.

4.6.2 Looking at the resurfacing and surface dressing elements of the SMFP the table below shows how funding has been allocated over recent years against the different types of treatment. The sub-optimal strategy has meant that funds have been diverted away from the B/C/U class network to support the other areas. The result is that trunk A roads have received 71% of the required budget, non-trunk A roads 60% and surface dressing 58% whilst B, C and U class roads have received just 46%. Moreover, as has been discussed elsewhere, because the money spent on the lower class network has, necessarily, been spent mainly on short-term solutions - repairing potholes and patching an increasingly deteriorating network - the reduced spend is actually being spent less effectively in terms of the life of the pavement. This explains why the vast majority of the maintenance backlog is related to the lower class network.

TABLE 13 COMPARISON OF OUTTURN EXPENDITURE WITH SNAITH REQUIREMENT AT 2017/18 PRICES

Road type	Snaith requirement £k	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	Average spend £k	% of Snaith
		£k	£k	£k	£k	£k	£k	£k	£k	£k	£k		
M/Way	-	-	-	-	-	-	-	-	-	-	-	-	-
Trunk A	12676	8332	9963	10994	14604	7389	11621	11355	3940	7917	4197	9031	71%
Non Trunk A	10395	2328	6694	4676	10751	9339	9412	6826	2617	5301	4277	6222	60%
B/C/U Class	77048	17518	32999	34709	44490	47568	62120	38426	15332	38018	24122	35530	46%
Bitmac (surf d)	18243	8538	10742	10210	10333	9983	12537	12059	11042	11034	9244	10572	58%
Total	118362	36716	60398	60589	80178	74279	95690	68666	32931	62270	41840	61355	52%

Roads Recovery Fund

The £15m Roads Recovery Fund has been devised to help mitigate the impact of the severe winter and underinvestment in recent years. It is envisaged that the Roads Recovery Fund will target around 1300 road locations in 2018/19, repairing many short lengths of road (e.g. 20-100m) in particularly poor condition, together with a number of longer resurfacing schemes. In addition to resurfacing, the Roads Recovery fund provides the potential for some additional road drainage enhancements to address a number of surface ponding issues at various locations across the existing road network. The aim is to quickly see a positive impact on road conditions across NI.

The fund was top sliced from the DfI Roads capital allocation and for 2018/19. It is unclear whether this fund will be repeated in future years.

the system and is being supported in its implementation by the system provider. The system chosen is similar to that used by others in the UK, in particular Scotland and Wales and it would be sensible for DfI Roads to engage with colleagues in Transport Scotland and/or Transport for Wales to better understand how best to deliver this vital resource.

CONCLUSION 11

The implementation of a fully functioning PMS will provide a more robust and transparent approach to programme and scheme prioritisation as well as supporting the determination of the Asset Value and road maintenance backlog. DfI Roads move to implement a fully functioning PMS is, therefore welcomed. This should be progressed as quickly as possible.

4.7 Asset Management Systems

- 4.7.1 DfI Roads is in the process of implementing a fully functioning Pavement Management System. This is to be encouraged as it will provide a more robust and transparent approach to programme and scheme prioritisation as well as supporting the determination of the Asset Value and road maintenance backlog. DfI has taken delivery of



CHAPTER 5

WHY GOOD ROAD CONDITION IS IMPORTANT

5.1 Asset Management

5.1.1 Asset management is the coordinated activities that are used to manage our assets in order to maximise customer satisfaction, maintain high levels of safety, improve journey time reliability, manage risks and enable the delivery of our outcomes and priorities in the most efficient and sustainable manner.

5.1.2 The way in which we manage our asset will draw on all available asset inventory and condition information to develop robust and prioritised programmes of work which, through our asset management objectives, will link to an organisations high level business and corporate objectives; in the case of DfI, there will be a direct line of sight from the way in which DfI Roads delivers on the ground right through to the Programme for Government Objectives.

5.1.3 DfI's Asset Management Plan 2017 to 2022 sets out the strategic objectives and challenges facing the Department and identifies important areas on which the Strategic Investment Board's (SIB) Asset Management Unit has worked closely with the Department to develop an Action Plan based on the known condition of its assets. However, the information contained in the Plan is at a high level and lacks the detail necessary to provide the basis of robust asset management of the roads asset.

5.1.4 Highways/Roads Asset Management Plans are now being used across all parts of the UK at National and Local Government level; indeed, the DfT requires local authorities in England to produce Highways Asset Management Plans (HAMP) as part of their bidding process. The plans set out how the road network is maintained strategically and efficiently in order to protect the assets and provide the best possible service with the resources available. HAMPs/RAMPs present the type and number of road assets that the authority is responsible for, including carriageways, footways, structures, lighting and drainage. For each type it describes its current condition and the range of activities used to manage and maintain it throughout its life.

5.1.5 The HAMP/RAMP describes the asset management techniques that are employed to assess outcomes against investment, prioritise maintenance and ensure cost-effective use of resources. It also describes how authorities engage with those using the network to understand better the service that they expect. Importantly, it sets out clearly how condition of the network and ancillary is likely to change under different funding scenarios in a robust and transparent manner. If DfI Roads were to develop its own HAMP, in line with best practice across other parts of the UK,

WHY GOOD ROAD CONDITION IS IMPORTANT

it would provide a much more robust framework in which to manage its asset effectively.

CONCLUSION 12

If DfI Roads were to develop its own Highways Asset Management Plan, in line with best practice across other parts of the UK it would provide a much more robust framework in which to manage its asset effectively.

5.2 The Economic, Environmental and Social Impacts

5.2.1 The road network in Northern Ireland is valued at £26bn and is the most valuable asset that the Northern Ireland Executive owns. It is widely accepted that the condition of that network is vital to the economic and social wellbeing of the country. Northern Ireland is more dependent on roads based transport to provide for the needs of industry, commerce, public and private transport than the rest of the United Kingdom, largely because of its modest rail network, something that is unlikely to change in the foreseeable future. How the road network is managed and maintained matters to the people of Northern Ireland.

A study undertaken by Transport Scotland and published in 2012 looking at the 'Economic, Environmental and Social Impact of Changes in Maintenance Spend on Roads in Scotland' concluded that there is an overall dis-benefit to society of reducing road maintenance expenditure on the Scottish road network. The quantitative analysis undertaken on those aspects that were able to be quantified (vehicle operating costs, travel time, accidents, delays, lighting and emissions) shows that for every £1 reduction in road maintenance, there is a cost of £1.50 to the wider economy. Moreover, the study concluded that if some of the qualitative impacts (such as the impact on tourism and local business) were able to be quantified, this would be expected to further enhance that conclusion. Interestingly, the study also concluded that whilst it is often thought that road maintenance only impacts on vehicle journeys, there are wider impacts on society and that the user group most affected by a reduction in road maintenance are pedestrians, especially those with mobility and visual impairments. These benefits to society are over and above those that might be achieved by better resource allocation identified earlier in this report.

The Audit Commission report on road maintenance in England in 2011 quoted a survey asking what services local residents thought 'need improving'. Number two from a long list was 'road and pavement repairs', ahead of crime at number four and health services at number fourteen.

CONCLUSION 13

Northern Ireland is more dependent on roads than other parts of the UK. The way in which roads are maintained is vital to the economic and social wellbeing of the country and there is a direct line of sight from the way in which DfI delivers on the ground to the Programme for Government Objectives. The Department leads on Outcome 11: 'We connect people and opportunities through our infrastructure' and also makes a particular contribution to Outcome 2: 'We live and work sustainably, protecting the environment'. A well maintained road network, particularly where rail alternatives are scarce, is fundamental to the delivery of these Outcomes.

A study undertaken by Transport Scotland concluded that there is an overall dis-benefit to society of reducing road maintenance expenditure; for every £1 reduction in road maintenance, there is a cost of £1.50 to the wider economy. This is in addition to the higher maintenance costs that would also be incurred and the lost economic activity (CBI reported that every £1 spent on construction generates a wider economic return of £2.84)

5.3 What is the true condition of the NI road network?

- 5.3.1 As explained in Chapter 2, the condition of the road pavement is assessed in a number of different ways. The deflectograph surveys indicate that the condition of the trunk road network has improved slightly over recent years. Similarly, the condition index for non-trunk A roads appears to show that DfI Roads is managing to maintain their condition; however, as explained in Chapter 4 this has been achieved by diverting budgets away from the B, C and U class network and towards the higher class roads in line with the sub-optimal budget strategy.
- 5.3.2 This means that, whilst DfI Roads has been successful in managing to maintain the condition of the trunk road network, it has allocated little funding towards arresting the deterioration of the lower class roads, relying primarily on surface dressing and patching works. Neither patching nor surface dressing will add strength to the pavement but surface dressing, and to an extent patching can improve the condition of the surface layer which, in turn would lead to better Scanner results. It is probable, therefore that the extensive use of surface dressing in particular is giving an indication that the non-trunk network, especially the unclassified rural element is

WHY GOOD ROAD CONDITION IS IMPORTANT

performing better than it actually is. This is compounded by the fact that, as explained in Chapter 3, inspectors are now only required to record those defects that are likely to be treated within the existing budgets. Consequently, a very large number of non-urgent defects are not being recorded - so there is no clear picture of the true condition of the non-trunk network. What we do know, though is there is a steady increase in the number of defects requiring patching works - potholes and that the strategy of merely fixing the potholes is very short term and ultimately unsustainable.

5.3.3 The situation is further exacerbated by the fact that, because of budget constraints, the amount of patching undertaken each year is now dictated by a resource budget cap of around £10m, rather than reflecting the actual need based on network condition. This coupled with the fact that inspectors are only recording those defects that are to be treated, further masks the true condition of the road.

5.3.4 An internal study carried out in April 2009 by Roads Service indicated that patches applied to roads in a reasonable condition might be expected to last between 2 and 4 years but in some cases can last even longer; however, as the general condition of the network

deteriorates it is likely that the longevity of patches will shorten. This was confirmed during face to face discussions with Roads Managers as described in Chapter 3.

5.3.5 The result of this policy is that the increased incidence of potholes is inevitable and that, whilst this might be masked by rapid intervention when winter conditions are benign, it will become ever more obvious to everyone, not least the travelling public during the course of a severe winter; that is what has happened this year but which also happened to a lesser extent in 2015/16. Moreover, as explained in Chapter 3, it is unlikely at current budget levels that the Area teams will be able to properly patch all of the potholes that have appeared this year and certainly won't be able to carry out treatments that will restore any of the road to a reasonable condition; in effect they will be papering over the cracks. The consequence of this is likely to be a continued increased incidence of potholes appearing as the very fabric of the road in many areas has all but disappeared.

CONCLUSION 14

The sub-optimal maintenance strategy of maintaining the TRN and surface dressing/patching the non-trunk network has allowed DfI Roads to broadly maintain the condition of the TRN; however, whilst surface dressing and patching might help to arrest the rate of deterioration to an extent, they do not add strength. The consequence is that the non-trunk network has almost certainly seen significant deterioration of its strength and fabric. This deterioration is not evident in the vehicular and visual surveys, very probably because the surface dressing/patching mask surface defects but it is very evident in the rate at which potholes are appearing, the level of public criticism and the views of professional staff charged with maintaining the network.

WHY GOOD ROAD CONDITION IS IMPORTANT

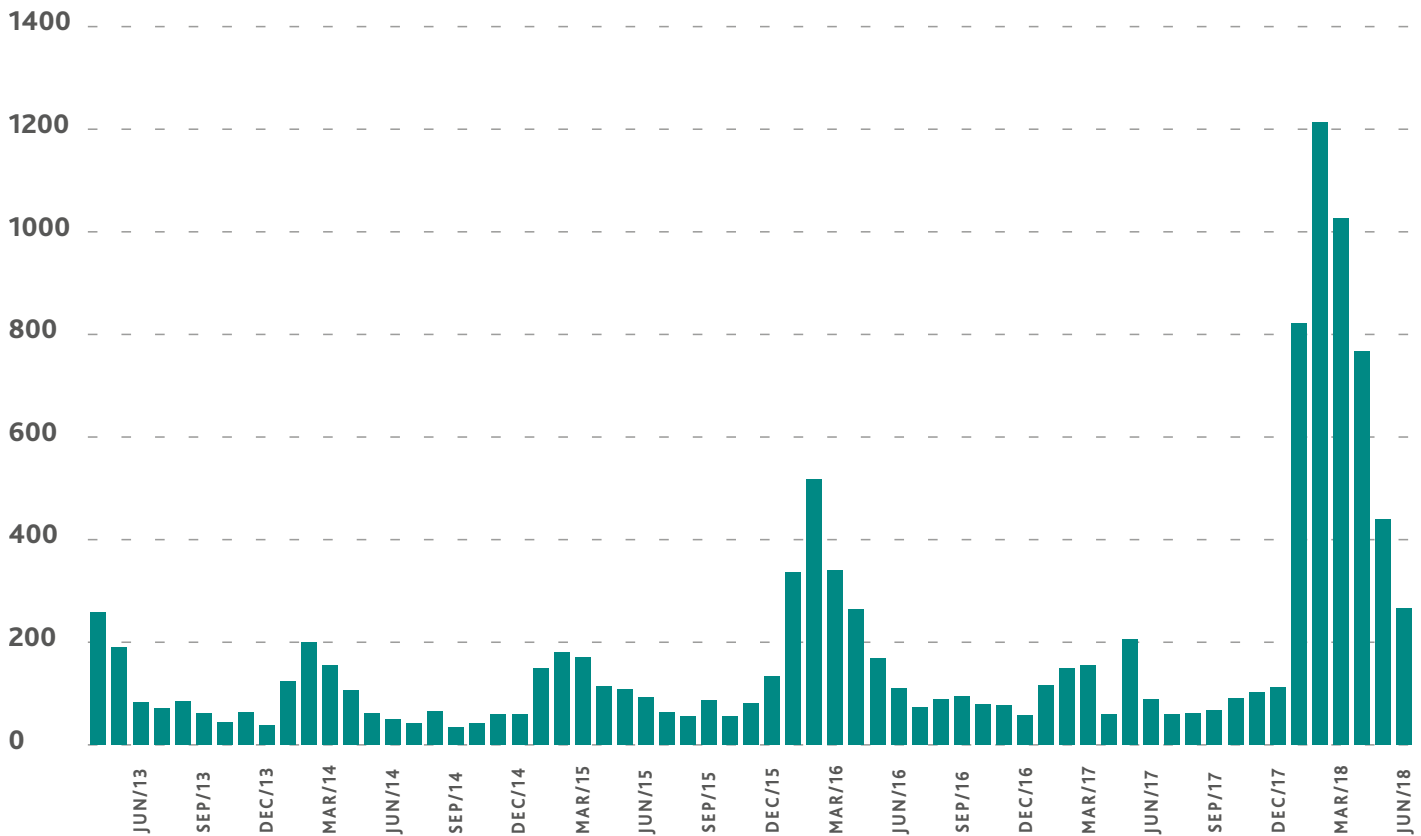
5.4 The cost of potholes

5.4.1 Potholes are damaging to the organisation; they are costly both to repair and in terms of public liability claims, they are disruptive to planned programmes of work and to the travelling public and they are reputationally very damaging when they reach the point where the public view them to be at an unacceptable level. This last point is very evident this year when the level of potholes has been seen by many as a key indicator on how well, or badly, DfI Roads manages the network.

5.4.2 The graph opposite shows the number of vehicle damage claims by month over the past 5 years. Not surprisingly, there is a peak every winter as the cold and wet attack the vulnerable parts of the network and more potholes appear. The winter of 2015/16 shows a significant increase in claims over previous years and coincides with the introduction of the skeleton service and limited resource-based patching only. The figures for 2016/17 are more in line with previous years, however, the winter of 2016/17 was remarkably mild and it is likely that this is the reason why less damage was caused to the network - an assertion that is borne out by the very dramatic increase in vehicle damage claims over the very severe winter just passed where there were over 4360 claims between

January and May 2018 compared to an average of around 690 claims over the same months in 2014, 2015 and 2017 and over 1600 in 2016.

FIGURE 14 - NUMBER OF VEHICLE DAMAGE CLAIMS



5.4.3 The total annual cost of public liability claims (includes compensation, legal fees and other claim expenses) has been around £4.5m over recent years. That figure is based on the average annual level of claims ranging from 2500 to 3000 per year (although many of the claims will not be settled in the same year as they are lodged). In 2017/18 the total number of claims was around 4800 across all claim

types. This represents a significant increase on the previous year and was due to an unprecedented spike in vehicle damage claims with around 3930 vehicle damage claims received in the last financial year. To put this into context, this is the highest level of vehicle damage claims on record. It is nearly three times the average of the previous four years with the vast majority of vehicle damage incidents

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occurring at the end of the year. In addition, nearly 1300 vehicle damage claims were received in April and May 2018, which is four times the average of previous years (308).

5.4.4 It is difficult to put a precise figure on how much these extra claims will, ultimately cost DfI. However, at 31 May 2018, the estimated total value of vehicle damage claims received from 1st January 2018 is c£1m. For the financial years 2014/15 to 2016/17 the settlement rate for vehicle damage claims was 60%. Therefore, a high level estimate of the impact in terms of vehicle damage compensation payments is that c£600k will be paid out for claims received during the first 5 months of 2018. To put this into context, the department normally pays out around £300k in vehicle damage compensation per annum.

5.4.5 Although the Department makes provision for public liability claims within its budget, savings can be directed to road maintenance funding. Therefore increased expenditure on compensation payments means that there is less funding available for roads maintenance activities, in essence, money that could have been spent actually maintaining the network is used to compensate claimants. If we add to this the estimated cost of repairing the damage through patching it is clear to see how money required for much

needed planned long term repair and strengthening is being diverted into short term fixes and claims.

5.4.6 Whilst potholes can cause serious damage to vehicles they can be significantly more damaging to cyclists. When potholes fill with water or during the hours of darkness it is very difficult for cyclists to see how deep the pothole is or, in many cases even to see the pothole at all. The result of a cyclist hitting a deep pothole can be extremely serious, causing personal injury and even death. This has become a major issue across the UK over the past winter attracting strong media attention. From a policy perspective, not maintaining roads that cyclists use in a condition that is safe for them to do so runs directly against the objective of encouraging active travel; there might also be an issue in terms of the roads service fulfilling its statutory responsibility.

5.4.7 There is no doubt that the higher incidence of potholes and vehicle damage claims will always be higher in the winter. This is clearly as a consequence of the cold and wet conditions and is common to all roads authorities: however, the number of potholes and level of vehicle damage claims as a consequence of the last winter is unprecedented and is, in fact, an order of magnitude different to any other year whereas last winter,

whilst more severe than recent years, was not, in meteorological terms, unprecedented. This further confirms that the reason that the road network suffered so badly was related to its condition.

CONCLUSION 15

The number of vehicle damage claims in 2017/18 is the highest level of claims on record and is nearly three times the average of the previous four years with the vast majority of incidents occurring at the end of the year. Unsurprisingly this tracks, very closely, the incidence of potholes occurring. Whilst the incidence of pothole and vehicle damage claims are unprecedented, last winter, whilst more severe than recent years was not, in meteorological terms, unprecedented.

CONCLUSION 16

Potholes are damaging to an organisation; as well as the cost to repair, they disrupt travel and other operations and they are reputationally very damaging when they become greater than stakeholders perceive to be reasonable.

Whilst they predominantly result in damage to motorised vehicles, which, in itself can be costly, the potential consequences for cyclists are much more severe with the threat of personal injury and even loss of life. The policy of choosing not to repair all potholes on routes that may be used by cyclists is, at the least, contrary to the Executive's wider PfG objectives relating to encouraging active travel.



CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In undertaking this Review I have considered an extensive amount of evidence both relating to the situation in Northern Ireland and more widely. I have spoken to a number of people within DfI Roads all of whom have been very forthcoming in seeking to provide the information that I have requested and answer the questions that I have asked - all without seeking to unduly influence my Review.

I am very grateful for the assistance offered.

I have set out below fifteen Conclusions, These are presented in the order that they appear in my report for ease of reference. At the end of this Chapter I have sought to pull together my overall assessment of the tasks that were set for me in undertaking this Review before making five specific Recommendations.

6.1.1 Conclusion 1

NI is more dependent on road travel than the rest of the UK. A well maintained road network is fundamental to the economic and social wellbeing of the country and the delivery of PfG Outcomes.

6.1.2 Conclusion 2

The requirement for a properly funded and maintained road network was confirmed in policy terms in 1998. The development of the Structural Maintenance Funding Plan as

a rational way of determining the optimum level of spend for structural maintenance has been established over successive studies and endorsed by NIAO and the Northern Ireland Assembly's Regional Development Committee. The Structural Maintenance Funding Plan requirement, at 2018 prices, is c. £143m.

6.1.3 Conclusion 3

Roads are designed to last for a defined period but internal and external factors will mean that they do not deteriorate in a uniform or homogeneous manner. Timely intervention is highly cost effective with late intervention costing as much as four times the optimum.

There is a very strong business case for timely intervention; the key outcome being a better customer experience resulting from a better maintained network and at a lower cost to the authority to maintain.

6.1.4 Conclusion 4

Road condition surveys on all but the unclassified road network are carried out in a broadly similar manner to that in the rest of the UK.

The techniques used for the Coarse Visual Inspection (CVI) surveys carried out on the unclassified road network are the same as those used in the rest of the UK where they are still used. The decision to undertake these surveys on just a 10% sample of the

CONCLUSIONS AND RECOMMENDATIONS

unclassified network means that changes in the true condition year on year are masked by the volume of available data that remains unchanged.

6.1.5 Conclusion 5

Based on the outputs from the machine surveys A, B and C Class roads have seen a gradual improvement in their estimated residual life (e.g. fewer roads being considered for maintenance) over the past 5-6 years. Unclassified roads have not seen this same improvement and appear to be maintaining a broadly constant condition. Possible reasons for this could be connected to the strength of resurfacing and/or the recent mild winters as well as recent interventions such as the rural roads initiative; limited survey coverage will continue to mask out condition on these particular roads.

Nearly half of the trunk road network and a third of the non-trunk network is at or below the 'investigatory level' for skidding resistance and requires further investigation. The investigatory level is the level of skidding resistance at which consideration is given to the need for further maintenance. At this level, evidence (e.g. accident rates) would be taken into account to determine possible future actions. It is worth noting that the 'investigatory level' relates to skidding resistance of the road surface and is a safety indicator, not an indicator of structural condition.

6.1.6 Conclusion 6

DfI Roads has a statutory duty to maintain roads in a safe and serviceable condition. In order to seek to comply with that duty DfI Roads has developed guidance and standards related to the inspection and repair of defects; however, these standards have had to be changed on 12 separate occasions since 2015 to deal with funding cuts and in-year changes.

6.1.7 Conclusion 7

Managers responsible for the maintenance of the road network believe that, whilst the trunk and A Class network is in a reasonable condition, the B, C and U Class roads are in progressive decline. Their professional opinion is supported by the level of complaints that they receive in respect of the lower class roads.

Funding pressures, leading to sub-optimal maintenance strategies, are resulting in reduced value for money.

As of August 2018 there is insufficient money allocated to the repair of the network to bring it back, even, to the condition that it was in prior to last winter.

6.1.8 Conclusion 8

Funding for the SMFP has been significantly less than required. Between 2009 and 2017 there was a funding shortfall of £311m (based on 2017/18 prices). This has resulted

in an increase in the maintenance backlog over the same period of c£400m from £796m to £1.2bn.

6.1.9 Conclusion 9

Greater certainty of budgets would yield efficiencies. Fluctuating budgets in-year make it extremely difficult to properly plan and implement programmes of work and DfI Roads needs to be allocated realistic budgets for the whole of the year sufficiently far in advance for it to develop and implement those programmes with confidence.

If the Executive were to move to longer term committed budgets as is the case with Highways England, it is expected that much greater efficiencies could be achieved. Based on evidence from elsewhere efficiency savings of around 20% could be expected with a 5 year committed budget.

6.2.0 Conclusion 10

Whilst overall public spending in NI is higher than any other part of the UK, spend on transport is lower.

The amount that NI spent per capita on roads (local and national combined) in 2015/16 was half that spent in 2010/11.

England and Scotland both spend two and a half times that spent per km in NI; Wales spends 40% more.

6.2.1 Conclusion 11

The implementation of a fully functioning PMS will provide a more robust and transparent approach to programme and scheme prioritisation as well as supporting the determination of the Asset Value and road maintenance backlog. DfI Roads move to implement a fully functioning PMS is, therefore, welcomed. This should be progressed as quickly as possible.

6.2.2 Conclusion 12

If DfI Roads were to develop its own Highways Asset Management Plan, in line with best practice across other parts of the UK it would provide a much more robust framework in which to manage its asset effectively.

6.2.3 Conclusion 13

Northern Ireland is more dependent on roads than other parts of the UK. The way in which roads are maintained is vital to the economic and social wellbeing of the country and there is a direct line of sight from the way in which DfI delivers on the ground to the Programme for Government Objectives. The Department leads on Outcome 11: 'We connect people and opportunities through our infrastructure' and also makes a particular contribution to Outcome 2: 'We live and work sustainably, protecting the environment'. A well maintained road network, particularly where rail alternatives are scarce, is fundamental to the delivery of these Outcomes.

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A study undertaken by Transport Scotland concluded that there is an overall dis-benefit to society of reducing road maintenance expenditure; for every £1 reduction in road maintenance, there is a cost of £1.50 to the wider economy. This is in addition to the higher maintenance costs that would also be incurred and the lost economic activity (CBI reported that every £1 spent on construction generates a wider economic return of £2.84).

6.2.4 Conclusion 14

The sub-optimal maintenance strategy of maintaining the TRN and surface dressing/patching the non-trunk network has allowed DfI Roads to broadly maintain the condition of the TRN; however, whilst surface dressing and patching might help to arrest the rate of deterioration to an extent, they do not add strength. The consequence is that the non-trunk network has almost certainly seen significant deterioration of its strength and fabric. This deterioration is not evident in the vehicular and visual surveys, very probably because the surface dressing/patching mask surface defects but it is very evident in the rate at which potholes are appearing, the level of public criticism and the views of professional staff charged with maintaining the network.

6.2.5 Conclusion 15

The number of vehicle damage claims in 2017/18 is the highest level of claims on record and is nearly three times the average

of the previous four years with the vast majority of incidents occurring at the end of the year. Unsurprisingly this tracks, very closely, the incidence of potholes occurring. Whilst the incidence of pothole and vehicle damage claims are unprecedented, last winter, whilst more severe than recent years was not, in meteorological terms, unprecedented.

6.2.6 Conclusion 16

Potholes are damaging to an organisation; as well as the cost to repair, they disrupt travel and other operations and they are reputationally very damaging when they become greater than stakeholders perceive to be reasonable.

Whilst they predominantly result in damage to motorised vehicles, which, in itself can be costly, the potential consequences for cyclists are much more severe with the threat of personal injury and even loss of life. The policy of choosing not to repair all potholes on routes that may be used by cyclists is, at the least, contrary to the Executive's wider PfG objectives relating to encouraging active travel.

6.3 Overall Conclusions

6.3.1 The tasks set for me in undertaking this Review were to consider and comment on how the current budget requirements were derived, how they compare with what has been allocated, how allocated funds have

been deployed and how the network is currently performing. I was also asked to assess how those charged with maintaining the network do so and provide a view on likely funding needs going forward.

6.3.2 My overall assessment is that the funding requirements, as set out in the Structural Maintenance Funding Plan, provide a sound rationale. It has been developed over many years and has been endorsed by NIAO and the Northern Ireland Assembly's Regional Development Committee. It is based on the premise that road pavements have defined lifespans and require to be periodically maintained. The lifespans and treatment periods are recognised as best practice by pavement engineers across the world; consequently, the basis of the SMFP is well founded. In the absence of meaningful conditional modelling, which will only become available once the PMS is fully functional, I can offer no better way of determining maintenance need. The figure set for the SMFP in 1998 was £80m and is now estimated at c. £143m in today's terms. I would therefore suggest that the figure of £143m is a realistic estimate of the annual requirement for structural maintenance funding.

6.3.3 However, a sustained budget shortfall of between 40% and 50% of the SMFP (based on expenditure over the last 5 years or so) has forced those

charged with maintaining the network to adopt a sub-optimal maintenance strategy that has been focussed on maintaining the condition of the trunk road network and seeking to keep the remainder of the network in a safe condition. Whilst this strategy is entirely logical in its approach and appears to have been successful in maintain the condition of the trunk road network, it has led to a widespread weakening of the fabric of the non-trunk network, although the focus on surface dressing has given the impression that the non-trunk network is in a better condition than it is. However, it has now reached the point where any adverse weather, particularly winter weather, will cause significant damage which will be costly to repair and is likely to incur significant compensation payments. The measures being taken to repair the road following the last winter will not bring it back to an appropriate condition and it is highly likely that even a normal winter will see significant deterioration of the non-trunk network. This is further evidenced by the fact that the current road maintenance backlog, which is a useful indicator of trend rather than an absolute statement of need, has risen from £796m in 2009 to £1.2bn with the vast majority of the backlog

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being on the lower class network. Continuing on this funding trajectory will almost certainly see an increase in:

- A significant deterioration in the condition of the network giving rise to increased safety related defects such as potholes and poor skidding resistance;
- Adverse impacts following winter/severe weather;
- Criticism from public representatives; and
- Inability to deliver the Programme for Government Outcomes.

6.3.4 The road network is fundamental to the economic and social wellbeing of the people of Northern Ireland and it is questionable whether this level of maintenance funding will allow the Executive to achieve its PfG Objectives or DfI Roads to fulfil its statutory responsibility. The very significant deterioration of the network over the last winter resulting in a massive increase in the number of potholes and vehicle damage claims is both wasteful in resources and reputationally very damaging.

6.3.5 My conclusion regarding the way in which the network is currently managed is that those responsible are doing the best that they can with the resources available to them;

however, much greater certainty of budgets that actually meet the needs of the SMFP would allow DfI roads to bring forward much more effective maintenance programmes that could be properly resourced. It should be entirely possible to achieve efficiencies of at least 20% if adequate long term budgets were in place. These savings might allow the SMFP budget to be reduced by 20% or, better still, allow DfI Roads to make a much needed impact on reducing the maintenance backlog, which would, in turn, yield even greater efficiencies.

6.3.6 I would therefore make just five recommendations:

1. I Recommend that the Department should aim to allocate £143m to structural maintenance each year, through renewed engagement with the Department of Finance and reprioritisation of Departmental Funds and that this figure should be index linked to account for inflation. Whilst it might be possible to allow that some of this were received in-year, a target of least 80% of the funding being confirmed as being available at the start of the year should be established and late (i.e. January) in-year funding should be avoided or at least kept to an absolute minimum. Consideration should also be given to making a

longer term commitment to allocating this budget over future years as this would undoubtedly yield significant benefits.

with UK Best Practice in order to provide a much more robust and transparent approach to managing and maintaining the NI road network.

2. I Recommend that DfI Roads uses some of this allocation to speed up the implementation of its Pavement Management System and that it uses the PMS to refine the overall funding requirement and improve the prioritisation and transparency of its budget allocation process and in its determination of the roads maintenance backlog.
3. I Recommend (i) that as routine safety inspections are no longer identifying low risk defects that affect the serviceability of the network, DfI should consider the feasibility of carrying out serviceability inspections and how best to introduce these, and (ii) that on the basis that current inspections and the frequency of condition surveys, particularly on the unclassified network (currently only 10% subject to condition survey), are concealing the amount of deterioration, that DfI reviews its policy on carrying out condition surveys on the unclassified roads in conjunction with other GB road authorities.
4. I Recommend that DfI Roads takes steps to develop its own Highways Asset Management Plan in line

5. I Recommend that DfI Roads engages more with highways professionals in other parts of the UK; with Transport Scotland and transport for Wales to help support the speedy implementation of the PMS and Asset Management Plan and with the United Kingdom Roads Liaison Group(UKRLG) and the Association of Directors Environment, Economy, Planning and Transport (ADEPT) working groups to share knowledge and increase understanding of common issues and problems, and importantly, of best practice and techniques.

SOURCES OF INFORMATION

Listed below are all of the documents that have been identified as useful sources of information. Although all are not referenced directly they have all, nevertheless influenced and contributed to my thinking and the development of the Review.

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 - Asset Management Manual: A guide for Practitioners. World Road Association
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**REVIEW OF THE STRUCTURAL
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